Request for proposal for Selection of System Integrator for Implementation of ICT Solutions including Establishment of City Operations Centre in Belagavi

Volume 2: Scope of Work

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1 Project Scope of Work

Karnataka Urban Infrastructure Development and Finance Corporation intends to select a Master System Integrator (MSI) for city of Belagavi by following competitive bidding process to design, develop, implement and maintain the Smart City System for a period of five years after Go Live date on turnkey basis. This document contains the following details:

a. Scope of work that will be assigned to the MSI as part of this project

b. Other terms and conditions of the envisaged Smart City System

MSI will develop a City Operations Centre as Integrated Smart City System for Belagavi comprising of 12 Track/Components packaged under 3 levels of intervention:

1. Level1: Integrate and View

   a) City Surveillance

   b) E-governance

      I. Lodge Your Grievance (Jananihata)

      II. Trade License (Vyapara)

      III. Building Licenses

      IV. Birth and Death Registration

   c) Belagavi One- 8 core services

2. Level 2: Integrate, Command and Control

   a) Ambulance & Fire

   b) Geospatial Database Management (including Land Management System and Utilities Mapping)

   c) Smart Parking (for future integration)

   d) Smart Lighting (for future integration)

   e) Smart UGD (for future integration)

   f) Smart Energy Management (for future integration)

3. Level 3: Implement, Command, Control and Fully Operate

   a) Smart Water

b) ICT based solid waste management with RF at household and community level

c) Intelligent Traffic Management System (Adaptive Traffic Control System)

d) Intelligent Transport System (ITS)

e) Intelligent Pole (with environmental sensors, public address system, variable messaging system, digital billboard, panic button)

Main objective of the project is to break silos in the city with in the departments and across the departments. Also to install appropriate check points for solutions implemented, so that the services delivered to the public are to the at most satisfaction of public.

SI shall be responsible to carry out the detailed survey prior to submission of bid for the complete solution component requirement in order to finalize infrastructure requirement, network bandwidth requirement, operational & administrative challenges etc.

The subsequent sections detail out the solution and scope with respect to each of the solution component. MSI shall note that the activities defined within scope of work mentioned are indicative and may not be exhaustive. MSI is expected to perform independent analysis of any additional work that may be required to be carried out to fulfil the requirements as mentioned in this RFP and factor the same in its response.
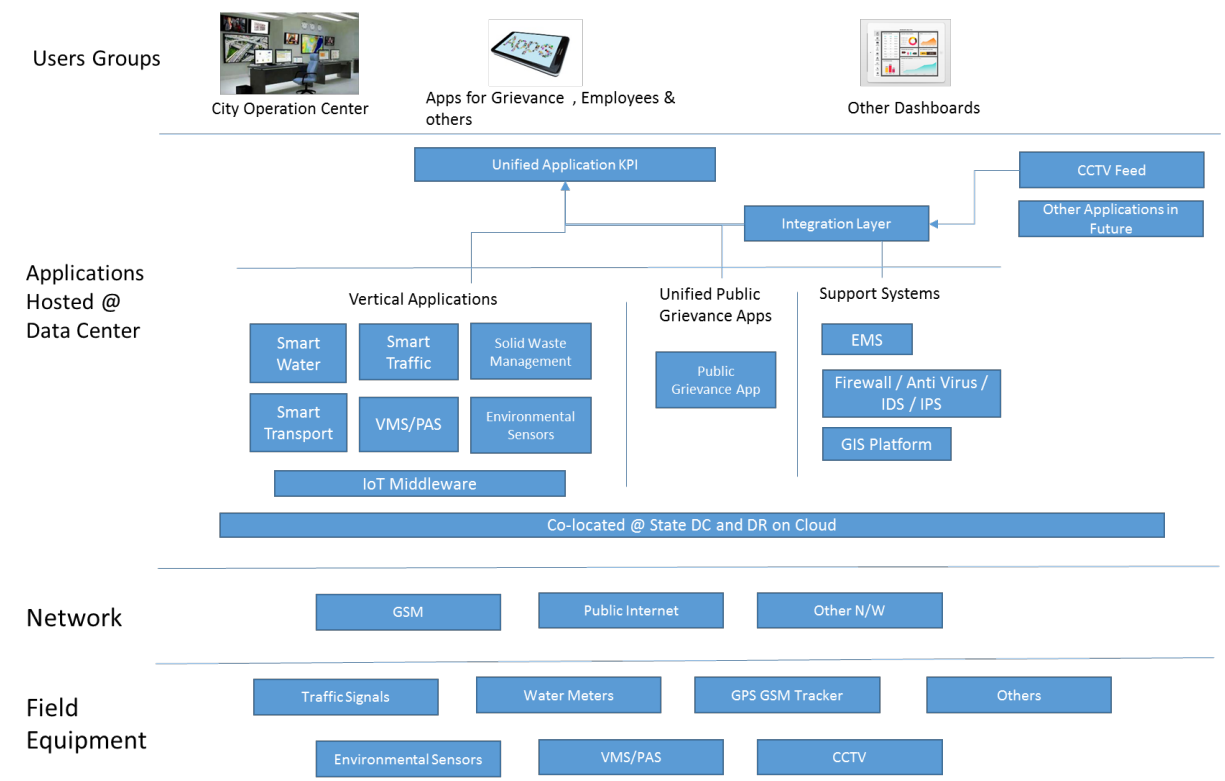
Diagrammatic representation of scope of work for System Integrator

More specifically, the following will be the activities to be carried out by the MSI:

1. Project Planning, execution and Management

2. Assessment and Gap analysis of requirement for all smart city components under scope.

3. Solution Design, System Customization and development for all components mentioned in this volume.

4. ICT items Procurement, deployment and commissioning

5. Site Preparation including required civil work, LAN Networking

6. Application and general awareness Training

7. Business Process Reengineering for the selected applications/ services, if required

8. STQC Certification

9. UAT & Go live

10. Capacity Building

11. Technical Support

12. Operation & Maintenance (O&M) for 5 Years after complete system go Live date.

1.1 Finalization of the detailed Technical Architecture for smart city network

SI will be required to review the Technical Architecture suggested in the Tender and finalize the detailed architecture for the overall system, incorporating findings of site survey exercise. All the components of the Technical Architecture should:

(a) At least comply with the published e Governance standards, frameworks, policies and guidelines available on http://egovstandards.gov.in (updated from time-to-time); and

(b) Be of leading industry standards and /or as per standards mentioned at Annexure –XI.

1.2 Finalization and submission of a detailed technical architecture

SI shall submit the detailed Technical Architecture and description of each sub components, along with the bid, which should take into consideration following guiding principles:

- **Scalability** - Important technical components of the architecture must support scalability to provide continuous growth to meet the growing demand of the city (s). 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, data centre equipment or

other smart city components. Main technology components requiring scalability are storage, bandwidth, computing performance (IT Infrastructure)

The architecture should be scalable (cater to increasing load of internal and external users and their transactions) and capable of delivering high performance till the system is operational. In this context, it is required that the application and deployment architecture should provide for Scale-Up and Scale out on the Application and Web Servers, Database Servers and all other solution components. The data center infrastructure shall be capable of serving at least 1000 concurrent users.

The Applications proposed for various vertical solutions shall be capable of handling 200% growth for the next 5 years. ***MSI shall clearly quantify the expansion capabilities of the application software without incurring additional cost.***

- **Availability** - The architecture components should be redundant and ensure that are no single point of failures in the key solution components. Considering the high sensitivity of the system, design should be in such a way as to be resilient to technology 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. Redundancy has to be considered at the core / data centre components level. The system should be designed to have uptime for 99.99%

- **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 Prevention Systems such attacks and theft should be controlled and well supported (and implemented) with the security policy. The virus and worm attacks should be well defended with gateway level Anti-virus system, along with workstation level Anti-virus mechanism. There should 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 should be properly stored & archived for future analysis and forensics whenever desired. The authority would carry out the security audit of the entire system upon handover and at regular interval during O&M period.

Field equipment installed through this Project would become an important public asset. During the contract period of the Project the SI shall be required to repair / replace any equipment if stolen / damaged/faulty. Appropriate insurance cover must be provided to all the equipment supplied under this project.

The systems implemented for project should be highly secure, considering that it is intended to handle sensitive data relating to the city and residents of the city. The overarching security considerations are described below.

I. The security services used to protect the solution shall include: Identification, Authentication, Access Control, Administration and Audit and support for industry standard protocols.

II. The solution shall support advanced user authentication mechanisms including digital certificates and biometric authentication.

III. Security design should provide for a well-designed identity management system, security of physical and digital assets, data and network security, backup and recovery and disaster recovery system.

IV. The solution should provide for maintaining an audit trail of all the transactions and should also ensure the non-repudiation of audit trail without impacting the overall performance of the system.

V. The overarching requirement is the need to comply with ISO 27001 standards of security.

VI. The application design and development should comply with OWASP top 10 principles

- **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 growth of the environment. Network should be auto/manual configurable for various future requirements for the ease of maintenance / debugging.

- **Interoperability** - The system should have capability to take feed from cameras installed by private / Govt. at public places, digitize (if required) & compress (if required) this feed & store as per requirements.

- **Open Standards** - Systems should use open standards and protocols to the extent possible.

- **Single-Sign On-** The application should enable single-sign-on so that any user once authenticated and authorized by system is not required to be re-authorized for completing any of the services in the same session. For employees of the department concerned, the browser based application accessed on the intranet, through single-sign-on mechanism, will provide access to all the services of the departments concerned (based on their roles and responsibilities), Help module, basic and advanced reporting etc. Similarly, for external users (citizens, etc), based on their profile and registration, the system shall enable single-sign on facility to apply for various services, make payments, submit queries /complaints and check status of their applications.

- **Support for PKI based Authentication and Authorization-** The solution shall support PKI based Authentication and Authorization, in accordance with IT Act 2000, using the Digital Certificates issued by the Certifying Authorities (CA). In particular, 3 factor authentications (login id & password, biometric and digital signature) shall be implemented by the SI for officials/employees involved in processing citizen services.

- **Interoperability Standards-** Keeping in view the evolving needs of interoperability, especially the possibility that the solution shall become the focal point of delivery of services, and may also involve cross-functionality with the e-Government projects of other departments / businesses in future, the solution should be built on Open Standards. The SI shall ensure that the application developed is easily integrated with the existing applications. The code does not build a dependency on any proprietary software, particularly, through the use of proprietary 'stored procedures' belonging to a specific database product. The standards should:

  (a) At least comply with the published e-Governance standards, frameworks, policies and guidelines available on http://egovstandards.gov.in (updated from time-to-time); and

  (b) Be of leading industry standards and /or as per standards mentioned at Annexure –XI.

All the personnel working on the Project and having access to the Servers / Data Centre should be on direct payroll of the SI/OEM/Consortium partner. The SI would not be allowed to sub-contract work, except for following:

- Passive networking & civil work during implementation and O&M period,

- Viewing manpower at Command / viewing centres & Mobile Vans during post-implementation

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

However, even if the work is sub-contracted, the sole responsibility of the work shall lie with the SI. The SI shall be held responsible for any delay/error/non-compliance/penalties 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 city and approved by the Authority before resource mobilisation.

- **GIS Integration-** SI shall undertake detail assessment for integration of all the Field level ICT interventions proposed with the existing Geographical Information System (GIS) using ArcGIS Platform. SI is required to carry out the seamless integration to ensure ease of use of GIS in the Dashboards in Command Control Centers. If this requires field survey, it needs to be done by SI. If such a data is already available with city, it shall facilitate to provide the same.

SI is to check the availability of such data and it's suitability for the project.SI is required to update GIS maps from time to time.

- **SMS Gateway Integration-** SI shall carry out SMS Integration with the Smart City System and develop necessary applications to send mass SMS to groups/individuals. Any external/third party SMS gateway can be used, but this needs to be specified in the Technical Bid, and approved during Bid evaluation.

- **Application Architecture**

    I. The applications designed and developed for the departments concerned must follow best practice and industry standards. In order to achieve the high level of stability and robustness of the application, the system development life cycle must be carried out using the industry standard best practices and adopting the security constraints for access and control rights. The various modules / application should have a common Exception Manager to handle any kind of exception arising due to internal/ external factors. Standards should (a) at least comply with published e-Governance standards, frameworks, policies and guidelines available on http://egovstandards.gov.in (updated from time-to-time); and (b) be of leading industry standards and /or as per standards mentioned at Annexure –XI.

    II. The modules of the application are to be supported by the Session and Transaction Manager for the completeness of the request and response of the client request. The system should have a module exclusively to record the activities/ create the log of activities happening within the system / application to avoid any kind of irregularities within the system by any User / Application.

SI shall design and develop the Smart City System as per the Functional and System requirement specifications finalized.

    I. The Modules specified will be developed afresh based on approved requirement.
    II. Apart from this, if some services are already developed/under development phase by the specific department, such services will be integrated with the Smart City System. These services will be processed through department specific Application in backend.

1.3 Other expectations from SI

1. SI shall engage early in active consultations with the Authority, City Police and other key stakeholders to establish a clear and comprehensive project plan in line with the priorities of all project stakeholders and the project objectives.

2. SI shall assess existing infrastructure's current ability to support the entire solution and integrate the same with the proposed solution wherever applicable and possible

3. SI shall judiciously evaluate the resources and time planned for undertaking the current state assessment, given the overall timelines and milestones of the project.

4. SI shall be responsible for supply of all the Products/equipment such as optical fibre cable, Network, Hardware, Software, Devices, etc. as indicated (but not limited to) in the tentative Bill of Materials included in the RFP and their appropriate quantity & capacity.

5. SI shall be responsible for supply of passive components indicated in the Bill of Materials section of the RFP viz. Housings, Fibre Patch Cords, Racks etc..

6. Validate / Assess the re-use of the existing infrastructure if any with Authority site

7. Supply, Installation, and Commissioning of entire solution at all the locations.

8. SI shall provide the bandwidth required for operationalizing each smart city initiative. The bandwidth requirement shall be analyzed and procured by the SI at its own cost / risk.

10. SI shall Install and commission connectivity across all designated locations.

11. SI shall ensure high availability, reliability and redundancy of the network elements to meet the Service Level requirements.

12. SI shall be responsible for up gradation, enhancement and provisioning additional supplies of network (including active / passive components), hardware, software, etc. as requisitioned by Authority.

13. SI shall ensure that the infrastructure provided under the project shall not have an end of life within 24 months from the date of bidding

14. SI shall ensure that the end of support is not reached during the concurrency of the contract and 5 years thereafter.

15. SI shall ensure compliance to all mandatory government regulations as amended from time to time.

16. The SI shall ensure that all the peripherals, accessories, sub-components required for the functionality and completeness of the solution, including but not limited to devices, equipment, accessories, patch cords (fibre), cables, software, licenses, tools, etc. are provided according to the requirements of the solution.

17. Authority shall not be responsible if the SI has not provisioned some components, sub-components, assemblies, sub-assemblies as part of Bill of Materials in the RFP. The SI shall

have to provision these & other similar things to meet the solution requirements at no additional cost and time implications to Authority.

18. All the software licenses that the SI proposes shall be perpetual software licenses along with maintenance, upgrades and updates for the currency of the contract. The software licenses shall not be restricted based on location and Authority shall have the flexibility to use the software licenses for other requirements if required.

19. SI shall ensure there is a 24x7 comprehensive onsite support for duration of the contract for respective components to meet SLA requirement. The SI shall ensure that all the OEMs have an understanding of the service levels required by Authority. SI is required to provide the necessary MAF (Manufacturer Authorization Form) as per the format provided in the RFP in support of OEMs active support in the project.

20. Considering the criticality of the infrastructure, SI is expected to design the solution considering the RFP requirement of no single point of failure with high level of redundancy and resilience to meet the network uptime requirements.

21. SI shall be responsible for periodic updates & upgrades of all equipment, cabling and connectivity provided at all locations during the contract period.

22. SI shall be responsible for setting up / building / renovating the necessary physical infrastructure including provisioning for network, power, rack, etc. at all the locations.

23. SI is expected to provide following services, including but not limited to:

   i. Provisioning hardware and network components of the solution, in line with the proposed authority's requirements

   ii. Size and propose for network devices (like Router, switches, security equipment including firewalls, IPS / IDS, routers, etc. as per the location requirements with the required components/modules, considering redundancy and load balancing in line with RFP.

   iii. Size and provision the WAN bandwidth requirements across all locations considering the application performance, data transfer, DR and other requirements for smart city initiatives.

   iv. Size and provision the internet connectivity for Service Provider network and Network Backbone.

   v. Liaise with service providers for commissioning and maintenance of the links.

   vi. Furnish a schedule of delivery of all IT/Non-IT Infrastructure items

vii. All equipment proposed as part of this RFP shall be rack mountable.

viii. Authority may at its sole discretion evaluate the hardware sizing document proposed by the SI. The. SI needs to provide necessary explanation for sizing to the Authority

ix. Complete hardware sizing for the complete scope with provision for upgrade

x. Specifying the number and configuration of the racks (size, power, etc.) that shall be required at all the locations.

xi. The SI shall provide for all required features like support for multiple routing protocols, congestion management mechanisms and Quality of Service support.

xii. The SI shall ensure that all active equipment (components) are Simple Network Management Protocol (SNMP) V3 compliant and are available for maintenance/management through SNMP from the date of installation by a Network Monitoring System.

24. SI shall directly interact with electricity boards for provision of mains power supply at all desired locations for any Field Infrastructure solution. The Belagavi Smart City shall facilitate, if any documentation is required from its side. SI shall be responsible for provisioning of requisite electricity power and its recurring charges (during operational phase). SI may provision the same under appropriate heads in the commercial bid.

25. 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-erected shall be cleaned, provided with new fixings where necessary and the posts re-painted in accordance with Belagavi Smart City guidelines. Road signs, street name plate etc. damaged by the SI during their operation shall be repaired or replaced at the SI's cost.

26. The infrastructure of existing Traffic signal systems or any other filed Infrastructure including the poles, cantilevers, aspects, controllers and cabling and associated mountings and civil infrastructure may need to be dismantled (where ever applicable) and replaced with the new systems proposed and shall be in the scope of SI. The dismantled infrastructure shall be delivered at the Belagavi Smart City designated location without damage, at no extra cost.

27. Prior to starting the site clearance, the SI shall carry out survey of field locations as specified in Vol 4, for buildings, structures, fences, trees, existing installations, etc. The Belagavi Smart City 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 BSCL.

28. Lightning Proof Measures

   i.   The SI shall comply with lightning-protection and anti –interference measures for system structure, equipment type selection, equipment earthing, power, signal cables laying.

   ii. 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 functions; capable to bear certain mechanical external force.

   iii. Signal separation of low and high frequency; equipment protective field shall be connected with their own public equal power bodies; small size/equipment signal lightning arrester shall be erected before the earthling.

   iv. 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.

   v.   Data line protection shall be installed as per zone defined in IEC 62305.

   i. Type 1 device shall be installed between zone 0B and zone 1.

   ii. Type 2 devices shall be installed before the equipment in zone 2 and 3.

29. After signing of contract, the Systems Integrator needs to deploy the team proposed for the project and ensure that a Project Inception Report is submitted to Belagavi Smart City Limited which should cover following aspects:

   i.   Names of the Project Team members, their roles & responsibilities

   ii. Approach & 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).

   iii. Responsibility matrix for all stakeholders

   iv. Risks the SI anticipates and the plans they have towards their mitigation.

   v.   Detailed Project Plan, specifying dependencies between various project activities / sub-activities and their timelines.

30. Feasibility Report for all ICT projects mentioned in the report should be conducted. System Integrator should provide as part of feasibility report the detailed To-Be designs (Junction layout plans) specifying the following:

i. High Level Design (including but not limited to)

ii. Application architecture documents

iii. ER diagrams and other data modelling documents

iv. Logical and physical database design

v. Data dictionary and data definitions

- Application component design including component deployment views, control flows, etc.
- Field equipment deployment architecture
- Low Level Design (including but not limited to)
  - Application flows and logic including pseudo code o 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 Karnataka
- Location of all field systems and components proposed at the junctions/other locations,
- Height and foundation of Traffic Signals and Standard Poles for Pedestrian signals.
- Height and foundation of Poles, cantilevers, gantry and other mounting structures for other field devices
- Location of Junction Box
- Location of PoP
- Electrical power provisioning

31. Any functionality not expressly stated in this document but required to meet the needs of the organization 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.

2   Level 1: Integrate and View

Certain components will be integrated using direct feeds, dashboards and sharing of alerts/ actionable inputs for integrate and view operations, such as:

a) City Surveillance

b) Ambulance & Fire

2.1   Track 1 -City Surveillance

CoC will be required to be integrated with Police Command and Control system, to receive real-time feeds of the camera installed by them. These video feeds will not be saved, but will be utilized in Analytical layer to help administration monitor its assets and do a better urban planning. CoC should also be able to trigger the commands / alerts (if required) to the respective command centre.

Belagavi City police has already started city surveillance; surveillance is being monitored from police HQ in Belagavi. As part of this work SI – needs to bring in the feed from the police HQ and integrate it with the CCC/CoC. Sizing of the network to bring in the feed to the CCC/CoC should be calculated by the SI. The SI shall also provision for future feeds. The details of the same is provided in Section 4, Annexure-VI

2.2   Track 2- E Governance & Belagavi One:

The State of Karnataka has already implemented various e-governance initiative that shall be integrated and made available in the form of a dash board in the CoC. The various modules are:

1) Lodge Your Grievance (Jananihata)

2) Trade License (Vyapara)

3) Building Licenses

4) Birth and Death Registration

5) Belagavi One- 8 core services of the 32 services

API 's for the above said module will be provided to the MSI for integration with CoC

3 Level 2: Integrate, Command and Control:

For Integrate and Command level of work, SI will be required to integrate already implemented services in the city and also scope to integrate services which are proposed to be implemented by any of the line departments, city corporation or smart city SPV in near future. This level will not require full-fledged implementation of the tracks identified in this. For this the client has identified following tracks:

3.1 Track 3 - Ambulance & Fire

CoC will be required to integrate the real-time feeds of emergency services where citizens can call on 108 & 102 during emergency. CoC should also be able to trigger the commands / alerts (if required) to the respective command centre.

It is now proposed to install GPS in all the fire engines and ambulance for online tracking.

3.2 Track 4- Geospatial Database Management:

SI shall undertake detail assessment for integration of all the Field level ICT interventions proposed with the existing Geographical Information System (GIS) using ArcGIS Platform. SI is required to carry out the seamless integration to ensure ease of use of GIS in the Dashboards in Command Control Centres. If this requires field survey, it needs to be done by SI. If such a data is already available with city, it shall facilitate to provide the same. SI is to check the availability of such data and it's suitability for the project.SI is required to update GIS maps from time to time.

3.2.1 Existing ArcGIS Enterprise system

Currently department has procured ArcGIS Enterprise Server with the following features:

a) The GIS application is scalable and robust with powerful GIS functionalities & capabilities.

b) GIS application is web responsive that enables the user to view the application on different devices (tablets, smartphone, etc.) in such a way that it shall auto fit to any screen resolution.

c) Department users can use GIS map viewer application that has readily available map browsing functionalities.

3.2.2 The following functionalities have already been built using said software :

a) **A citizen portal** which is a Single Window information portal for all the information related to the smart city.

b) A **Map Visualization module** which provides map view and navigation tools to public

c) **POI based information module** which allows public to access and analyze information in relation to selected Points of Interest like:

- Education, Community Services, Culture, Health/Family, Sports and Recreation, Security, Emergency, Govt. offices

d) **Search and Query Module** for users to search the map content based on the available attribute information provided in the GIS layers available

e) **Public Grievance Application module** to enable a GIS based web application for public to report Grievances to client

f) **Social Media Integration Module**

3.2.3 Integration with Business Systems:

a) live monitoring of sensors on GIS location & Alerts

b) GIS mapping of Utilities

c) Incident reporting Application

d) GIS based utility operations and maintenance & planning system

e) GIS based consumer indexing and Mobile based workforce management

f) integration with Command & Control Center

3.3 Track 5- Smart Parking:

It is proposed to implement one Multilevel parking facility under the SCP. Once implemented, SI will be required to integrate smart parking solutions with proposed City Operations Centre.

3.4 Track 6- Smart Lighting:

Belagavi has planned to implement smart lighting solution through energy saving models, auto dimming technology, solar panels, IP/GSM based solutions etc. SI on-boarded under this RFP will be responsible for supporting the implementing agency and further integration of implemented smart lighting solution in the city to the CoC. It is estimated that there are about 36,000 street lights at present. The MSI for future integration may consider about 50,000 street lights to the CoC

3.5   Track 7- Smart Energy Management and Electricity Supply

As a mandated feature under Smart Cities Mission, the BSCL has proposed to integrate energy supply for city Belagavi through smart electricity meters and SCADA. The MSI/SI will be required to integrate smart electricity (and SCADA) project with City Operations Centre for command and control as and when implemented. The approximate number of properties that would be covered under this project would be around 1,10,000.

3.6   Track 8- Smart UGD

MSI will be required to integrate smart UGD (SCADA) project with City Operations Centre for command and control as and when implemented.

4 Level 3: Implement, Command, Control and Fully Operate

4.1 Track 9- Smart Water

4.1.1 Overview

In 2009 Belagavi city has successfully implemented the 24x7 distribution of water in demo zones covering 10 wards. There is a plan to extend the 24x7 water distribution to the entire city in the span of next few years. Currently in the 10 wards in which 24x7 water supply is done, 10 wards are divided in north and south demo zones, where in north zone

4.1.2 Scope of Work

SI shall set up an Integrated Information Management System (IIMS) in the city operation centre for collation of data for overall water consumption at all House Hold Level and collection of data directly from the AMR bulk flow meters, pressure sensors, chlorine and turbidity monitoring at WTP by way of GSM/GPRS installed in various locations of the water distribution systems. The IIMS shall help the city to perform the following:

Computerize consumption of water

Monitor and record the following:

  a) Raw water Out flow at the Intake or Jack well

  b) Raw Water In Flow at the WTP

  c) Turbidity of the water at the WTP

  d) Clear Water Out Flow at the WTP

  e) pH content of clear water at the WTP

  f) Pure Water Out Flow at the Pump house

  g) In flow at All OHTs

  h) Out flow at all OHTs

  i) Pressure at the Critical Zone Points

MSI will keep the scope for future integration of Water SCADA and Smart Domestic Meters in the smart water management system, Water SCADA is envisaged to be taken up as a separate project under convergence with other programs.

4.1.3 Functional Specifications

- Procure necessary hardware, system software for successful running of IIMS.

- Liaison with necessary stake holders, understand and collect the required information

- Collect monthly meter readings using Android based mobile phone, calculate consumption of each house hold and transmit the consumption details to the IIMS

- Install data collection mechanism to monitor the water distribution network

- Set up IIMS and ensure 24x7, 365 days availability of the system

- Ensure timely back up of database

- Perform initial configuration of the systems and database conversion

- Trouble shoot the database and application modules

- SI has to collect information regarding the Consumption of water by visiting respective connections along with ULBs meter reader and record current meter reading manually.

- The system shall support secure communication over Radio Frequency, Ethernet, Global Packet Radio System, Optical Fiber Cable, Wi-Fi, SMS, HTTP, SHTTP, FTP for both short range and long range communication.

- The system shall support both real time and offline data collection, transmission mechanism. The offline mode shall be used when the networks seize to exist and data is collected and transmitted in batch when the communication network resumes. The system shall also support data dump to flash drives which then can be uploaded to the system where connectivity prevails.

Bulk Flow Metering:

a) Raw water Out flow at the Intake or Jack well: Flow Rate, Flow volume

b) Raw Water In Flow at the WTP: Flow Rate, Flow volume

c) Clear Water Out Flow at the WTP: Flow Rate, Flow volume

d) Pure Water Out Flow at the Pump house: Flow Rate, Flow volume

e) In flow at all OHTs: Flow Rate, Flow volume

f) Out flow at all OHTs: Flow Rate, Flow volume

g) Pressure at the Critical Zone Points: Pressure

Schematic Diagram and Number of Bulk flow Meter requirement is provided in Volume 4, Annexure V

WTP Monitoring:

a) pH at the WTP

    b) Turbidity at the WTP

    c) Chlorine at WTP

- The data collection mechanism at each of the above points shall be through GPRS/GSM mechanism.
- IIMS shall continuously record the data and make it available for any statistical analysis.

METER READING SOFTWARE – ANDROID BASED

- Meter reading software for Android device should be Android based APK file and Same software should be activated with proper License along with supporting files from OEM.
- The software should have user name and password for login into appropriate account created on Server side.
- After login user should view the meters which are assigned to that particular user only.
- Meter reading software shall have facility to record the meter reading of Non-Amr water meters (i.e manual reading/eyeball reading) and also for AMR RF based water meters through Walkby or drive by method. i.e Same software shall be used for existing Non-Amr water meters which are already installed at consumer location and also for new meters which may have RF based AMR Facility.
- Meter reading software shall show the Customer Details like name, address, Meter serial number.
- Meter reading software shall have facility of putting comments or remark on site by meter reader for each consumer to facilitate instant analyses at server end.
- Meter reading software shall have facility filter the meters by Manual/Eyeball, AMR/Wireless, Read, unread. This filter facility should be available for the meters which are in the reading schedule for particular meter reader/user.
- Meter reading software must show the consumption of the consumer along with approx. avg per day consumption once current reading is entered for particular consumer.
- Meter reading software must have facility to take a picture/image on site.
- Meter reading software shall read the location of installed meter and also once reading is done it should show the reading location also. For Installation location the MSI has to record the GPS coordinate during installation or while first reading schedule using this Meter reading software only.
- Meter reading software should have sync facility to upload the data back to server after reading the meters on site using internet connection (GPRS or WiFi).
- Meter reading software should alert if new version of software is available on cloud and should have option to update the software using internet connection.

Cloud Based Data Hosting Software (Web Application) for measuring customer water consumption

- Software should be web based application with different user login credentials according to user profile
- The web based application should have an access level that defines the tasks that user are allowed to complete within the application. Ie some user should be allowed to view the data of their network and cannot modify the data in any way, other user can read meters but cannot adjust meter or account details and other will have full access that allows the creation of new accounts, modify reading etc.
- Software should allow user to manage water meter network, collect and store readings of water meters and integrate with external exiting/ new billing software of utility.
- Software should have the facility to create the route according to meter reading schedule/ zone/ DMA or any predefined area.
- Software should include all meters irrespective of type (domestic or commercial/bulk), reading method (manual, wireless, data loggers)
- Software should hold all the information associated with the physical installation of the meter. This includes meter type, serial number, reference number, GPS location, installation date, expected collection/reading method.
- Software should have summary page which should meters in routes, read meters, unread meters, exceptions, skips, GPS deviation.
- Software should display different types of reports like, read meter's details, wireless meters, manually reads, unread meters along with its GPS locations (GPS location will be recorded during installation of water meter or during reading schedule).
- Software should meter reading along with historical consumption of each consumer along with approx. avg per day consumption once current reading is entered for particular consumer.
- Software should facility to download the data in form of XLS or CSV file.
- Admin should have facility to assign the meters to meter reader according to reading schedule.
- The software (admin) should have facility to update account/consumer details like meter serial number, address, GPS location.
- Software should display the photos/images taken by the meter reader during reading along with comments. This facility will help utility to analyse/ cross check the meter reading or any other discrepancies

- Software should display the Reading GPS location and should indicate any discrepancies for reading GPS location.
- Software should have facility to download the entire network data in form of XLS or CSV.
- Addition to above specification, software should have facility for individual customers to view their meter consumption data through web portal

4.1.4 Technical Specifications

METER READING ANDROID DEVICE

- Minimum System Requirement for Android Device

  a. 5" Screen
  b. 2.2 GHz Processor
  c. 1 GB of RAM
  d. 8 GB of Flash Disk
  e. GPS Sensor
  f. Wi-Fi Connection
  g. Bluetooth 4.0 LE
  h. Android 5.0 or Higher (highly recommended)

- Meter reading device shall have the sufficient memory for storage of maximum data / reading along with sufficient power back up.
- Meter reading device shall have the onsite search facility, to locate the exact physical location of water meter in particular area and to obtain the corresponding details of it.
- The Meter reading device should have adjustable back light, sun light readable, colour display and touch screen.
- The Meter Reading Device must come with an integrated intelligent fast charge capability that allows full charge within 3 Hours.

No	Specification	Qty
1	Supply of Automatic Meter Reading (AMR) Electromagnetic full bore Bulk Flow Water meters with 24hrs battery backup confirming to ISO 4064 with EEC/FCRI certification. The data transmission shall be trough data analyzer by way of GPRS/GSM. All meters shall be suitable for indefinite immersion under water compliant with IP 68 etc. complete including Supply & laying data cable, Erection, testing, trail run and commissioning of flow meter in line with	7

	transmission main after cutting the main, fixing reducer / expanders using fasteners with packing as the case may be etc., complete Installation and commissioning of the flow meter in a complete manner as per specifications, design, drawings and directions of Engineer in charge.150 mm to 450 mm dia	
2	Supply and fixing of mechanical joint for pipe line with suitable bolt & nut and Installation and commissioning of Flange Adaptor along with commissioning accessories	7
3	Supplying and fixing Brand new standard approved Pressure transducers with pressure range 0 - 100Bar to with stand over pressure at 2 time of full scale, connection with 1/4" NPT, 1/8"NPT, G 1/4", G 1/4", accuracy +/- 1% to +/- 0.5%, Stability 0.25% F.S/year, Total error should not cross 1%, operating temperature 20 to 800 C, Output 0.5-4.5V or 4-20mA Output 0.5-4.5V, 1-5V, 0-10V, 0.5-10.5V, 4-20mA, Electrical connection IP68 cable gland, DIN43650A, Power supply 5Vdc, 8-30Vdc Lithium battery with 60 month life from the start of O&M period including all material charges, installing, commissioning with all fittings, conveyance charges with all lead and lift etc., complete as per direction of Engineer in charge.	12
4	Supplying, fixing and commissioning of Brand new standard approved Seamless Programmable Data Transmission Unit equiped with GSM, with 1 analog channel, 1 RS485 to record the following at the minimum sampling Rate: Pressure. pH analyser, Turbidity Analyser : 1 samples per hour or when the pressure drops below a preset threshold Power: 5V to 24V DC, Battery powered. The system should work with or without availability of AC power supply with suitable source of alternate power supply Including all material charges, labour charges etc., complete as per direction of Engineer in charge	13
5	Supplying, fixing and commissioning of Brand new standard approved Turbidity analyser ranging from 2.5 to 10 to suit the 230V power supply with required cable and fixing it in position in pump room including cable connections etc. The analyzer shall provide either 4-20mA, RS232 or RS485 interface to programmatically read the analyzer output. The scope includes complete with all lead and lifts including all material charges, labour charges etc., complete as per direction of Engineer in charge - for the raw water main at WTP complex.	1

6	Supplying, fixing and commissioning of Brand new standard approved pH analyser ranging from 7 to 8.5 to suit the 230V power supply with required cable and fixing it in position in pump room including cable connections etc. The analyzer shall provide either 4-20mA, RS232 or RS485 interface to programmatically read the analyzer output. The scope includes complete with all lead and lifts including all material charges, labour charges etc., complete as per direction of Engineer in charge - for the clear water main at WTP complex.	1
7	Supplying, fixing and commissioning of Brand new standard approved Residual Chlorine analyser in range 0 to 2 ppm to suit the 230V power supply with required cable and fixing it in position in pump room including cable connections etc. complete with all lead and lifts including all material charges, labour charges etc., complete as per direction of Engineer in charge - for the clear water main at WTP	1
8	Android Device with Meter reading software	20

4.2   Track 10- ICT Enabled Solid Waste Management

4.2.1   Overview

Belagavi has a population of over 5 lakhs populated in 94 square km. It has around 58 wards, which generates a Municipal Solid waste of around 180-200 TPD. Out of 58 wards, 48 wards are outsourced to a third-party vendor. Belagavi Municipal Corporation along with the Vendor is responsible for collection, segregation, transportation, dumping and processing of the city waste from door to door.

Waste is transferred from primary collection vehicles into secondary collection vehicles for dumping at Waste Processing plant. Authority has approx. 158 field staff which is responsible for street sweeping and collection of street waste and dumping to the nearest bins.

Currently, managing the people responsible for the activity and proper utilization of assets/resources assigned to them has become a complex job for Authority. The main problems of the existing solid waste collection process are:

1. Lack of information about the collecting time and area.

2. Lack of proper system for monitoring, tracking the vehicles

3. Physical visit required to verify employee performance

4. Transfer of Waste from Primary collection to secondary collection is vehicle transfer and improper co-ordination leads to missed trips and garbage piling.

5. There is no quick response to urgent cases like truck accident, breakdown, long time idling etc.

Authority intends to implement a RF based and GPS enabled Solid Waste Management System practices within the existing landscape to:

1. Door to door collection tracking and monitoring

2. RFID Tags for Door to door, waste tracking and monitoring: One of the primary objectives of the project is to track the locations of the each house-hold waste pickup and tipper vehicles movement. Placing RFID tags on each house-hold from where waste is picked up.

3. Manage routes and vehicles dynamically through an automated system.

4. Do Route optimization which shall help in reduction of trip time, fuel saving and serving more locations

5. Reduce the human intervention in monitoring process

6. Keep history of vehicle routes, attended sites and other details

7. Reporting of vehicles, garbage collected and other SWM details to higher authorities from any location at any time

8. Monitor and track the activities of field staff force on daily basis

Detailed objectives also include

– Real time management of missed garbage collection points

– To reduce the human intervention in monitoring process

– To ensure complete coverage of door to door and community collections

4.2.2 Scope of Work

End-to-End Solution to implement and to provide Support Services & Maintenance.

1. Implementation of "Door to Door Collection Monitoring System"

    1.1. Supply and installation RFID tags and readers.

    1.2. Design and integrate Door to Door Tracking and Monitoring System

2. SI should provide Automatic Vehicle Locator solution to vehicles at primary (excluding pushcarts) and secondary collection points

3. SI should provide GPS based attendance management system to the staff

4. SI should install Surveillance cameras at bulk waste generation points.

5. SI Shall provide an MIS System which shall be capable of recording the details of daily waste receipt, waste processed and waste disposed in terms of tonnage. The solution provided shall be automated by having a computerized weigh bridge. The data shall be transmitted online to the CCC/CoC

6. Integrating data feed from waste disposal site (data feed access would be provided by BSCL/BMC) like feeds from CCTV camera and Data from Weigh Bridge

7. Sizing of Hardware, software and network devices required in the data Centers for using the Integrated SWM.

8. Supply & Installation of hardware (servers), software and network devices required in the data Centers for using the Integrated SWM.

9. Design, Development, Supply, Deployment & Implementation of Web Based Application software integrated with GPS, RFID devices, VTMS and complaint management modules.

10. Maintenance of RFID devices and after warranty period including the replacement of devices in cases of damage, new vehicle or any other change.

11. Maintenance of web based application for Integrated SWM., during and after warranty period.

12. Provide resources for support, maintain and administering the system.

13. Integration of ISWM with City Operation Centre

14. Provide training to BSCL resources for operating the tracking system.

Information regarding total number of vehicles, field staff, etc. can be found in Volume -4, Annexure - 4
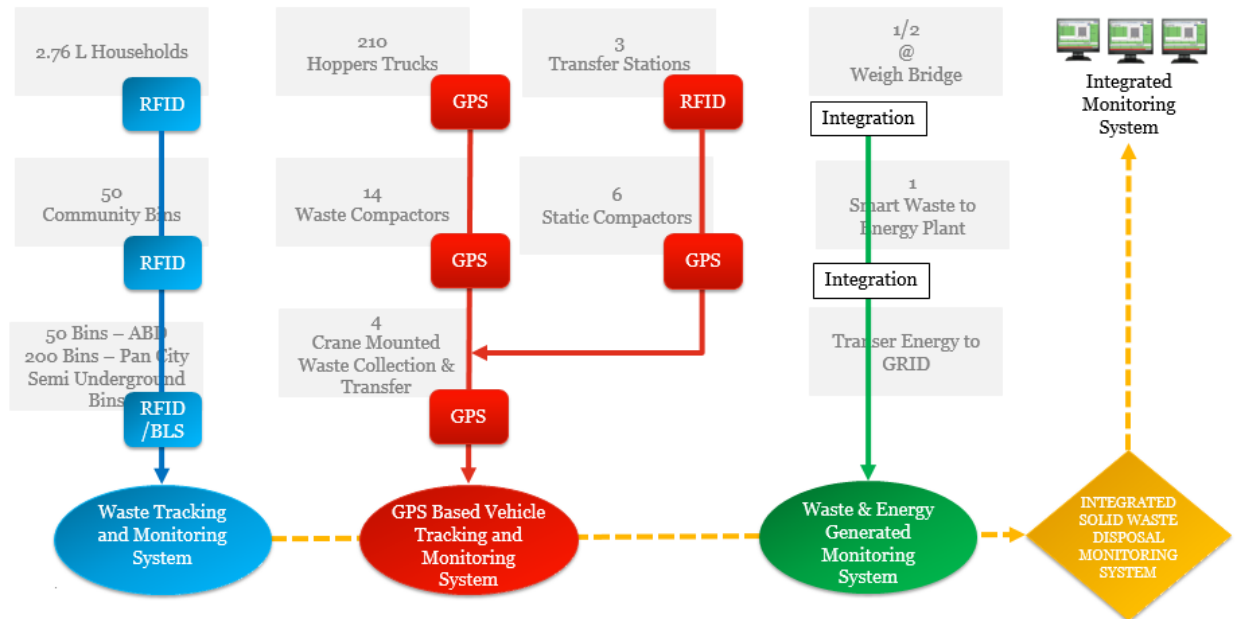
Process Diagram for ISwM
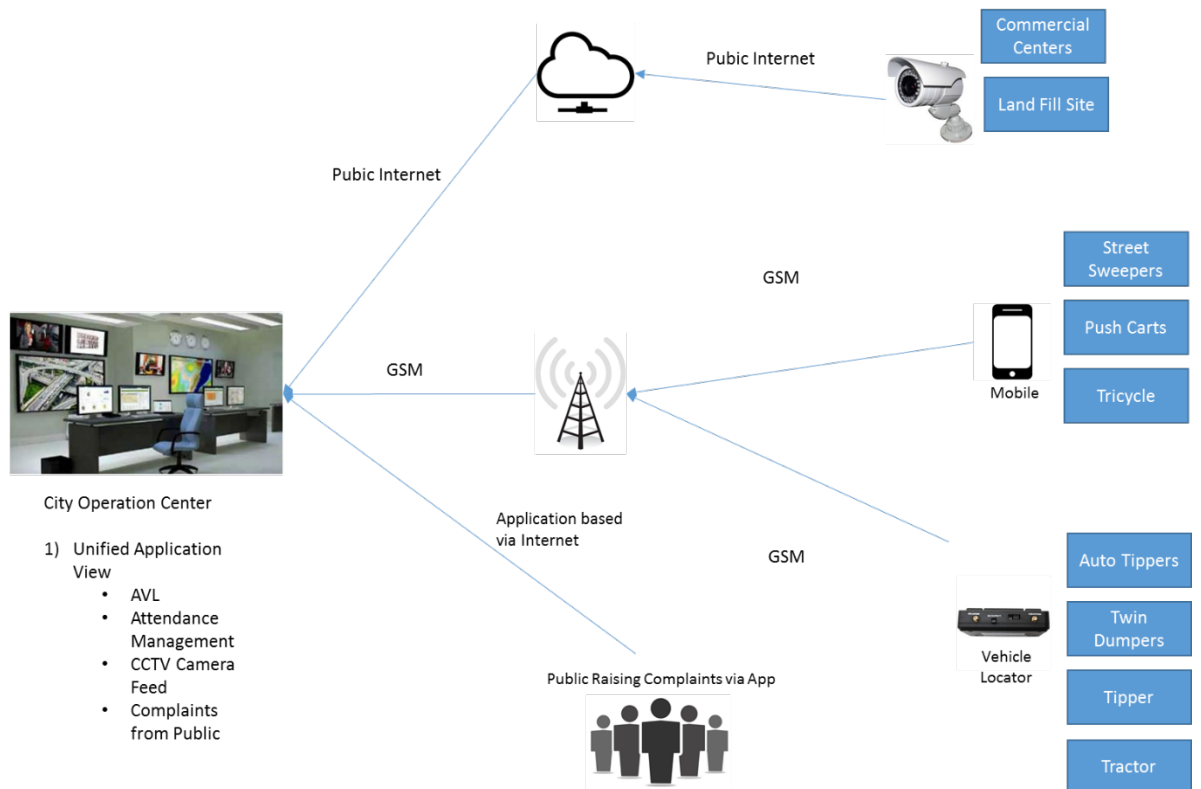
Schematic View of the Applications Integrated to CoC

4.2.3   Functional Specifications

4.2.3.1   Automated Vehicle Locator Management System –

1. GPS tracking of the waste pick up vehicle for real time tracking
2. System should help in co-ordination between primary and secondary collection vehicles for transferring dump
3. Route Optimization will help in reduction of trip time, fuel saving and serving more locations
4. System should ensure that complete coverage of door to door and community collections served by vehicles
5. Record history of vehicle routes, attended sites and other details
6. Monitoring & Reporting Application - reports of vehicles, garbage collection status etc.
7. Ensure complete coverage of door to door and community collections served by vehicles
8. Alert / Alarm management
    a. Real time management of missed garbage transfer
    b. Daily report of Door-Door Collection efficiency combined with complaints raised by Public
9. Monitoring & Reporting Application - reports of vehicles, garbage collection status, bin status etc.
10. Solution should be integrated into the GIS map provided by BSCL

4.2.3.2   Mobile GPS based Staff Attendance Management System –

GPS based device with RFID receiver shall enable Authority's field staff to register their attendance/presence throughout the day. The system shall periodically track the location (with time stamping) of the staff through their GPS based mobile device and shall map it in the system with the pre-defined area coordinates. The device shall feed the data through GPRS/GSM network to the city operation centre central application for reporting generation and alerts.

1. Provided to Staff who are doing activities like door-door collection via Pushcarts / Tricycle / street sweeping
2. Provide ability for the staff to update job completion reports along with pictures.
3. Pictures should be stored on historical mode in the GIS Map for a period of 1 week.
4. Solution should be integrated into the GIS map provided by BSCL
5. Solution should be able to mark route attended by the staff along with the allocated route

4.2.3.3   Mobile Application for Customers

SI should develop a mobile application to be provided to the Public which will help them raise complaint for following:

    a. Garbage Pile on the roads

    b. Missed Garbage Collection at home / Industrial Area

    c. Crowd sourcing application for compliant registration and grievances

    d. Request for Garbage Collection

4.2.3.4 Unified Dashboard View for Solid Waste Management

1. A unified View should can show the primary and secondary collection.

    a. Included all vehicles tracked via AVL or Mobile based.

    b. Collection Percentage achieved daily – co-relating with the final dumping processes

    c. Co-relation with the complaints raised / Area, along with photographic evidence

2. System should be capable of providing missed collection

3. System should be capable of marking areas where waste is generated or high to low basis

4. System should be capable of showing only a single selected process for a particular area

5. System should be capable of showing complaints raised by citizen tagged to a particular location.

6. System should be capable of showing CCTV footages from bulk waste generation points and inside the waste treatment plant on the GIS map

7. System should be capable of showing real time data from the load cell placed in the Waste Treatment Facility

8. Unified view should be capable of being integrated with other departments

9. Unified View goal will be to improve waste collection efficiency using the field infrastructure deployed

    a. Any other reports aiding to perform the same shall be in scope of SI.

4.2.3.5 Infrastructure Solutions

The MSI shall be responsible for the supply, installation & commissioning of the following field equipment's as per the technical specifications mentioned in the RFP document:

    a. GPS Tracking System with all fittings & fixtures in all the vehicles

    b. GPS based mobile attendance management.

    c. CCTV Cameras at Waste Processing Site and at bulk waste generation points

    d. RFID tags at households

    e. RF tags on collection vehicles

    f. Automated Weigh bridge

Type of vehicle	
Auto Tipper (Primary Collection)	GPS Tracking System
Push Carts + Tricycle (Primary Collection)	Tracking via GPS Based Attendance System
Twin Dumpers (Secondary Collection)	GPS Tracking System
Tipper (Secondary Collection)	GPS Tracking System
Tractor (Secondary Collection)	GPS Tracking System
Staff Sweeping Roads	Tracking via GPS Based Attendance System

The solution that will be proved by the selected SI will have the below mentioned indicative functional requirements. However detailed functional requirement will have to be prepared by the selected SIs after the award of the project by carrying out a details requirement gathering activity with BSCL, BMC and other line departments:

Functionality	Integration required with
Common Functional Requirements	
Dash board	
Dashboard Module should give a quick and easy view to know overall fleet status on real time basis. It should display status information of all vehicles i.e. Running, Idle or Standby. The Dashboard view should provide the following information: Each department separate authentication based vehicle tracking module. 1. Within department section, there shall be an aggregated view of all the department specific vehicles, its location, movement and other real time details shall be available. 2. There should be a facility to club the area specific and category specific vehicles in groups. 3. Zone name, Ward Name, Vehicle No, Vehicle Type, Current Location & Last Updated Date & Time of each vehicle. 4. It should give alert message if GPS device gets disconnected from a vehicle.	

5. Dashboard should have search parameter where different searches i.e. Vehicle Number wise, Zone & Ward wise, running / idle / standby vehicle wise and "No communication" wise searches can be done. 6. It should also give an indication regarding the running speed of the vehicle i.e. Normal speed, Alarming speed and above Alarming speed. 7. There should be provision to see a vehicle on map.	
Map Based Analysis	
8. Creating buffers along the emergency site, working site. 9. Creating & sending alerts in case SUB's reached at particular level for vehicle movement, which can be shown on the map	▪ **GIS** ▪ **Vehicle Tracking System**
Functional Requirements – SWM	
A] Area Details	
10. Area information (Zone / Ward / Colony / Society) 11. Population details 12. Volume of the Solid waste which includes Wet & Dry waste (Recycled & Non Recycled) 13. Resources required 14. Collection procedure (i.e. Primary : House to House & Secondary : Community Bin to Garbage transport centre or mix)	
B] Garbage Collection Scheduling	
15. Assign SWM Vehicles to pick-up the Garbage. Category wise assignment like A: Highly in demand, B: Medium, C: Low Demand. 16. Assignment of dynamic routes using the vehicle initial route and bins attended. 17. Location-wise assignment of Sanitation Staff 18. Scheduling of garbage collection and cleaning activities with the objective of maximizing citizen friendliness on the one hand and optimum use of resources on the other.	▪ **GIS** ▪ **Vehicle Tracking System**
C] Primary Garbage Collection & Disposal	
19. Record the volume of garbage collected and disposed on a daily basis.	▪ **Weigh Bridge**

20. Keeping certain Checks as per environmental regulations, like minimum frequency of lifting garbage etc.	▪ **Vehicle Tracking System**
MIS	
21. Monitor the deployment of pickup trucks and personnel based on the schedule originally drawn. 22. Info on the use of Transfer Stations 23. How much garbage received? 24. Door to door collection, ward wise 25. Dashboard for all activities 26. Reports of Ward Wise Weight Reports. 27. Energy production report 28. Any other custom report as per department	

4.2.4 Technical Specifications

4.2.4.1 GPS/GSM Tracker

#	Parameter	Minimum Specifications or better
1	Weight	Should Be Lightweight.
2	Housing	Aluminium Or Fibre Case
3	Operational Temperature	-25～70
4	Storage Temperature	-40～80
5	Power Consumption	<1 W (60ma～100ma)
6	Backup Power	24 Hrs Minimum.(In Ideal Mode)
7	Input Voltage	10～30v
8	Frequency	L1,1575.42 MHz
9	Protocol	Nmea 0183 V2.2
10	Channels	20
11	Flash	4mbit
12	Sensitivity	Tracking: -159dbm

#	Parameter	Minimum Specifications or better
13	Cold Start	42seconds, Average
14	Warm Start	38seconds, Average
15	Hot Start	1 Seconds, Average
16	Reacquisition	0.1 Seconds, Average
17	Accuracy	Position: 10meters, 2d Rms,5meters, 2d Rms,Waas Enabled Velocity: 0.1 M/S Time: 1us Synchronized To Gps Time
18	Frequency Bands	Sim 340 Quad-Band: Gsm 850,Egsm 900,Dcs 1800,Pcs 1900. The Band Can Be Set By At Command, And Default Band Is Egsm 900 And Dcs 1800 ,Compliant To Gsm Phase 2/2+
19	Temperature Range	Normal Operation: -20 To +55 Restricted Operation: -25 To -20 And +55 To +70 Storage Temperature -40 To +80
20	Data GPRS	GPRS Data Downlink Transfer: Max. 85.6 Kbps GPRS Data Uplink Transfer: Max. 42.8 Kbps Coding Scheme: Cs-1, Cs-2, Cs-3 And Cs-4 Sim340 Supports Protocols PAP (Password Authentication Protocol) Usually Used For PPP Connections. Sim340 Integrates TCP/IP Protocol. Support Packet Switched Broadcast Control Channel (Pbcch) Csd Transmission Rates: 2.4, 4.8, 9.6, 14.4 Kbps, Non-Transparent Unstructured Supplementary Services Data (Ussd) Support
21	Sms	Mt, Mo, Cb, Text And Pdu Mode Sms Storage: Sim Card Support Transmission Of Sms Alternatively Over Csd Or Gprs. User Can Choose Preferred Mode.
22	Sim Interface	Supported Sim Card: 1.8v ,3v
23	Two Serial Interfaces	Serial Port 1 Seven Lines On Serial Port Interface
24	Sim Application Toolkit	Supports Sat Class 3, Gsm 11.14 Release 98
25	Real Time Clock	Implemented

#	Parameter	Minimum Specifications or better
26	Timer Function	Programmable Via At Command
27	Firmware Upgrade	Firmware Upgradeable Over Serial Interface
28	Internal Battery Cum Charger	Li-Ion Battery With Minimum 08 Hrs Backup When Idle And 04 Hrs When Continuously Used. With Appropriate Charger To Be Charged From Vehicle Battery
29	Certification	Minimum IP65 & ARAI Certification

4.2.4.2 Technical Specs (Pan Tilt and Zoom – based Cameras CC TV)

#	Parameter	Minimum Specifications or better
1	Video Compression	H.264 or better
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, 4.7 – 84.6 mm (corresponding to 18x)
6	Minimum Illumination	Colour: 0.5 lux, B/W: 0.1 lux (at 30 IRE)
7	Day/Night Mode	Colour, Mono, Auto
8	S/N Ratio	≥ 50dB
9	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) 18x optical zoom and 10x digital zoom 16 preset positions Auto-Tracking Pre-set tour
10	Auto adjustment + Remote Control of Image settings	Colour, brightness, sharpness, contrast, white balance, exposure control, backlight compensation, Gain Control, Wide Dynamic Range
11	Protocol	HTTP, HTTPS, FTP, RTSP, RTP, TCP, UDP, RTCP, DHCP,SNMP
12	Security	Password Protection, IP Address filtering, User Access Log, HTTPS encryption

#	Parameter	Minimum Specifications or better
13	Operating conditions	0 to 50°C
14	Casing	NEMA 4X / IP-66 rated
15	Certification	UL / CE / FCC / EN
16	Auto Detection & Configuration	The camera should be automatically discovered and configured when connected to VMS or Network Switch, to set the right network parameters for the video stream on the network
17	Activity detection	Camera should support User- definable alerts with configurable sensitivities and thresholds, email alert, and HTTP notifications. Camera should also support for IEEE 802.1X authentication

4.2.4.3 Technical Specs for RFID Tag and Reader

UHF Passive RFID Tag Specifications:

Parameter	Specification
Type	ABS, High Quality Engineering Plastic
Supported Transponders	ISO18000-6C EPC Class 1 GEN2
Frequency Range	ISM865~928MHz
Operation Mode	Fixed Frequency or FHSS Software Programmable
Memory capacity	The tag should support ISO18000-6C protocol standard 2K Bits storage capacity, 1728 Bits (216bytes) writable user area; MR6730B metal supports EPC C1 GEN2 (ISO18000-6C), with 96Bits writable EPC Code area, 512Bits writable user area, and 32Bits password area, EPC 128 bit user 512 bit TID 96 bits.
Reading Rate	Software Programmable, Average Reading per 64Bits <10ms
Tags material	Metal material
Reading Range	Should be able to be calibrated. (to be kept as 2-4m max) based on the site visit.
Operation Temp	-35°C to 85°C
IP Classification	IP 68
Weather	Heat, dust proof, UV resistant & sea water resistant.

Parameter	Specification
Chemical Resistance	No physical or performance changes in 168 hour Motor oil exposure 168 hour Salt water exposure (salinity 10%) 5 hrs Sulfric acid (10 %Ph 2) 1 h Naoh (10 % Ph 14) exposure

4.2.4.4 RFID Reader Specifications:

Parameter	Specification
Protocol	ISO18000-6C EPC GEN2 Configurable for mixed or single tag-type operation. Air interface software on IV7 is downloadable to add Gen 2 and Class 1 air interfaces and to "future-proof" the product as standards evolve and new features become available.
Frequency Range	Standard ISM 902 928MHz or 915 MHz (US FCC), 865 MHz (ETSI 302-208), and 869 MHz (ETSI 300-220)
Operation Mode	FHSS
RF Power	0~30dBm, software adjustable
Reading Speed	Software Programmable Average Reading per 64Bits <6ms
Reading Mode	Timing or Touch, Software Programmable (reading should be such that the reader does reads two tags at a time)
Communication Mode with central server	TCP/IP and GPRS or higher
Data Input Port	Trigger input one time
Reading Range	Max 12 m(able to calibrate)
Communication Interface	RS232
Accessories	Vehicle-mount DC power cable kit Antennas, and antenna cables
Environmental Rating	IP65
Humidity	10% - 90%g1g
Shock and Vibration Protection	Withstands standard material handling vehicle environments. Meets or exceeds MIL STD 810F
Operating Temperature:	-25°C to 55°C (-13°F to 131°F)

Storage Temperature:	-30°C to 75°C (-22°F to 167°F)
Humidity	10% to 90%
Power Supply	Vehicle DC power 12 to 60V, 4.5 A maximum

4.2.4.5 Indicative Hardware Specifications:

Item	Minimum Specifications
Application Server & Database Server	• 64 bit , x86/ RISC / EPIC with minimum 8 cores with 2.4 GHz or above Processor and the latest series/generation for the server model being quoted • Support for either of 64bit LINUX with cluster support • Cache to be min 4MB per processor/ on chip • Minimum 64 GB RAM; with provision of future expansion • 2 x 600 GB(or higher) SAS/ hot plug drives (10k rpm or more) • Disk bays: Support for min 2 more hot plug SAS/ SATA in disk drive carriers that slides out from front • 2 Ethernet Ports of 10/100/2000 Mbps • Fiber Channel adapters/ports 2 x 8Gbps • Ports Two USB ports (Ver 2.0) • Hot plug Redundant Power Supply; • RAID Controller supporting RAID 0, 1, 5 with 256 MB Cache • Security: Power-on password / admin password / unattended boot / selectable boot / boot without keyboard • Cooling fans: minimum Four fans / multispeed / hot-swap and redundant fan failure signals to management module / fan in each power supply / CPU / memory. • Form Factor: Rack Mountable / Blade

4.3   Track 11 - Intelligent Traffic Management System

4.3.1   Overview

Currently, there are total 40 junctions enabled with traffic signals either with LED or with GLS lights in some of them. Majorly, city is having a large proportion of 4-Arm traffic junction just like every other Indian city.

As part of Area based development and pan city improvement we have identified 13 major traffic junctions (this included new junctions + existing junctions). Currently, city is lacking on advanced ICT enabled Traffic Management and Communication tools/systems and existing system is facing few problems like:

1. Traffic congestion and huge waiting time

2. No dedicated lane reservation for emergency vehicles like ambulance, police etc.

3. VIP movement clearance

4. Lack of information on prominent & frequent traffic congestions both location wise and time wise

5. Absence of street level public information & communication channel

6. Absence of central control mechanism to monitor & regulate the city traffic flow

Authority intends to implement an Intelligent Traffic Management System within the existing landscape to:

1. Automate the process of traffic management by optimally configuring the traffic junction lights on real time basis

2. Minimize the traffic congestions and waiting time

3. Centrally controlled traffic management system to ensure smooth movement of emergency services like ambulance, police etc.

4. Increase Traffic Signal Efficiency

5. Improve Journey Time Reliability

6. Managed & coordinated VIP movements

7. Availability of traffic data to further analyses and optimize the traffic flow

8. Real Time Incident Message and Advisory Messages to citizens

9. Improved Traffic Regulation

4.3.2 Scope of Work

- The SI shall study the existing traffic management systems and processes deployed by the competent authorities, MIS reporting requirements, problem areas and expectations of Belagavi Traffic Police.

- Collect data of existing operating conditions, traffic volumes across various time periods of a day, which will cover all peak and non-peak hours, weekends, etc., saturation flow rates, free flow travel time through the junction and actual travel time in peak operating conditions.

- Journey time surveys for as-Is conditions should be conducted along designated corridors which should be designed such that all junctions are picked in at least one corridor. For major junctions, both directions (e.g. east west and north-south) and key turning movements should also be covered.

- Develop Feasibility report for finalization of detailed technical architecture and project plan along with following KPI's

    a. Volumes of vehicles moving in the road network

    b. Vehicle type distribution

    c. Directional distribution

    d. Physical and visual characteristics of the area

    e. Travel times, delays between different points of the network

    f. Emission

    g. Additional dependencies with respect to the available infrastructure and geometry at the junctions

    h. Any other relevant data which the SI anticipates will assist in establishing the benchmarks for the project

    i. Expected Measurable Improvements against each KPI

- The System Integrator shall identify the customization or additional installations needed to deploy a standardized ATMS solution as per the functional specifications mentioned in this section of the RFP

    a. Feasibility report will be submitted As-Is study , improvements , Gap analysis

    b. On Approval of Feasibility Report.

4.3.3 Design, Implementation, Customization, Integration with existing Systems & Maintenance of Adaptive Traffic Management System (ATMS)

This shall consist of following activities:

- Preparation of Solution Architecture and Gap Analysis

- Installation of vehicle detectors, controllers and other required accessories for successful operation of the ATMS for BSCL.

- Installation of ATMS software application as per the functional requirements specified by the Authority.

- Procurement and supply of necessary software required for successful functioning of the ATMS sub module.

- Integration of ATMS infrastructure with existing traffic applications

- 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.

- SI shall supply, install, commission and maintain the following

    a. Adaptive Traffic Control System (ATMS) – Vehicle detectors, Signal controller, Traffic light aspects & poles, if required, power supply provisioning and related accessories and associated civil work including cabling for successful operation of the system

    b. Provide software platforms in Data Center (DC) which would aggregate incoming data streams onto a single platform, provide traffic flow estimates for near term future on a real-time basis and assist in analyzing impact of alternate traffic management strategies.

    c. Develop individual signal control strategies including definition of signal grouping, setting of potential strategies for traffic control under various scenarios, specification of traffic management strategies for planned and unplanned events

    d. Develop a consolidated database of incoming real time data for future analysis and evaluation purposes. It is envisaged that the proposed adaptive traffic management system will incorporate historic trends for development of traffic management strategies and adaptive control strategies.

    e. Field Equipment: Design, Supply, Installation and Commissioning of following field equipment envisaged in ATMS:

        I. Adaptive Traffic Control/Management System at Signalized traffic junctions

    f. Network Connectivity: Will use Network as a Service from the ISP to connect to the Data Center and CCC

4.3.4 Functional Specification

- Adaptive Traffic Control System shall offer traffic signal optimizing functionalities, use data from vehicle detectors and optimize traffic signal settings resulting improved vehicle delays and stops. The system shall also allow interconnecting individual area controllers and thus enabling traffic monitoring and regulating functionality from the central location.

- The primary objective of the system is to monitor and control traffic signals, including signalized pedestrian crossings, using a traffic responsive strategy based on real time traffic flow and vehicle presence information.
- All junctions under Adaptive Traffic Control System shall be provided vehicle detection system & communication equipment. This shall allow each intersection controller to be monitored from central control for proper functionality. Any corrective action can be initiated either automatically based on status information or by an operator. The real-time detection data shall be communicated to the central control station by each controller.
- ATMS shall be driven by a central control system, on real time basis, 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 which in turn can also work in configurable manner. These calculations shall be based upon assessments carried out by the ATMS central application software running on a City Operation Center based on the data and information gathered by vehicle detectors at strategic locations at the intersections controlled by the system
- Health Monitoring should also be available for the traffic lights with Auto / manual mode of controller, Flash mode or normal mode, Power interruption, Intrusion in controller, Aspect monitoring of traffic lights.
- The solution should include following minimum reports:
  a. Stage Timing report
  b. Cycle Timing report
  c. Stage switching report
  d. Cycle Time switching report
  e. Mode switching report
  f. Event Report
  g. Power on & down
  h. Intensity Change
  i. Plan Change
  j. RTC Failure
  k. Time Update
  l. Mode Change
  m. Lamp Status Report
  n. Loop Failure Report
  o. Corridor Performance Report
  p. Corridor Cycle Time Report

4.3.5   Technical Specification

4.3.5.1   Adaptive Traffic Sensor

Traffic sensors would include intrusive detectors like Inductive Loop Detectors, Magnetometers, or non-intrusive detectors such as microwave detectors, or any other kind of detectors to suit the need. The detectors should provide a standard open contact interface to the traffic controller to provide vehicle presence data.

4.3.5.2   Adaptive Traffic Control Software

Adaptive Traffic Control Software (ATMS) would be chosen which implements SCOOT (Split Cycle & Offset Optimization Techniques), CoSiCoSt (Composite Signal Control Strategy) or a dynamic signal timing plan selection system using real-time detector data. ATC must be chosen to provide the accuracy as required for successful function of the ATMS system as per the SLAs defined. The ATMS software should have a centralized user interface accessible from the control room, and it should support remote manual operation of traffic signals from the control room. In addition, the ATMS software should support selective vehicle (fire engines, ambulances and VIP vehicles) priority at traffic signals using GPS data. Communication between ATMS and traffic signal controllers on street should use industry standard protocols such as UTMC/UG405, OCIT or NTCIP. The ATMS should support linking with offline modelling tools for offline optimization of traffic signal plans on an ongoing basis and for preparing special signal plans during planned events.

ATMS software should also have a historic data warehouse for aggregated traffic detector data and signal timing data. ATMS software also should be integrated with Variable Message Signs (VMS), thereby enabling seamless operation of all ITS components on-street. ATMS software should also have functionality to input and manage information about planned events and unplanned incidents and should have the ability to disseminate information about such events through VMS and mobile channels. The system should provide such information to mobile applications using industry standard protocols such as TPEG (tpegML), UTMC XML or Datex-II.

ATMS should provide functionality to aggregate fault data from on-street ITS components and the ability to track fault status by operational staff till the fault is resolved.

4.3.5.3   Adaptive Traffic Controller

Adaptive Traffic Controller would be chosen which follows SCOOT model (Split Cycle & Offset Optimization Techniques) or CoSiCoSt (Composite Signal Control Strategy) or a dynamic signal timing plan selection system. ATC must be chosen to provide the accuracy as required for successful function of the ATMS system as per the SLAs defined

1. Power supply: 230 V AC at 50 Hz

2. Standards compliance: EN 50556 and EN 12675, Safety integrity level SIL3, OCIT

3. Number of signal groups: 64

4. Number of signal head outputs: 128

5. Number of signal plans: 60

6. Number of stages in signal plans: 16

7. Number of detector inputs: 128

8. Interfaces: Ethernet, RS232, USB, 3G

9. Signal head compatibility: LED 230V, 40V and 42V with dimming

4.3.5.4 Adaptive Traffic Control- Traffic Light Aspects

Key Features:

1. Lowest power consumption for all colors

2. Meets or exceeds intensity, color and uniformity specifications

3. Temperature compensated power supplies

4. Uniform appearance light diffusing

5. ITE products shall be Intertek/ETL/EN/Equivalent certified

6. All units operate on AC or DC as the per the suggested solution by SI

LED aspects:

1. Red, Amber, Green-Full (300 mm diameter): Hi Flux

2. Red, Amber, Green-arrow (300 mm diameter): Hi flux

3. Red, Green-Pedestrian (300 mm diameter): Hi Flux and Hi Brite

4. Animated Pedestrian-Red and Green Animated c/w countdown (200 mm) Hi Brite with diffusions

4.3.5.5 LED Retrofit Specifications, if required:

1.Power supply: 230 Vac *10% and frequency 50*5Hz

2. Standards: EN 12368 complaint

3. Convex Tinted Lens: Available

4. Fuse and Transients: Available

5. Operating Temperature Range: 00 Celsius to 550 Celsius

6. Turn Off/Turn On Time: max 75 milli seconds

7. Total Harmonic Distortion: <20%

8. Electromagnetic interference: Meets FCC Title 47, Subpart B, Section 15 Regulation or equivalent EN/IRC standard

9. Blowing Rain/Dust Spec: MIL 810F complaint or equivalent EN/IRC standard

10. Minimum Luminous Intensity (measured at intensity point)(nm): Red 250, Amber 250, Green 250

11. Dominant Wavelength (nm): Red 630, Amber 590, Green 490

12. Lamp conflict compatibility system: Compatible with lamp failure and conflict detection

4.4   Track 12 - Intelligent Transport System (ITS)

4.4.1   Overview

As part of Belagavi Smart City initiatives we intend to make public transport efficient by introducing following components.

- Fleet Management System for NWKSRTC Buses (67 Busses)

- PIS at Bus Shelters to display Schedule of buses (21)

- PIS, Bill Boards, WI FI for Smart Bus Shelters (10)

- Geo Tagging of bus routes through RF readers on bus stops and RF tags & GPS devices on buses

During survey of the public transport in Belagavi it was observed that the city had unscheduled arrivals and departures, missed trips causing lot of inconvenience to the public because of which public transport is minimally used, which in result is causing increase in traffic on road and there by vehicular pollution.

The proposed solution gives NWKSRTC ability to track, record, and analyze how vehicles are performing in real time. These features will lead to improvements in public transit service through better on-time performance and quicker response time to emergencies. The Location information along with other details such as the speed of the bus, the route followed etc. will be used to provide the passengers waiting at the bus stops with the expected arrival time of the bus. The information will be displayed on boards installed at the bus stops, inside bus, websites, mobile apps etc. The system should also help in improving the efficiency of bus operation by generating various standard and exception reports.

4.4.2 Scope of Work

- SI shall install GPS based Automated Vehicle Locator System (AVLS) in Buses (City buses) connected with CoC

- SI would install VMS at the bus shelters indicated Volume 4, Annexure -3

- SI should integrate the AVLS on the GIS maps provided by Belagavi Smart City Ltd

- SI should also provide a Mobile / Web Site based information to passengers about the real-time location of bus.

4.4.3 Functional Specifications

4.4.3.1 Vehicle Location System & Passenger Information System

1. Ability to locate a bus at a given time in its track to estimate its arrival/departure time at the next destination, based on traffic density, distance, speed, bus occupancy, run-time information from the previous bus arrival time for the same location etc.

2. Ability to receive SOS and alerts from moving / stranded buses en route

3. Facility to track defined vs. actual movement of vehicles, capture deviations if any.

4. Facility to view vehicle movement in a real-time mode on GIS maps provided by Belagavi Smart City Limited.

5. Ability to provide dynamic location specific information as the vehicle approaches bus stop/station for the benefit of passengers

6. Facility to generate information such as travel time estimation, average time at bus stop, passenger traffic at different location, alerts on exceptions, and logging of the journey details of the bus for each trip

7. Facility for citizens to access and view position / location information on GIS maps near real time through web interface with historic data displayed on maps

8. Facility for providing current information location on demand

9. It should enable operational managers to create locations, routes, schedules Vehicle service alerts for service and maintenance

10. Provide daily Maintenance Schedule, pending Insurance and pending Pollution Check status

11. Vehicle fleet summary dashboard – quick view on vehicle fleet performance based on fuel Consumption, it should provide average fuel consumed per kilometer.

12. System should also be able to record bus break down instances along with other exception recording/ actions (over-speeding, off-route detection, non- stoppage at bus stops, trip cancellation)

13. System should generate reports

   1) Depot, vehicle and route wise reports

   2) Missed stops reports

   3) Route deviation reports

   4) Trip status reports (Cut/Short/Missed)

   5) Distance travelled

14. Register a bus on unscheduled route from backend on real time basis

4.4.3.2 PIS at Bus Queue Shelter (BQS)

1) The information of the buses such as Route Number, Bus Number, Origin, Destination and Estimated Time of Arrival (ETA) & Estimated Time of Departure (ETD) will be displayed in both Kannada and English

2) The PIS information will also be made available via SMS / Mobile App / WebSite

3) Each BQS shall have two number of display terminals.

4) The SI shall be responsible for Supply, Installation and Insurance of PIS. All spares required for the smooth operation of the ITS system shall be maintained by the SI for the entire duration of the contract.

5) The Display unit will query the COC

6) The Bus Stop Display, which receives all such information, will display continuously until the next set of data is received.

7) Technical Specification of PIS Bus Shelter shall be as per VMS

4.4.3.3 Mobile Application

1) Real-time bus tracking system (Support 3rd party application provider)

2) Complete information on bus routes and stops to commuters

3) Real-time ETA for a combination of bus route and stop

4) Real-time tracking for the bus on the map

5) Mobile Application for IOS, Android and Windows mobile devices

6) SI shall develop mobile apps which shall include a mobile application to help passengers to get information about the buses, search and view bus schedules on various routes and deliver ETA based on their real time location.

7) System shall show the time table of the buses, fare structure etc.

4.4.4 Module Wise Functionality Requirements

Multi Fleet System

Functionality	Public Transport Requirements Served
Information about all running and idle vehicle with following information: Driver Name, Contact Number, Speed, Current Location, Schedule time to reach next destination, No. of trips till now, Current trip number, No. of Delayed trips, Current trip status	Multi-fleet systems: All-in and simultaneous management of several fleets. The sharing of resources (communications system, control center and human management resources) creates beneficial economies of scale. A section which enables user to have a full view of all activities of the fleet on a single Console. The dashboard shall form part of the UI delivery which shows all key performance and tracking indicators enabling control center staff and management team of Public Transport Authority to take proactive Decision to manage Transportation operations in a highly efficient manner. Application development and customization of screens, forms, reports and queries of data specifically include: Locating a particular bus in the fleet Auto pan facility for tracking a particular bus Sending online messages to an individual bus or group of buses selected on a map
Route wise vehicle information	
Violations / Alerts / Incidents	
Fleet Summary	

Module: Live Vehicle/Real Time Tracking

Functionality	Public Transport Requirements Served
Tracking and Monitoring Bus Status (Running, Stopped, Ignition Off) Running Speed Route Source & Destination Stoppages Visited Current Location Stoppages to Visit Bus Identity, Route Identity and Name	Integration of GPS with digitized map for tracking of vehicles on a real time basis including distress messaging between the vehicle and the control station. To monitor whether the buses are adhering to its scheduled route and time table through-out the route and identify if there are any deviation. Real time two way messaging between buses & Central Control Room. To monitor whether the buses halt at all the scheduled bus stops. Generating messages pertaining to speed violation, skipped bus stops etc., to Public Transport officials at the Central Control Station, online along with the Geo-graphical position and the violated vehicle number.
Punctuality Tracking Bus Actual Transit against Scheduled Transit	
Current Location & Time	
Transit Diagram and ETA	

Module: Reports & MIS

Functionality	Requirements
Different Analytical, Revenue Management and Alert reports (Through Data received from legacy Revenue Collection System)	Generation of exception reports like deviation from schedule route, timing, Missing Bus stops, Punctuality factor etc. based on captured vehicle data
Speed Log	Calculation of the actual distance (in Kilometers) travelled by the vehicle, using the map
Stoppage Log	Reports:
Summary Report Day Wise	Speed Log
Summary Report Vehicle Wise	Stoppage Log
Performance Day Wise, Week Wise, Monthly	Summary Report Day Wise
Performance Vehicle Wise	Summary Report Vehicle Wise
Monthly Performance	Performance Day Wise

Functionality	Requirements
Calculation of the actual distance (in KM) travelled by the vehicle using the digitized map.	Performance Vehicle Wise Statistics: Monthly Performance Alerts:
Depot Report	Fleet Summary Vehicle Status
Deviation from schedule route or timing.	Speed Violation Real-time application data delivery for PIS

4.4.5 General Functional Requirement of the proposed Application Software:

1) The proposed system will be capable of data communication with all the system components in real-time.

2) Uploaded data will not be deleted from device readers or workstations until the central system has provided confirmation acknowledgement that the transactions have been successfully received

3) The proposed system will be able to update its date and time using time synchronization application of servers. Also the date and time on all system devices and workstations should also be updated

4) All active equipment will have an internally maintained date and time clock that is synchronized using a time interval via the communications medium with the system date and time clock

5) Systems will be driven by configurable parameters and should provide flexibility for maximum configuration. Configurations will be for, but not limited to:

   a. User groups and users privileges

   b. Time based messages/reports

   c. Addition & deletion of equipment's, nodes, stations, user groups, users

   d. Reports Access

   e. Configurable messages

6) The system will handle all degraded conditions which can be, but not limited to the following:

   a. Power failures

b. Data connection lost

c. Central server down

d. Bus-station switch non-functional

7) The software will provide controls to view the entire sequence of reported locations from the beginning of the time or to step through the sequence incrementally forwards or backwards.

   a. The replay data will include location and headway adherence data.

   b. The system will allow replay for a single vehicle, selected set of vehicles or all vehicles or cluster wise vehicle or route wise vehicle on the selected map view for selected time period

   c. All users accessing the AVL software will be able to access the playback function.

   d. The system will be able to store a playback in a format that can be exported for viewing on any computer.

   e. The system will allow the ability to use playback without exiting from the current AVL operational view.

8) The software will be accessed on workstations and CCC/CoC of all users identified by BSCL. All communications and AVL data will be stored in a manner that allows direct access by the software for at least 120 days and reporting data for 18 months live in the system. SI will provide Utilities to support archive and restore functions for older data.

   a. The system will only be accessible by authorized persons, controlled using login and password protection. Single Sign On will be provided for all modules in CCC/CoC

   b. The system will maintain a transaction log that records all users that access system reports. The pages/reports accessed, edits and changes to the database and the system logon and logoff times. The transaction log will maintain this information for a minimum of one year.

9) The system will allow selection of any time for the historical data. All data will be the property of BSCL and will be immediately available to BSCL.

10) The central system shall be delivered with a fully functioning Graphical User Interface

11) The Graphical User Interface shall be based on standard web based browser controls or an equivalent system

12) It shall be possible to create different user classes/categories/roles with different access level

13) The system security will provide features to maintain data integrity, including error checking, error monitoring, error handling and encryption.

14) Features will be provided to ensure that all system-created files are uniquely identified, and that no files are lost or missed during data transfer.

15) System will have verification features to confirm that there have been no losses of data at any point in the transfers.

16) System needs to be tamper proof and SI should build features to confirm that there have been no unauthorized changes to, or destruction of, data.

17) Features will be provided to automatically detect, correct and prevent the propagation of invalid or erroneous data throughout the system.

18) All systems, sub-systems and devices will only allow access to authorized user classes.

19) All security breach detections will be confidential, and accessible only to users of the appropriate class.

20) The web-based system and all the equipment (on-board equipment, PIS displays in stations etc.) will all support a maintenance mode during repair, replacement and testing of equipment.

21) All the functions that are carried out in the maintenance mode will be reported separately similar to exception transactions

22) Maintenance mode will be possible to be activated based on a particular node wise

23) The maintenance mode can be activated only by a person having the highest user privilege in terms of system operations.

24) Logins and logouts will be transmitted to the system, along with associated Date/Time, employee ID, equipment ID etc.

25) It will be possible to upgrade the firmware/ software from the central server using the internet communication available at the station level.

26) The central software will be scalable to accommodate for buses, bus-station/BQS/terminal PIS, without any modifications to the central software except minor configuration changes, the details of how scalable the system is will be provided in the proposal by the SI at the time of inception report.

27) The minimum scalability will be for 300 Buses, 100 PIS for BQS and Bus terminal. Authority will not pay any excess fees for increase in volume up to scalability.

28) The software will provide standard reports based on the AVL data. SI will provide details in their proposal related to reports that are offered and the degree to which they can be configured (at minimum all report will be configurable for a specified date/time range and route). Some of the expected standard reports are as follows:

    a. Headway adherence

    b. Active fleet (weekday and weekend)

    c. Service hours and mileage

    d. Schedule Adherence

    e. Speed Reports

    f. Route Deviation reports

29) All reports will use standard reporting tools (e.g., RDBMS or SQL or Crystal Reports etc.) and will have the ability to export data into file formats that can be exported to and edited with standard tool i.e. excel, etc. The SI shall provide the relational database layout including related fields, key fields and definitions for all fields in all tables in the database

30) Any portion of the transactional database will be exportable in standard formats (such as comma separated variable (.CSV, xls, xlsx files etc.) for analysis in third party programs.

31) It will be possible for users to build custom reports from the data in the transactional database with tools such as RDBMS or SQL. The reports will be capable to be exported to pdf, xls, xlsx formats easily

32) A data dictionary will be provided to Authority to facilitate development of custom reports.

33) SI will be responsible for the design and development of the website, including all required HTML, scripting, and integration with the AVL system. The website GUI will allow for the graphical presentation of vehicle locations on GIS-based maps.

4.4.6 Technical Specifications for AVL System

4.4.6.1 GPS/GSM Tracker

Parameter	Minimum Specifications or better
Weight	Should Be Lightweight.
Housing	Aluminium Or Fibre Case
Operational Temperature	-25～70
Storage Temperature	-40～80
Power Consumption	<1 W (60ma～100ma)
Backup Power	24 Hrs Minimum.(In Ideal Mode)
Input Voltage	10～30v
Frequency	L1,1575.42 MHz
Protocol	Nmea 0183 V2.2
Channels	20
Flash	4mbit
Sensitivity	Tracking: -159dbm
Cold Start	42seconds, Average
Warm Start	38seconds, Average
Hot Start	1 Seconds, Average
Reacquisition	0.1 Seconds, Average
Accuracy	Position: 10meters, 2d Rms,5meters, 2d Rms, Waas Enabled Velocity: 0.1 M/S Time: 1us Synchronized To Gps Time

Parameter	Minimum Specifications or better
Frequency Bands	Sim 340 Quad-Band: Gsm 850,Egsm 900,Dcs 1800,Pcs 1900.The Band Can Be Set By At Command, And Default Band Is Egsm 900 And Dcs 1800 ,Compliant To Gsm Phase 2/2+
Temperature Range	Normal Operation: -20 To +55 Restricted Operation: -25 To -20 And +55 To +70 Storage Temperature -40 To +80
Data GPRS	GPRS Data Downlink Transfer: Max. 85.6 Kbps GPRS Data Uplink Transfer: Max. 42.8 Kbps Coding Scheme: Cs-1, Cs-2, Cs-3 And Cs-4 Sim340 Supports Protocols PAP (Password Authentication Protocol) Usually Used For PPP Connections. Sim340 Integrates TCP/IP Protocol. Support Packet Switched Broadcast Control Channel (Pbcch) Csd Transmission Rates: 2.4, 4.8, 9.6, 14.4 Kbps, Non-Transparent Unstructured Supplementary Services Data (Ussd) Support
SMS	Mt, Mo, Cb, Text And Pdu Mode SMS Storage: Sim Card Support Transmission Of SMS Alternatively Over Csd Or GPRS. User Can Choose Preferred Mode.
Sim Interface	Supported Sim Card: 1.8v ,3v
Two Serial Interfaces	Serial Port 1 Seven Lines On Serial Port Interface
Sim Application Toolkit	Supports Sat Class 3, Gsm 11.14 Release 98
Real Time Clock	Implemented
Timer Function	Programmable Via At Command
Firmware Upgrade	Firmware Upgradeable Over Serial Interface

Parameter	Minimum Specifications or better
Internal Battery Cum Charger	Li-Ion Battery With Minimum 08 Hrs Backup When Idle And 04 Hrs When Continuously Used. With Appropriate Charger To Be Charged From Vehicle Battery
Certification	Minimum IP65 & ARAI Certification

4.4.6.2 Technical Specs for RFID Tag and Reader

UHF Passive RFID Tag Specifications:

Parameter	Specification
Type	ABS, High Quality Engineering Plastic
Supported Transponders	ISO18000-6C EPC Class 1 GEN2
Frequency Range	ISM865~928MHz
Operation Mode	Fixed Frequency or FHSS Software Programmable
Memory capacity	The tag should support ISO18000-6C protocol standard 2K Bits storage capacity, 1728 Bits (216bytes) writable user area; MR6730B metal supports EPC C1 GEN2 (ISO18000-6C), with 96Bits writable EPC Code area, 512Bits writable user area, and 32Bits password area, EPC 128 bit user 512 bit TID 96 bits.
Reading Rate	Software Programmable, Average Reading per 64Bits <10ms
Tags material	Metal material
Reading Range	Should be able to be calibrated. (to be kept as 2-4m max) based on the site visit.
Operation Temp	-35°C to 85°C
IP Classification	IP 68

Parameter	Specification
Weather	Heat, dust proof, UV resistant & sea water resistant.
Chemical Resistance	No physical or performance changes in 168 hour Motor oil exposure 168 hour Salt water exposure (salinity 10%) 5 hrs Sulfric acid (10 %Ph 2) 1 h Naoh (10 % Ph 14) exposure

4.4.6.3 RFID Reader Specifications:

Parameter	Specification
Protocol	ISO18000-6C EPC GEN2 Configurable for mixed or single tag-type operation. Air interface software on IV7 is downloadable to add Gen 2 and Class 1 air interfaces and to "future-proof" the product as standards evolve and new features become available.
Frequency Range	Standard ISM 902 928MHz or 915 MHz (US FCC), 865 MHz (ETSI 302-208), and 869 MHz (ETSI 300-220)
Operation Mode	FHSS
RF Power	0~30dBm, software adjustable
Reading Speed	Software Programmable Average Reading per 64Bits <6ms
Reading Mode	Timing or Touch, Software Programmable (reading should be such that the reader does reads two tags at a time)
Communication Mode with central server	TCP/IP and GPRS or higher
Data Input Port	Trigger input one time

Reading Range	Max 12 m(able to calibrate)
Communication Interface	RS232
Accessories	Vehicle-mount DC power cable kit Antennas, and antenna cables
Environmental Rating	IP65
Humidity	10% - 90%
Shock and Vibration Protection	Withstands standard material handling vehicle environments. Meets or exceeds MIL STD 810F
Operating Temperature:	-25°C to 55°C (-13°F to 131°F)
Storage Temperature:	-30°C to 75°C (-22°F to 167°F)
Humidity	10% to 90%
Power Supply	Vehicle DC power 12 to 60V, 4.5 A maximum

4.4.6.4 VMS

Parameter	Minimum Specifications or Better
Location	To be installed at Traffic Junctions / Bus Stops as identified by BSCL and the text on sign must be readable even in broad day light
Colour	True Colour
Brightness & Legibility	• To be read even in broad daylight without any shade • The displayed image shall not appear to flicker to the normal human eye • >6000 cd/m2
Luminance Class	L-3 as per EN 12966
Contrast Ratio	R2-R3 as per EN 12966

Parameter	Minimum Specifications or Better
Beam Width	B6+ : Viewing angle shall ensure message readability for citizens, motorists, pedestrians, etc. on the respective locations
Display Capability	Fully programmable, full color, full matrix, LED displays Alpha-numeric, Pictorials, Graphical & video
Display Language	To support both pictograms and multilingual (English, Kannada, Hindi) Text
Display Front Panel	• It shall utilize a front face that is smooth, flat, scratch-resistant, wipe-clean • 100% anti-glare
Message Creation	Through both a Central Control Room Application and a local Laptop/Device loaded with relevant software
Language	Multilingual (Kannada/English/Hindi) and with options of multi fonts
Auto Dimming	Auto dimming adjusts to ambient light level.
In built Sensor	Photoelectric sensor
Storage capacity	Minimum 60 GB
Display Area	Display size of VMD shall customized based on minimum viewing distance likely to be finalized in the feasibility stage
Number of Lines & Characters	The number of lines and characters can be customized as per the requirement (Min 3 Lines & 10 Characters)
Brightness & contrast	Controlled through software
Display Driving method	Direct current control driving circuit. Driver card of display applies Direct Current Technology

Parameter	Minimum Specifications or Better
Display Style	Steady, flash, partial flash, right entry, left entry, top entry, bottom entry, canter spread, blank, and dimming
Connectivity	IP Based
Access Control	Access control mechanism would be also required to establish so that the usage is regulated.
Integration	• Interface with GPRS/GSM • Integration with management application in CCC
Battery	• 230VAC+ 15%, 50Hz, Single Phase (automatically re-start in the event of an electricity supply failure) • Batteries with solar charging options can also be recommended as back up
Power	Automatic On/Off Operation
Casing	• Weather-proof Display for VMS • IP-66 rated for housing all control equipment
Operating Conditions	0° to 55°C
Message Validity	If the controller is unable to connect to the server for the next message, it shall not display the old message, which has passed its expiry time. Instead it shall be programmed to display a default message

4.4.6.5 Application Software for VMS (Control Messaging Application at Data Center)

The Application System for Controlling Messaging for VMS shall:

a. Be deployable over multiple workstations.

b. Ensure that provision for feeding/updating the following information:

- VMS messages and information
- Types of possible scenarios per VMS

- Types of possible messages to be displayed on each VMS during various scenarios

c. Ensure that the normal operator is not able to publish any custom message and shall only display predefined sets of messages.

d. The application shall have an option for Supervisor (someone with appropriate authority) to bypass the control during certain situations and to write in free-text mode.

e. Ensure that operator can publish specific messages for managing traffic and general informative messages.

f. Allow an operator to seamlessly toggle between multiple VMS points at each workstation to send specific messages to specific locations.

g. Accommodate different access rights to various control unit functionalities depending on operator status and as agreed with the client.

h. Application should also have an automatic provision for displaying Bus Arrival and Departure Status where ever necessary, based on the smart transport application.

4.5   Track 13 - Intelligent Pole (with environmental sensors, public address system, variable messaging system, digital billboard and panic button)

4.5.1 Overview

The Intelligent pole will be an integrated pole having the following components:

a) Environmental sensors
b) Public address system
c) Digital Bill Boards
d) Panic Button
e) CCTV Cameras
f) Wi-Fi

a) Environmental Sensors:

No.	Minimum Requirement
1.	The environment sensors should be have the following capabilities
2.	They should be ruggedized enough to be deployed in open air areas on streets and parks

3.	They should be able to read and report at least the following parameters • Temperature • Relative Humidity • Ambient Light • Noise • CO • NO2 • So2 • O3 • PM 2.5 • PM 10 • UVa • UVb • CO2
4.	Sensor should be able to communicate its data using wireless technology (GSM/WIFI)
5.	Data should be collected in a software platform that allows third party software applications to read that data. Data Buffer Capacity up to 3 years
6.	Data Capture Frequency – 30 seconds
7.	Li-Ion Battery Backup of 4 hours
8.	Aesthetic & Elegant Aerodynamic design
9.	Stabilization Time on power outages < 10 minutes
10.	LEDs on the enclosure for easy visual indications

11.	Software Solution
	
	a) Solution to enable APIs for mobile & Web services
	b) APIs to provide
	    a. Status of Devices
	    b. NAQI Colour Schema as per NAQI, India
	c) Lead pollutant contributing to NAQI

	d) Architecture to support computation of new parameters such as
	
	    a. Now Cast NAQI
	
	    b. Zonal Limits of pollutants if any

12.	Data Analytics
	
	    a. lead pollutants, trends & Source level apportionments
	
	    b. Integration and analysis of various northbound API's including traffic / parking & Environment to derive insights.

13.	The sensor management platform should allow the configuration of the sensor to the network and also location details etc.

b) Public Address system (PAS)

Public address systems will be used to communicate information related to traffic or any other announcement.

c) Variable Messaging System (VMS)

Communication to the public via sign boards has become important for displaying information. Information could range from

- Bus Arrival / Departure
- Traffic Blocks
- Environment Sensors
- Other general updates to the public

d) Digital Bill Boards

As a part of the beautification of certain specific locations in the city of Belagavi , SI will provide smart poles having digital bill boards which could house telecom base stations of 2G/3G/4G and WI-FI. These bill boards could provide information about various schemes, policies of Government being implemented for the welfare of citizens of Belagavi. It shall be possible to change the advertisements /Messages in these digital bill boards from a centralized location.

e) Panic Button

In the event of Emergency, distress, citizens could reach the pre-defined support centre for getting support through panic buttons mounted on smart poles. Panic buttons to be strategically located, suitably sized and identified/clearly labelled for "Emergency". Once pressed will send a call to the nearest police station or Quick Response Team.

f) CCTV Cameras for surveillance

BSCL proposes to host CCTV Cameras on these polls for the purpose of Surveillance. Every pole will have 2 fixed cameras & 1 panoramic camera.

g) WI FI hot spots/Access points

BSCL aims at providing internet facility at public places to its citizens via setting up of Wi-Fi hotspots at the public places like Smart Bus Shelters and Intelligent Poles.

4.5.2 Scope of Work

a) Environment Sensor: SI would setup environmental sensors at all the poles and shall also integrate already existing air quality monitoring station KSPCB.

b) PAS: SI should install PAS at **9 poles**, as indicated in volume 4. Each junction point should have 2 Speakers and should confirm to the technical specifications mentioned in the document.

c) Digital Bill Boards: SI to consider minimum of 9 poles and 10 bus shelters (2/bus shelter) in the City of Belagavi for providing digital information panel.

d) Panic Buttons: The number of Panic Button will be 9 mounted on intelligent poles.

e) CCTV camera: To be deployed on each intelligent pole.

f) VMS: To be deployed on each intelligent pole and 31 bus shelters

g) WI-FI:

- The SI is responsible for setting up of Wi-Fi Hotspot including supply installation and O&M of all the required hardware and software as per the technical specification and scope of work of the RFP.

- Detailed list of locations along with the no. of Access points at each location will be shared with the successful SI.

- System should support features such as user authentication, access etc. through OTP (One Time Password) on mobile no. & email. It should be capable to put a cap on the user session and amount of data consumed which shall be 200 mb/day , regulate bandwidth besides allowing users to buy in the extras usage access, if desired by BSCL.

- Thereby it shall be required to be integrated with SMS Gateway along with a payment gateway and centralized billing mechanism.

- The proposed solution should be inclusive of all the components like WLAN Controller, Authentication, Authorization and Accounting (AAA), RADIUS, SMS Gateway, Payment Gateway.

- The proposed solution should be fully secured and as per WPC regulations/guidelines. SI is responsible for keeping log of users by storing minimum required information like Phone No, MAC & IP addresses, access time, duration, data consumed etc.
- The proposed solution should allow firmware/ patch upgrade and monitoring from a central location.

4.5.3 Functional Specification

a) Environment sensor	Install environment sensors (as per the functional requirement) to display environment related information at various strategic locations through variable message system i. The environment sensors shall be integrated with the central control system at City operation center to capture and display/ provide feed on Temperature, Humidity, Pollutants like SoX, NoX, CoX, etc PM2.5, PM10, Noise Pollution. The data it collects is location-marked. ii. 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. iii. Then this information is relayed instantaneously to signage – large, clear, digital-display screens which let citizens know regarding the prevalent environmental conditions. iv. 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. v. SI can also make use of the nearby Variable messaging displays wherever possible (need to be finalized post detailed survey of locations). vi. The sensor management platform should allow the configuration of the sensor to the network and location details etc.
b) PAS	1. Public Address System (PA) should be capable of addressing citizen at specific locations from City Operation Center / CCC.

	2. The proposed system shall contain an IP based announcing control connected to the City Operation Center / CCC . 3. Public Address system shall be used at intersections, public places, market places or those critical locations as identified by SI during implementation, 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 over Ethernet) 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. 6. PA system's master controller should facilitate multiple MIC inputs and audio inputs. 7. SI shall describe in detail the design, operational and physical requirements of the proposed public announcement system to demonstrate compliance with all the specified requirements of RFP.

c) VMS	1. SI should setup VMS at identified locations. VMS would be used in two different verticals:
	    a. Passenger Information System at bus terminal – 31
	    b. Information System at smart polls - 9
	(Detailed information can be found in Vol 4)
	
	2. SI should integrate VMS with the appropriate system to display the information.
	
	3. Variable Message Signboard (VMS) shall be installed at identified strategic locations. The locations would include traffic junctions, bus stops.

	4. The VMS shall communicate information & guidance about traffic, diversions, bus arrival information etc. They shall also be used for showing emergency/ disaster related messages as and when required. 5. SI shall describe in detail the design, operational and physical requirements of the proposed Variable Message Signboards to demonstrate compliance with all the specified requirements in this RFP. 6. The VMS unit shall be able to communicate with the Command Control Centre system using GSM Data. 7. GSM data channel (GPRS) shall be used to send online messages and SMS channel shall be used to send configuration packets to configure the SIM. 8. Each unit shall be provided with a unique identification number and shall communicate with the Command Control Centre/CoC. 9. VMS shall be managed and operated from the Command Control Centre/CoC handled by a server where information in the form of data messages shall be fed in a manner to be displayed on a specific VMS installed at a particular location or across all locations. 10. Distance of view ability shall be finalized during the time of feasibility study.
d) Digital Bill Boards	BSCL will have rights for usage of advertisement display boards for a minimum of 20 minutes per hour per day. Further, BSCL may step in for displaying new/information for public convenience in case of any natural calamity, emergency etc.
e) Panic Button	SI to provide Panic Button on Intelligent poles. These buttons will enable citizens to establish a two way audio(microphone and speaker) communication link with operation staff at City Operations Center (or other locations where control solutions is deployed) through a press of a button
f) CCTV Cameras for surveillance	SI will be required to deploy CCTV cameras for surveillance.

4.5.4 Technical Specification:

4.5.4.1 Environment sensor

Parameter	Minimum Specifications or Better
Communication	3G/4G
Measurement Principle	Device should be capable of measuring • Temperature • Humidity • Ambient Light • Sound • CO • CO_2 • NO_2 • NO_X

Component Measurement Range	• NO2 upto 10ppm
	• CO upto 100 ppm
	• SO2 upto 2000 ppm
	• O3 upto 1000 ppb
	• PM 2.5 0 to 250 micro gms / cu.m
	• PM 10 0 to 450 micro gms / cu.m
	• Weather Parameters
	   o Temperature 0 to 100 Deg. C
	   o Relative Humidity upto 100%
	• Light upto 10,000 Lux
	• Noise 40 to 120 db(A)
	• UVa upto 15 mW/ cm2
	• UVb upto 15 mW/ cm2
	• CO2 upto 5000 ppm

Rain Water Measurement	• Rainfall in millimeters (mm), both in quantity and intensity.
Repeatability	±0.5% Full Scale

Parameter	Minimum Specifications or Better
Zero drift	• ±1.0% FS max./week (±2.0% FS/week max. if range is less than 200ppm) • ±2.0% FS max./month for O3 meter
Span drift	• ±2.0% FS max./week
Response speed	• 30 seconds max. for 90% response from the analyzer inlet
Integration	CCC with the Environmental Sensor Application Server.

4.5.4.2 PAS

Parameter	Minimum Specifications or Better
PAS System	Should have the capability to control individual PAS i.e. to make announcement at select location (1:1) or multiple locations (1:many). PAS Should support both, Live and Recorded Inputs.
Speakers	• Minimum 2 speakers to be used in different locations • Minimum 200 watts of Amplification
Connectivity	IP Based
Access Control	Access control mechanism would be also required to establish so that the usage (including sound volume) is regulated.
Integration	CCC
Battery	Internal Battery with different charging options (Solar / Mains) A 24V battery power supply for emergency backup, with automatic switchover.
Power	Automatic On/Off Operation
Casing	IP-65 rated for housing
Conditions	0° to 50°C

4.5.4.3 Digital Bill Board

No	Minimum Specifications or Better
1	Smart Billboard should be able to house small cell or limited macro main remote telecom sites and site build solution with space for all necessary equipment and functions that radio sites in mobile networks require. This should be self -contained, multi-application intelligent site that is aesthetically unique and functionally viable.
2	Height of smart billboard should be of 9-10 metre height
3	It should provide Space for telecom equipment, should be able to support 2G, 3G, LTE, Wi-Fi, 5G etc.
4	It should have ability to house power plant and battery
5	It should have provision for incoming power input cables and fibre connectivity
6	It can be Floor or Ground Mounted
7	It should be Vandal Proof
8	It should have display of minimum 60 inch.
9	It should be Aesthetical & Camouflaged finish with respect to environment

4.5.4.4 Panic Button

Parameters	Minimum specifications or Better
Construction	Cast Iron/Steel Foundation, Sturdy Body for equipment
Call Button	Watertight Push Button, Visual Feedback for button press
Speaker & Microphone	Watertight and industrial grade equipment
Connectivity	GSM/PSTN/Ethernet as per solution offered
Sensors	For tempering/Vandalism
Battery	Internal Battery with different charging options (Solar/Mains)
Power	Automatic on/off operation

Casing	IP-55 rated for housing
Operating condition	0° to 55°C

A high quality digital transceiver, to be placed at certain locations determined by SI.

4.5.4.5 CCTV Cameras *Type 1- 360° Panoramic Camera*

S.NO.	Camera Characteristics	
1	General Requirements	Multi-view layouts: 360° surround views and multi-region client dewarped views, with Digital PTZ functionality.
2	General Requirements	Camera should be based upon standard components and proven technology using open and published protocols. Device functionality can be extended by installing and running applications directly on the camera, for example SIP client, video analytics, audio analytics, etc.
3	Image Sensor	1/2.5″ Progressive
4	Lens Specs	Focal length: 1.5mm, Maximum aperture: F2.8
5	Resolution	Active Pixels 1920(w) x 1920(h)
6	Minimum illumination	Color mode: 0.6 lux Black/White mode: 0.01 lux, 0 lux with illuminator active, The infrared illuminator should light an area up to 33 feet (10 meters) away
9	Day/Night	Automatic, Manual, Scheduled
10	Image Compression	H.264 and Motion JPEG
11	Frame Rate	25fps for PAL mode
12	Local Storage	32GB
13	Streaming	Camera shall be able to setup and stream out two (2) stream profiles.
14	White Balance	Auto / Manual

S.NO.	Camera Characteristics	
15	Wide dynamic range	70dB
16	Shutter Speed	1/5 second to 1/32,000 second
17	Ethernet	10/100/ Base-T (RJ45)
18	Field of view	180° horizontal, 180° vertical, 180° diagonal
19	Protocols	TCP/IP, DHCP, HTTP, HTTPS, NTP, RTP, RTSP, SMTP, SSL/TLS, SRTP, CDP, Bonjour, SNMP, and SSH
20	Power Supply	Max 23W consumed with a PoE+ (802.3at-compliant) source
21	Security	Security Password protection, IP address filtering
22	Miscellaneous	Housing IK10 and IP66-rated
23		Detection of camera tampering and Detection of Motion should be possible using camera
24		Should support edge based audio analytics.
25		ONVIF 2.X' or 'S' compliant. Certifications: UL, EN, FCC, CE
26	Certifications Safety	UL60950-1 second edition CSA22.2-No.60950-1 IEC/EN60950-1 second edition
27	Certifications EMC-Requirements	CISPR22 Class B ICES-003 EN50121-4 EN50155 EN50130-4 EN55022 EN55024 EN61000-3-2/-3-3 VCCI Class B KN22 Class B KN24 CISPR 24 AS/NZS CISPR 22 FCC CFR Title 47 Part 15 Subpart B
28	OEM Criteria	All proposed Cameras should be from single OEM and OEM should have Registration in India min from 10 Years

4.5.4.6 CCTV Cameras Type 2- Fixed Box Camera

NO.	Camera Characteristics	Description
1.	Requirement Overview	High-definition IP Box Camera for outdoor
2.	Sensor Type	1/2.7" Progressive Scan CMOS with additional digital signal processor (DSP) to support complex applications such as real-time video analytics
3.	Max Resolution	1920x1080 @ 30fps
4.	Dynamic Range	69db
5.	Lens/Iris	3.1- 8mm- P-Iris
6.	Audio I/O	Camera supports full-duplex audio and options for half-duplex operation. Should support Audio compression G.711 A, Law, G.711 U, Law, G.726, Audio in x 1
7.	Digital I/O	(3.5-mm miniature jack) Audio out x 1 (3.5-mm miniature jack) DI x 1 DO x 1
8.	Max Illumination	Color: 0.3 lux B/W: 0.05 lux
9.	Day/Night	Automatic, manual, scheduled
10.	Local Storage	Should support MicroSD -min 32 GB

11.	Video Compression & Video Streaming	• Single stream H.264 or MJPEG up to 1080p (1920 x 1080) @ 30 fps
		• Dual stream H.264 and MJPEG
		  ◦ Primary stream programmable up to 1280 x 720 @ 30 fps
		  ◦ Secondary stream programmable up to 960 x 544 @15 fps

12.	ONVIF	Should support for ONVIF 2.0 allows for standards based interoperability

13.	POE and External Power	12V DC, 24V Ac and PoE- 802.3af compliant (Class 3)
14.	Power Consumption (in watts)	Max 10 Watt at DC
15.	Supported Protocol	Dynamic Host Control Protocol (DHCP), Hypertext Transfer Protocol (HTTP), Secure HTTP (HTTPS), Network Time Protocol (NTP), Real-Time Transport Protocol (RTP), Real-Time Streaming Protocol (RTSP), Simple Mail Transfer Protocol (SMTP), Secure Sockets Layer/Transport Layer Security (SSL/TLS), TCP/IP, Secure Real-Time Transport Protocol (SRTP), Bonjour, Simple Network Management Protocol (SNMP), and Secure Shell (SSH) Protocol. Differentiated-services-code-point (DSCP) marking and class-of-service (CoS) marking
16.	Operating Temperature	14° to 122°F (-10° to 50°C)
17.	Certifications Safety	UL60950-1 2nd edition CSA22.2-No.60950-1 IEC/EN60950-1 2nd edition IEC/EN60825
18.	Certifications EMC-Requirements	CISPR22 Class B ICES-003 EN55022 EN55024 EN61000-3-2/-3-3 Class A VCCI Class B KN22 Class B KN24
19.	Auto Detection & Configuration	Camera should be automatically discovered and configured when connected to VMS or Network Switch, to set the right network parameters for the video stream on the network.
20.	OEM Criteria	All proposed Cameras should be from single OEM and OEM should have Registration in India min from 10 Years

4.5.4.7 Video Analytics for IP Box Camera

The required software and licenses need to be provided by the SI as part of this project. Video Analytics Platform transforms video surveillance systems into pro-active and intelligent tools, unifying privacy, security and operational efficiency.

TYPE 1 – DIRECTION VIOLATION

No.	Characteristics and Description
1.	Analyze motion in a specified area and triggers alarms when any motion is detected in a defined direction
2.	Analyze area, object size and direction can be configured in a point-and-click interface
3.	Administrator should be able to define minimum object size should be relative to the reference object size.
4.	System should provide grid-based analysis (using cues at multiple scales for analytics)
5.	System should use feature-based tracking algorithms to detect and analyze motion
6.	System should provide option to enable privacy feature. (Privacy feature should be certified).
7.	Accurate detection for several objects moving in the prohibited direction
8.	Detect vehicles that travel in an incorrect direction on one way roads
9.	Visualization should be provided as an MPEG4 RTSP stream
10.	System should support most security management systems via API – using metadata in XML or JSON format
11.	System should support internal SSL in order to prevent tapping or any other kind of IP-based manipulation
12.	System should support built-in video recording and encryption options a. Certificate with asymmetric encryption: 3DES (+ 1024 bit RSA) b. Decryption with chip cards in combination with PIN codes (four-eye-principle) or by entering transaction codes
13.	System should support video formats in any resolution (from CIF to Full HD and more): H.265 / H.264 / MPEG-4 / MxPEG / H.263+ / M-JPEG / JPEG 2000
14	System should support automatic check of hard disk and server status as well as

No.	Characteristics and Description
	connections to cameras and triggers events by email if any problem is detected
15	System should support self-contained analytics modules. Support any particular stream to be processed by several modules.

TYPE 2 – BROKEN DOWN VEHICLE/PARKING VIOLATION ON ROADS

NO.	Characteristics and Description
1.	Detect any new object in the scene by comparing the current image to a background model
2.	System should provide grid-based analysis (using cues at multiple scales for analytics)
3.	Ability to do foreground detection based on edge detection rather than color
4.	System should support detection zone and perspective (near & far object size) to be configured on screen
5.	System should support an unlimited number of detection areas (each with its own zone and settings)
6.	System should monitor object size: little fluctuations should be ignored. The alarm conditions should be defined by relative object size (min and max) and minimum dwell time
7.	System should provide option to enable privacy feature. (Privacy feature should be certified).
8.	Visualization should be provided as an MPEG4 RTSP stream
9.	System should support most security management systems via API – using metadata in XML or JSON format
10.	System should support internal SSL in order to prevent tapping or any other kind of IP-based manipulation

NO.	Characteristics and Description
11.	System should support built-in video recording and encryption options a. Certificate with asymmetric encryption: 3DES (+ 1024 bit RSA) b. Decryption with chip cards in combination with PIN codes (four-eye-principle) or by entering transaction codes
12.	System should support video formats in any resolution (from CIF to Full HD and more): H.265 / H.264 / MPEG-4 / MxPEG / H.263+ / M-JPEG / JPEG 2000
13.	System should support automatic check of hard disk and server status as well as connections to cameras and triggers events by email if any problem is detected
14.	System should support self-contained analytics modules. Support any particular stream to be processed by several modules.

4.5.4.8 Wi-Fi Hotspot at Public places: -

WLC:

NO.	Specification
1	Must be compliant with IEEE CAPWAP or equivalent for controller-based WLANs.
2	Should have at least 2 x 10 Gigabit Ethernet interface.
3	Should support both centralized as well as distributed traffic forwarding architecture with L3 roaming support from day 1. Should have IPv6 ready from day one.
4	Controller should have hot-swappable redundant power supplies.
5	Controller should support minimum 20,000 users per chassis
6	WLAN Controller must be a dedicated hardware appliance which should support minimum of 1200 Access points in a single chassis. Proposed controller should support 1+1/N+1 redundancy from day one

7	Should be rack-mountable. Required accessories for rack mounting to be provided.
8	WLC should support AVC functionality on local switching architecture
9	WLC should support AC and DC powering options
10	Should support minimum 4000 VLANs
11	WLC should support L2 and L3 roaming for IPv4 and IPv6 clients
12	WLC should support guest-access functionality for IPv6 clients.
13	Should support IEEE 802.1p priority tag.
14	Should ensure WLAN reliability by proactively determining and adjusting to changing RF conditions.
15	Should provide real-time radio power adjustments based on changing environmental conditions and signal coverage adjustments.
16	Should support automatic radio channel adjustments for intelligent channel switching and real-time interference detection.
17	Should support client load balancing to balance the number of clients across multiple APs to optimize AP and client throughput.
18	Should support policy based forwarding to classify data traffic based on ACLs
19	Should support minimum 500 WLANs
20	Should support dynamic VLAN assignment
21	Should support Hot Spot 2.0
22	To deliver optimal bandwidth usage, reliable multicast must use single session between AP and Wireless Controller.
23	Must support coverage whole detection and correction that can be adjusted on a per WLAN basis.

24	Must support RF Management with 40 MHz and 80 MHz channels with 802.11n & 802.11ac
25	Should provide visibility to Network airtime in order to set the airtime policy enforcement
26	Must be able to restrict the number of logins per user.
27	Should support web-based authentication to provide a browser-based environment to authenticate clients that do not support the IEEE 802.1X supplicant.
28	Should support port-based and SSID-based IEEE 802.1X authentication.
29	Should support MAC authentication to provide simple authentication based on a user's MAC address.
30	WLC Should support Rogue AP detection, classification and standard WIPS signatures.
31	WLC should be able to exclude clients based on excessive/multiple authentication failure.
32	Shall support AES or TKIP encryption to secure the data integrity of wireless traffic
33	Should support AP location-based user access to control the locations where a wireless user can access the network
34	Should support Public Key Infrastructure (PKI) to control access
35	Must be able to set a maximum per-user bandwidth limit on a per-SSID basis.
36	Should support SNMPv3, SSHv2 and SSL for secure management.
37	Should support encrypted mechanism to securely upload/download software image to and from Wireless controller.
38	Should provide visibility between a wired and wireless network using IEEE 802.1AB Link Layer Discovery Protocol (LLDP) and sFlow/equivalent.
39	Should support AP Plug and Play (PnP) deployment with zero-configuration capability

40	Should support AP grouping to enable administrator to easily apply AP-based or radio-based configurations to all the APs in the same group
41	Should support selective firmware upgrade APs, typically to a group of APs minimize the impact of up-gradation
42	Must Support the application visibility from Layer 4-7.
43	Should have a suitable serial console port.
45	Should meet Gartner Magic quadrants criteria for Wired and Wireless LAN Access Infrastructure specified in Vol.1

Outdoor AP:

No.	Specification
1	Access Points proposed must be 802.11ac, Wave 2 compliant, include radios for both 2.4 GHz and 5 GHz.
2	Must have -88 dB or better Receiver Sensitivity.
3	Must support 2X2 multiple-input multiple-output (MIMO) with two spatial streams
4	Must support data rates up to 860 Mbps on 5Ghz radio.
5	Must support 80 MHz wide channels in 5 GHz.
6	Must support WAP enforced load-balance between 2.4Ghz and 5Ghz band.
7	Must support up to 28dbm or higher of transmit power
8	Access point should 802.11ac, Wave 2 802.11n and 802.11a/b/g Beamforming
9	Support Encrypted and authenticated connectivity between all backhaul components

10	Access point should have multiple wired uplink interfaces including 10/100/1000BASE-T Ethernet autosensing (RJ-45) and a build-in SFP port
11	Wireless AP should support beamforming technology to improve downlink performance of all mobile devices, including one-, two-, and three-spatial-stream devices on 802.11ac without taking the inputs from client.
12	Wireless AP Should able to detect and classify non-Wi-Fi wireless transmissions.
13	Must incorporate radio resource management for power, channel, coverage hole detection and performance optimization
14	Access point shall support pole, wall and Cable strand mounting options.
15	The equipment shall support up to 100 MPH sustained winds & 165 MPH wind gusts.
16	The Access point shall be IP65 or above.
17	The Access point shall support operating temperature of -30 to 55°C
18	The Access point shall support Storage temperature of -50 to 70°C
19	802.11e and WMM
20	WiFi Alliance Certification for WMM and WMM power save
21	Must support QoS and Video Call Admission Control capabilities.
22	Must support Spectrum analysis including @ 80 MHz
23	Same model AP that serves clients must be able to be dedicated to monitoring the RF environment.
24	Should support mesh capabilities for temporary connectivity in areas with no Ethernet cabling.
25	Must support 16 WLANs per AP for BSSID deployment flexibility.
26	Must support telnet and SSH login to APs directly for troubleshooting flexibility.

27	Should meet Gartner Magic quadrants criteria for Wired and Wireless LAN Access Infrastructure specified in Vol.1

5 Common Components

5.1 City Network

5.1.1 Overview

Belagavi is an education and medical hub, trying to take this opportunity Telecom / Internet Service Providers in the city has already laid out fibre covering 194 KM of the city.

5.1.2 Scope of Work

1. SI should tie up with an Internet Service Provider or Telecom Service Provider to provide connectivity from the Field Infrastructure to CoC.

2. SI should use public internet for transmission of information between field infrastructures to the core router of CoC. Required security applications should be factored in to avoid hacks at field infrastructure level.

3. SI should estimate the bandwidth requirement for connectivity between CoC and Data Center and the same shall be clearly provisioned in the technical proposal with detailed calculations. The connectivity between CoC and Datacenter shall be through Karnataka State Wide Area Network (KSWAN). The bandwidth provisioned needs to adhere to the following minimum benchmark requirements –
   a) Latency should be less than 40 ms
   b) Jitter should be less than 10% of one-way latency
   c) Packet loss should be less than 0.5%

4. The SI shall meet the parameters of video feed quality, security & performance. SI should factor the same while designing the solution.

5.1.3 Technical Specifications

Data Transmission Requirements for Field Infrastructure to Application Level

ICT Solution	Field Level Devices	Connectivity	Data Time	Collection
Smart Water	Sensors to measure			

	Quantity of Water Level Sensing Devices Pressure Sensor **Quality of Water** Turbidity ph Level Residential Chlorine	RFID/GSM	Once in every 6 Hours
	AMR Meters		
Intelligent Transport system	1) GPRS/GSM 2) VMS at Bus Stops	GPRS	15-20 Sec
ICT based SWM	1) GPRS/GSM Devices 2) GPRS – Attendance Management System 3) Weigh Bridge Sensors	GPRS	Real Time
	4) Video Surveillance	Public Internet	Real Time
Intelligent traffic management system	1) Traffic Signals 2) Vehicle Detection Sensors 3) VMS 4) PAS (Speakers at Junction)	Public Internet	Continuous
Intelligent poles	1) Environmental Sensors 2) VMS 3PAS 4) Digital Bill Board 5) Panic Button 6) CCTV Camera	Public Internet	Continuous

Security Requirements for Network as a Service

1) Every field device should be authenticated in the IoT Platform before being able to access to the network resources

  a. Field devices should use X.509 certificate based authentication

  b. Certificate Authority chosen should be mutually agreed upon.

  c. Along with X.509 certification , Device should also support authentication

2) Other information regarding the security is mentioned in IoT Platform section.

5.2 Centralized Control Centre / City Operation centre

5.2.1 Overview

City Operation centre main objective is break silos between departments and in departments, make process integrated to serve public in an efficient manner. As part of Smart City Belagavi –it is proposed to build one common operation centre. This centre will provide an integrated view of all ICT projects identified in this document, its primary focus is to serve as a decision support engine for city administrators in day to day operations or during emergency situations.

This common centre, shall leverage information provided by various departments and provide a comprehensive response mechanism to the day-to-day challenges across the city. City Operation Centre shall be fully integrated, web-based solution that provides seamless incident – response management, collaboration and geo-spatial display. Various ICT projects shall be able to use the data and intelligence gathered from operations of other elements so that civic services are delivered more efficiently and in an informed fashion.

SI shall develop application module for the smooth operation of City Operation Centre, and shall deploy support and maintenance manpower at the CCC/CoC

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 to have a proven Enterprise Management System (EMS) for the efficient management of the system, reporting, SLA monitoring and resolution of issues.

5.2.2 Scope of Work

- BSCL has already identified a location to host CCC/COC, SI should inspect the location and factor in the amount of work needed to build CoC in the bid document.
  - SI Should provide a universal dashboard to view all applications in a consolidated manner on GIS map provided by BSCL and also general KPI View.
- SI should be able to provide Unified view for each Departments on GIS map provided by BSCL and general KPI views.

- SI should be able to project this information on the video wall
- SI should also continuously monitor the Field infrastructure/Servers/Routers/CCC which has been built as part of this RFP
- KPI's which need to be tracked and project on the video wall shall be during inception stage
- Key KPI for each domain needs to be tracked based on Clients requirement, which will be decided post award of work by the client.
    - ***KPI's list given are indicative and a detailed list of KPI's need to be furnished by SI during feasibility study***
    - KPI's should include from the following categories
        - Process KPI
            - KPI's which measure the efficiency of the integrated processes
        - Event Based KPI
- System should be capable of creating new KPI's on the fly.
- SI should setup a dedicated helpdesk to support the field infrastructure laid out as part of the RFP.

5.2.3 Indicative Layout of CoC
- Spacing should be provided for teams from different departments
- Design of the CoC should be as per the ISO 11064 standards
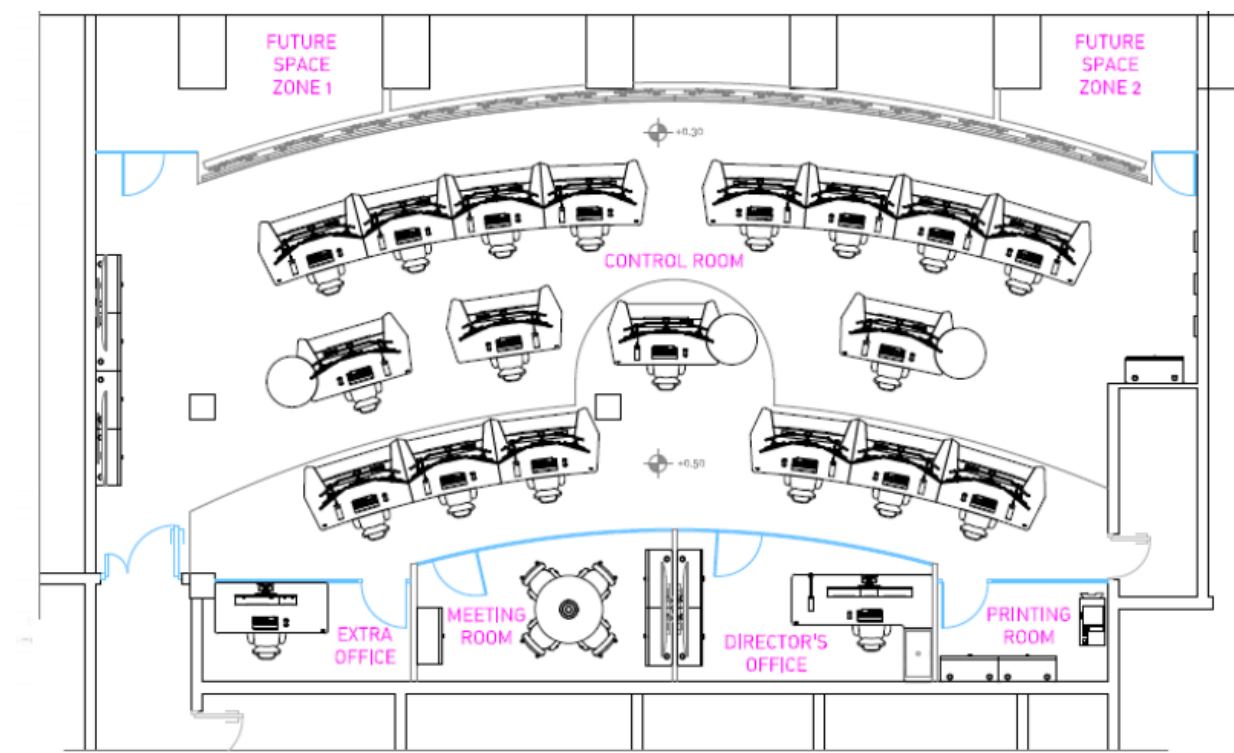
Please Note: Not to scale

5.2.4 City Operations Platform - Functional Specifications

The Proposed Integrated Operations Platform (IOP) shall have IoT Platform Software (Data Normalization software) & City Operation Centre Software functionalities;

All applications which will have field infrastructure like – Smart Water, Smart Transport, Smart Traffic, Solid waste management etc., proposed to be built as part of Smart City initiative shall pass information processing via IoT Platform.

IoT Layer must integrate lots of Services in the current scenario and must deliver an architecture which will be future scalable and can accommodate more Services / Utility Solution Integration.

IoT shall be a Common layer and is required for the **Normalization of the data** from different edge applications. This layer will aggregate **and integrate utilities & sensors data** so as to ensure that **Device management**, **Analytics, Reporting, Dash Boarding** and **Integration of the Different Authorities data** can be performed from a single operational screen. This layer shall also **integrate with different Independent Software Vendor (ISV) applications** hosted at Data Centre or at Cloud to provide the completeness of the solution.

5.2.4.1 IoT Platform

In general, IoT Platform shall have following functionality:

1) **Data Aggregation, Normalization and Access** –

- Normalizes the data coming from different devices of same type (i.e. Different lighting devices, different energy meters etc.) and provide secure access to that data using data API(s) to application developers

    a) The City will be using various device vendors for various urban services. For example, in the Smart city journey of the city, various vendors of smart elements will be used for deployment and each will be generating data in their own format. This Smart City platform should be able to define its own data model for each urban service like parking, waste, lighting, transport etc and map data from different device vendors to the common data model. This way, application development and analytics applications do not need to worry about the complexity of various data formats.

- Data from the IoT platform must be exposed to application eco system using secure APIs using API keys

- The attributes of the API key(s) must restrict / allow access to relevant data, i.e. (the attributes can be like: specific domain (either parking or lighting or waste etc or combination of these), RO / RW /, specific to tenant (city, street within city etc)).

- The platform should be able to integrate with any type of sensor platform being used for the urban services irrespective of the technology used. Agnostics to sensor technologies such as LoRA, ZigBee, GPRS, WiFi, IP Camera

- The platform should also allow the manufacturers of the sensors to develop integrations themselves using SDKs without affecting the northbound applications and existing integration. The platform should have the ability and provision to write adaptors, which interface with the sensors or sensor management software.

- 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.

- The platform should support distributed deployment of functions (workflows & policies) across city's network and compute infrastructure with centralized management and control

2) **GIS Map Support** - System should support Esri, map box, Open street etc.

- Provides the geographical coordinates of specific facilities, roads, and city infrastructure assets, as well as unmapped facilities

- Calculates distance between two, or more, locations on the map

- Locates and traces devices on the map

3) **Service Catalog Management** -The Service catalog management module should allow to categorize the externalized and non-externalized services into logical groups by creating the service catalogs. In addition, system should allow manage the service catalogs by adding, modifying, or deleting the catalog details.

4) **IOT platform shall enable online Developer Program tools** that help the City to produce new applications, and/or use solution APIs to enhance or manage existing solution free of cost. The IoT platform vendor shall have technology labs via an online public facing web interface. These labs should be available 24X7.

5) **Multi-tenancy** -

Single instance of SMART CITY PLATFORM can be logically partitioned to host multiple tenants.

- Each tenant should have respective administrator users.
- Each Tenant can be further partitioned with access to users for the respective zones/streets.
- City software platform Dashboard should display only relevant data (associated geographical data) for the user who logs in.

6) **Authentication**: Authorization System should support standard Authentication, Authorization Performs

7) **Resiliency:**
- This architecture provides the smart city use cases much needed resiliency while adapting cloud architecture
- Provides ways to define policies that make applications or things respond to external environments
- Schedule actions to happen at future time points
- Smart city platform should have integrations with the network layer to proactively monitor any incidents on the network for active troubleshooting and triaging
- Smart city platform should be able to alert any incidents in the network proactively on City Operation center
- Smart City platform should have demonstrated integration to collaboration tools to bring multiple stake holders and responders to respond an emergency or an urban services event.

8) **Edge Computing**:
- Provides standard edge appliance to connect industrial protocol devices, provides secure connection to cloud infrastructure, provides remote lifecycle management including software/firmware downloads and upgrades, provides remote management, self-registration, and local administrative interface.

- Provides edge appliance to abstract downstream industrial protocols and upstream internet protocols.

- Edge appliance is provided in three form factors Over the Pole, in street Cabinet and street appliances. Should be light weight with no moving parts and small in size. Should not need more than 1 GHz of dual core CPU and 1 GB of memory to run with reasonable load.

- Edge appliance provides software modules to interact with control systems and SCADA systems.

- Smart City platform should be functionally complete on the edge, providing local processing of events, contextualization, transformation, analytics, decisions and controls. Business relevant events only passed to cloud.

- Provides runtime load of new functions on the edge from the cloud.

- Smart City platform should allow to set or change the behavior on the edge through policies, which could be defined through cloud instance of Smart City Platform.

- Edge provides inline actions with analytics in same time window as SCADA functions.

- Edge should learn the behavior as analyzing the data to create better decisions with time. Share the outcomes with the cloud to impact other edges.

- Provide centralized Device Management from sensor to cloud.

- Provide management tools to view, analyze, report on and modify the edge configurations.

- Edges and cloud instances of platform should create a logical cluster to distribute the workload dynamically between the nodes, if and when applicable. (Need to check, if too strong of the requirements)

- Edge software should not be dependent on sensors and devices or protocols. Same software blueprint should be deployed and running on all edges. Data and Configurations can be different from edge to edge.

9) **API Repository / API Guide** -Normalized APIs should be available for the listed domains (Parking, Outdoor Lighting, Traffic, Environment, Urban mobility etc.) to monitor, control sensor and/or actuators functionality to enable app developers to develop apps on the platform. For example Lighting APIs: Vendor agnostic APIs to control Lighting functionality.

    a) Platform OEM should have published the normalized APIs in their website for the listed domains (Parking, Outdoor Lighting, Traffic, Environment, Urban mobility etc.) to allow sensor vendors and app developers to develop their connectors / adaptors to the platform

    b) Cross collaboration APIs: Enabling contextual information and correlation across domains and verticals (Multiple vendor and Multi-sensor in future)

10) **Platform upgrade and maintenance** -The OEM should be able to securely access the platform remotely for platform updates / upgrades and maintenance for the given duration

- Platform should be able to be deployed on a public cloud for disaster recovery

11) **Platform functionality API management and gateway:** Provides secure API lifecycle, monitoring mechanism for available APIs

- User and subscription management: Provides different tier of user categorization, authentication, authorization, and services based on the subscriptions

- Application management: Provides role-based access view to applications

- Enabling analytics: Time shifted and real-time data available for big data and analytics

- The platform should also be able to bring in other e-governance data (SCADA system's) as i-frames in the command and control center dashboard

- All of these data should be rendered / visualized on the command and control center dashboard.

12) **API Based Open Platform**:

- Provides urban services' API(s) to develop operation applications for each of the Urban Services domains. For example, the lighting operator of the City should be able to develop a City Lighting management application based on the API(s) provided by the platform. This lighting application should also have the ability to access data from other domains like environment based on the access control configured in the system.

- Smart city platform should have API Management capabilities like API Security, API Metering, API Monetization

- The smart city platform is should be able to provide API access based on roles and access control policies defined for each user and the key issued to that user

- The vendor should have already documented different Urban Services APIs using which applications can be developed

- The vendor should be able to demonstrate existing applications that are developed using these urban services APIs

- Enables the City and its partners to define a standard data model for each of the urban services domains (i.e. Parking, lighting, kiosks etc....)

- Enables City and/or its partners to write software adaptors based on the API(s) provided by device vendors and have the ability to control, monitor and collect the data from these street devices

- Provides urban services API(s) to develop operation applications for each of the Urban Services domains. For example, the lighting operator of the City should be able to develop a City Lighting management application based on the API(s) provided by the platform.

This lighting application should also have the ability to access data from other domains like environment based on the access control configured in the system.

13) **Trending Service** -System should provide trends in graphical representation from data sources over a period. Trends should allow to monitor and analyze device performance over time.

14) **Policies and Events** -System should allow policy creation to set of rules that control the behavior of infrastructure items. Each policy should a set of conditions that activate the behavior it provides. System should allow Default, Time-based, Event-based and Manual override polices creation. For example, an operator might enforce a "no parking zone" policy manually to facilitate road repairs.

- System should provision to defines a set of conditions that can be used to trigger an event-based policy

15) **Global Market Presence** -

- Smart city suppliers should be adaptable to the emerging needs of cities. Suppliers should develop offerings that meet the growing interest in urban Internet of Things (IoT) applications, big data solutions, and the transformation in city approaches to energy policy, urban mobility, and city resilience.

5.2.4.2 Visualization/CoC Layer

1) **CoC Operations** - The solution should be implemented and compliant to industry open standard commercial-off-the-shelf (COTS) applications that are customizable.

- The solution should have the capability to integrate with GIS
- The solution shall integrate with GIS and map information and be able to dynamically update information on the GIS maps to show status of resources.
- The solution should provide operators and managers with a management dashboard that provides a real-time status and is automatically updated when certain actions, incidents and resources have been assigned, pending, acknowledged, dispatched, implemented, and completed. The above attributes shall be color coded.
- The solution shall provide the "day to day operation", "Common Operating Picture" and situational awareness to the center and participating agencies during these modes of operation
- It shall provide complete view of sensors, facilities, e-governance/erp, video streams and alarms in an easy-to-use and intuitive GIS-enabled graphical interface with a powerful workflow and business logic engine
- It shall provide a uniform, coherent, user-friendly and standardized interface

- It shall provide possibility to connect to workstations and accessible via web browser
- The dashboard content and layout shall be configurable and information displayed on these dashboards shall be filtered by the role of the person viewing dashboard
- The solution should allow creation of hierarchy of incidents and be able to present the same in the form of a tree structure for analysis purposes
- It shall be possible to combine the different views onto a single screen or a multi-monitor workstation
- The solution should maintain a comprehensive and easy to understand audit trail of read and write actions performed on the system
- The solution should provide ability to extract data in desired formats for publishing and interfacing purposes
- The solution should provide ability to attach documents and other artifacts to incidents and other entities
- The solution is required to issue, log, track, manage and report on all activities underway during these modes of operation:

  a)   recovery

  b)   incident simulation

1) **Integration capabilities** - The Platform shall also be able to integrate, connect, and correlate information from IoT Platform and other IT & non IT systems, providing rule based information drawn from various sub-systems for an alert.

   - Platform should support on the fly deployment of Sensors. Platform shall have the ability to add / remove sensors including new vendor types without a need for shutdown.

2) **Notifications, Alerts and Alarms** -System should generate Notification, Alert and Alarm messages that should be visible within the Dashboard and the Field Responder Mobile App if required.

   - All system messages (notifications, alerts and alarms) should always be visible from the Notifications view, which provides controls that operator can use to sort and filter the messages that it displays.
   - Systems should deliver message to a set of subscribers. The Notification service should support min two types of notification methods – Email notification and Short Messaging Service (SMS) notification.

3) **Users and roles** -Users access the platform to perform various tasks, such as adding new locations, configuring new devices, managing adapters etc. Each user should be associated with one or more roles and each role is assigned a certain set of permissions.

   - The platform should allow different roles to be created and assign those roles to different access control policies.

- The platform should allow single or multiple users to view and manage alarms in defined areas/Locations. User can be part of Single or multiple Areas/Locations.

4) **Reports** -The platform should have capability to provide access to real time data and historical data from various connected devices for reporting and analytics.

- System should have ability to generate reports and have provision to add reports in favorites list.

    a.   Ability to display report on monitor and print report.

    b.   Ability to capture Operators response in Text, Audio & Video

    c.   Ability to select information to be included in report at time of report generation.

    d.   Details of alarm including severity, time / date, description, and location.

    e.   Map of surrounding area associated with alarm.

    f.   Capture the operator response by text, audio & video

    g.   Allow operator to transfer the incident report to Mobile Device/another operator's console

5) **Standard Operating Procedure -** The software should provide for authoring and invoking un-limited number of configurable and customizable standard operating procedures through graphical, easy to use tooling interface.

- Users should be able to edit the SOP, including adding, editing, or deleting activities.
- Users should be able to also add comments to or stop the SOP (prior to completion).
- 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.
- The SOP Tool should have capability to define the following activity types:

    a)   Manual Activity - An activity that is done manually by the owner and provide details in the description field.

    b)   Automation Activity - An activity that initiates and tracks a work flow and select a predefined flow order from the list.

    c)   If-Then-Else Activity - A conditional activity that allows branching based on specific criteria. Either enter or select values for Then and Else.

    d)   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.

    e)   SOP Activity - An activity that launches another standard operating procedure

6) **Collaboration:**

- The CCC platform should provide an ability to bring multiple stake holders manually/automatically on to a common voice conference call/chat room/Collaboration room/Meeting room as a standard operating procedure to handle event incident.

- The stake holders can be on various types of devices like computer, smart phones, tablets or normal phones

- The platform should allow stakeholders to share multi-media content relevant to the issue in the collaboration space.

- The platform should allow stakeholders with various smart devices (smart phones, Laptops, Analog Phones etc.) to invoke/participate in a web conferencing session directly from the collaboration space.

- The platform should allow smart city devices (cameras, lights, various sensors etc.) to be added to the collaboration spaces. It should also allow the stakeholders to acquire data from such devices and to control such devices directly from the collaboration space, subject to access privileges for each user and device.

7) **Analytics Engine** - Analytics Engine should be an artificial intelligence-based smart city analytics platform module to maximize business value through advanced machine learning capabilities. The machine learning capabilities aid in automating policies that result in better asset and infrastructure management.

- The solution should be flexible to integrate with other city and government software applications.

- Analytics Engine module should have below intelligence capabilities;

  a) Advanced Predictive Analytics should be part of the solution.

  b) The solution should be flexible to integrate with other city and government software applications

  c) The solution should be able to predict insights consuming data from city infrastructure viz., Traffic, Parking, Lighting etc.

  d) The solution should have predictions with measurable accuracy of at least > 70%

  e) The solution should be able to predict and integrate with Smart City solutions helping in driving operational policies creation.

  f) The solution should have a visualization platform to view historic analytics

- The application should enable the customers to discover, compare, and correlate data across heterogeneous data sources to unravel the patterns that are previously hidden. At a broader level, when you work with the application, system do the following tasks:

  a) Connect to a variety of data sources

b) Analyze the result set

c) Visualize the results

d) Predict outcomes

- Analytics Engine should support multiple Data Sources. Min below standard data sources should be supported from day 1 – CSV, TSV, MS Excel , NoSQL, RDBMS

- Analytics Engine should provide analysis of data from a selected data source(s).

- Analytics engine should provide capability to check analysis with multiple predictive algorithms

- Analytics Engine Visualizations -Analytics Engine should provide visualizations dashboard.

- In the visualization workspace, it should allow   to change visual attributes of a graph.

- User should not be allowed to alter the graph/visualization definition.

8) **API & Interface Security:**

- Access to the platform API(s) should be secured using API keys.

- Software should support security standards: OAuth 2.0, HTTPS over SSL, and key management help protect the data across all domains.

- Should support security features built for many of its components by using HTTPS, TLS for all its public facing API implementations. For deployment where CCC Software API(s) exposed to application eco system, API Management, API security features and API Key management functions are required.

9) Platform vendor should maintain complete inventory of critical production assets. Asset could be defined as source code, documents, binaries, configuration data, scripts, supplier agreements, SW Licenses

10) **Business Operations Audit & logging:** Platform should support centralized logging & auditing framework.

- Legal / Supplier chain agreements: Platform provider vendor should have policies and procedures established, and supporting business processes and technical measures implemented, for maintaining complete, accurate and relevant agreements (e.g. SLAs) between providers and customers

- Critical production assets: Platform vendor should maintain complete inventory of critical production assets. Asset could be defined as source code, documents, binaries, configuration data, scripts, supplier agreements, SW Licenses

11) **Field Responder Mobile -Apps**   Provide Integrated Mobile Application for capturing real-time information from the field response team using Mobile- Standard Operating Procedure.

Overall Integrated Operations Platform should account for below solution components, which can be extended to Multi-tenancy architecture;

- City Tenant activation license with one lakh device connection
- Integration of various for sensors, applications/systems as per city requirements
- Operator Client License min 25 with one city activation license

5.2.4.3 Enterprise 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, VMS, etc .

Proposed Network Management system shall also help monitor key KPI metrics like availability 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 management 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, discovered topology data 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 alter in such cases

- The system should provide complete and up-to-date picture of the managed environment. Should have capability to receive discovery and topology information from multiple automated discovery sources on a near real time basis Solution should provide a consolidated event dashboard of the entire IT environment covering virtualization technologies, cloud infrastructure, third-party products, applications, servers, storage, networks

- 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.

- System should also automatically create tickets based on alarm type

- There should be only one integration/interface to Helpdesk after event suppression, correlation and consolidation across the IT landscape to reduce number of tickets in helpdesk

- The proposed tool should integrate with network performance management system and support operating system monitoring for various platforms supplied as part of this RFP.

- The proposed tool must provide information about availability and performance for target server and installed applications on these 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.

5.2.4.4 Centralized Help Desk System

- Proposed helpdesk solution must provide flexibility of logging, viewing, updating and closing incident manually via web interface for issues related to surveillance project.

- 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.

- Helpdesk should be an ITIL certified tool from certified Authority like PinkVerify for Incident, Problem, Change, Knowledge, Configuration and SLA Management processes.

- The proposed helpdesk solution must have a built-in workflow engine to define escalations or tasks to be carried out after issues or change order are logged pertaining to surveillance project.

- Solution should provide a clustered view of recurring themes hidden in the huge quantities of data for spotting service desk trends easily

- Helpdesk should have capability to automatically categorize, understand the impact, and assign the service desk ticket to relevant helpdesk team members

- Centralized Help Desk System should have integration with Network / Server Monitoring Systems so that the Help Desk Operators can to associate alarms with Service Desk tickets

to help surveillance operators that for what alarms corresponding helpdesk tickets got logged.

- Helpdesk should have an integrated CMDB to automatically collect and manage accurate and current business service definitions, associated infrastructure relationships and detailed information on the assets

- It must be a centralized monitoring solution for all IT assets (including servers, field level infrastructure etc.)

- The solution should provide inventory of all the discovered devices. Out of box inventory fields should be available and it should have provision to add additional fields as required

- The SLA & Contract Management module of helpdesk should be able 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. 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 –

- The helpdesk must have integrated dashboard providing view of non-performing components / issues with related to service on any active components

- The solution must support Service Level Agreements version control and audit Trail to ensure accountability for the project.

- 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.

A general process flow for the helpdesk management is depicted in the flow chart given as follows. Systems Integrator shall prepare a detailed Helpdesk Policy in consultation with BSCL prior to the Go Live date.
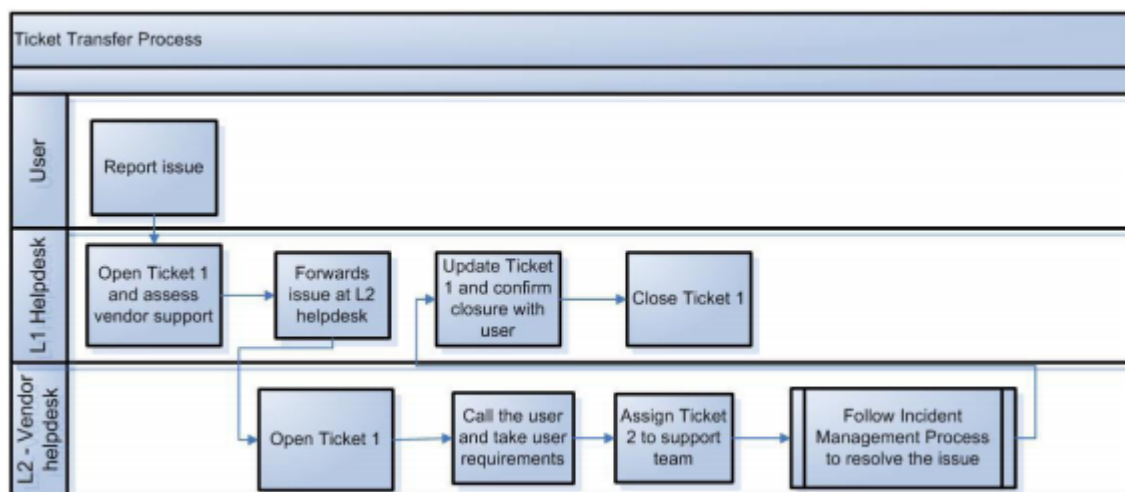
Help Desk Process

5.2.4.5 *Reporting*

- The solution should provide historical and concurrent service level reports 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.

- Support real-time reports (like at-a-glance status) as well as historical analysis reports (like Trend, TopN, Capacity planning reports etc.)

- The solution must support security for drill-down capabilities in dashboard reports ensuring visibility for only relevant personnel of the surveillance project

- Resource utilization exceeding or below customer-defined limits

- Resource utilization exceeding or below predefined threshold limits

- The Network Management function should be able to do traffic analysis. The Traffic Analysis must include Bandwidth Utilization patterns by protocol/source/destination, Network Response time patterns for various applications over the network. It should help with out of the box analysis reports to understand top bandwidth consumers by application, source, or destination. It should help with advanced reporting features to provide various reports that help understand capacity needs of the network bandwidth based on current utilization and response time trends.

- The discovery must also support device redundancy discovery in case of virtual IP addresses using vendor specific protocols such as VRRP and HSRP.

- Proposed solution should be able to also provide a threshold and profile capability on the KPIs monitored on the network in order to understand the impact of failures and degradations which eventually results in revenue loss.

- It should support automatic base lining on historical data, and thresholds that can be adjusted as required, based on data collected

- Solution should offer off-the-shelf Reports for KPIs such as Availability, Uptime, and Resource

5.2.5 Video Management Software

All City cameras will connect to single platform and shall manage video feeds for all CCTV systems required under this project through Video Management System (VMS) application hosted at Command and Control Centre or sub-command and control centre.

This organization requires an integrated security solution that includes a command and control style operator console; an open source based video management software system, standard and high definition IP-based cameras.

System should meet the following requirements. The Video Surveillance System should intend to effectively monitor all the critical operational areas of the locations. The broad objectives of the Video Management System are as follows:

- Access points monitoring with Motion Detection Alarms

- Coverage for detection of any intrusion of defined areas

- Enhancement of operational control by covering critical areas

- Recording of camera outputs for analysing critical events. Concessionaire shall provide recording solution at 15FPS of 2MP for day as well as night. Proposed application should support for back-up.

General Requirements:

a) The software described in this specification is highly scalable Multi Site enterprise level (IP) based Video Management (VMS) Software, centrally managed with multi server as well as distributed sites.

b) The VMS shall utilize 64-bit architecture OS supporting native or virtualized environment and the client shall be 64-bit application supporting from Windows 7 professional & above.

c) The surveillance system shall be open standard supporting multiple vendor IP cameras and encoder manufacturers within the same system. The system shall support integration of ONVIF compliant cameras.

d) The surveillance system viewing system should be in thick client for local viewing and thin client through http browser for remote viewing. Both thin and thick client shall provide the capability of viewing single or multiple live and archive cameras, control PTZ camera.

e) The VMS shall allow bidirectional audio communication with the cameras Two-way Audio Communication.

f) The VMS shall provide file export tool for export of single frame of video in BMP, GIF, TIF, JPG and PNG formats and export of video files in MP4, AVI and other industry standard format

g) The VMS shall support synchronized playback for up to 25 cameras in sync with alert/user selected time

h) The VMS shall support Configurable recording rate per camera using templates and Remote Administration, Monitoring & Management of Video

i) Support any video resolution like CIF, 2CIF, 4CIF & HD up to 20MP.

j) VMS application should have a mobile application for Android & Apple devices

k) The System shall support the scalability of additional camera installation beyond the originally planned capacity. One single Video Management system shall be expandable up to 10,000 cameras.

l) VMS shall support in-built Server storage, Direct Attached Storage(DAS) and Storage Area Network (SAN) systems and shall have the ability to directly record on the storage platform.

m) VMS system should support High Availability for both Management platform and Recording Servers if required.

n) The proposed video management system shall support deploying the software on Virtual servers, so that the hardware requirement can be reduced for this project.

o) The system shall have capability to stream video at remote sites by optimizing the bandwidth on WAN.

p) The System should support automatic discovery and configuration of Cameras connected to the network

q) The System should support LDAP (Lightweight Directory Access Protocol) server

5.2.6 Core Router

Refer the Core Router Specifications mentioned in Section 5.4.3.1

5.2.7 Core Switch

Refer the Core Switch Specifications mentioned in Section 5.4.3.1

5.2.8 Internet Router

Refer the Internet Router Specifications mentioned in Section 5.4.3.1

5.2.9 Access Switch

Refer the Access Switch Specifications mentioned in Section 5.4.3.1

5.2.10 Firewall with IPS

Refer the Firewall with IPS Specifications mentioned in Section 5.4.3.2

5.2.11 Telephony System

5.2.11.1 IP Phone

S. No.	Minimum Specifications
1	The phone should be SIP based.
2	Should have 5" coloured IP Phone or higher diagonal Display and supporting resolution of 700 x 400 or better pixel.
3	Should have full duplex speaker phone and dedicated headset port with RJ-9 interface.
4	It should support G.711, G.722, G.729a and iLBC audio compression codecs.
5	Should provide the directory services to the user by displaying the missed, received and dialled call details including the caller ID and calling time.
6	Should have 5 or more programmable line keys.
7	Should support IEEE 802.3af POE and external AC power adapter option.
8	The phone should have two 10/100/1000 BASE-T Ethernet ports, one for the LAN connection and the other for connecting to PC/laptop.
9	The phone should support QoS mechanism through 802.1p/q.

10	The phone should support XML based services and applications.
11	The phone should be IPV4 and IPV6 compliant
12	The phone should be supplied with external module for increased number of line keys. The external module should support 18 additional physical keys

5.2.11.2 IP Communication Manager

S. No.	Minimum Specifications
1	IP telephony system should be a converged communication System with ability to run TDM and IP on the same platform using same software load based on server and Gateway architecture.
2	The system should be capable of supporting analog and IP Telephones. System have hardware, software and licensing for 20 at DC and DR perpetual licenses from day 1 and should be scalable to 100 IP Phones on same hardware.
3	All the users to be managed in a single database, which is managed centrally, no multiple databases. CLI facility for all users should be provisioned from day 1.
4	The system should be based on server gateway architecture with external server running on Linux OS. No card based processor systems should be quoted.
5	The voice network architecture and call control functionality should support both SIP & H.323.
6	The call control system should be fully redundant solution with no single point of failure and should provide 1:1 redundancy. The solution must provide geographical redundancy by separating the servers over LAN/WAN. i.e. if the server in the main data centre fails, the other server, which is installed at geographically different location over LAN/WAN should take over the entire communication network load.
7	The system to have distributed architecture and the centralized control for all the IP PBX entities in the network.

8	The communication feature server and gateway should support IPv6 from day 1 so as to be future proof.
9	It should support Survivable Call Control functionality so that the survivable system at the remote location shall provide fall back call control service in case the remote site loses all connectivity to the main Call Control system placed at data centre. It is expected that the survivability call control system will provide a minimal set of essential telephony features to the end-users that could be a subset of the feature that are available from the main call control system.
10	It should be possible for the IP phone to be connected on the same line which is connected to the computer i.e. Single wire to desk.
11	Call control server / appliance should be Intel based hardware with necessary configuration to support the desired expandability. No proprietary hardware is acceptable. It is desired to have support for virtualization.
12	The system software version offered should be the latest release as on the date of supply of EPABX as available globally.
13	The offered solution must have standards based QoS implementation.
14	System should allow direct registration / profile creation of SIP endpoints onto it and perform all functions of Proxy / Registrar / Redirect etc.
15	In progress Internal / PSTN Calls at each of the locations should not be interrupted in the event of Call Server failure or WAN link failure.
16	Quality of Services (QoS) would be configured to administer the call and ensure voice traffic get priority over normal traffic.
17	The System should support Call Admission Control to configure number of calls that can be active between locations.
18	Should support Active Directory integration for directory synchronization and user authentication.
Call processing and call control functionality	

20	Should support signalling standards / Protocols – SIP, H.323, Q.Sig.
21	Voice CODEC support - G.711, G.729, G.729ab & G.722
22	Video codecs: H.264
23	Video telephony support (H.323, and SIP)
24	Support for configuration database (contains system and device configuration information, including dial plan)
25	Having inbuilt administration web based administration. No additional thick client for administration on the Admin PC. Should also support HTTPS for management.
26	Call control system should provide for SIP trunks for integration with other exchanges or Applications for interoperability. Bidder to bundle at least 100 SIP/IP trunk licenses with the offer.
27	Should support 6 party adhoc conferencing.
28	Should support at least 15 meet-me audio conference of up to 8 party in each conference.
System Management and monitoring	
29	The System should have GUI support web based management console
30	System should provide management tool to monitor system performance, device status, device discovery and CTI applications.
31	Should provide alert notifications for troubleshooting performance
32	Generate various alerts online on management console in different colours when values go over / below preconfigured threshold levels.
33	Should monitor the system in real time on a set of preconfigured parameters.
34	The management platform must provide different levels for accessing the system based on the role being played by the user who is accessing the system. The administrator should have the highest authority.

Security	
35	The protection of signalling connections over IP by means of authentication, Integrity and encryption should be carried out using TLS.
36	The password and Access Control must Include the following:
	# Passwords to prevent the possibility of an aggressor to easily read or deduce system or account access password.
	# Password aging with Configurable time periods.
37	System should support SRTP for media encryption and signalling encryption by TLS.
38	Secure HTTP support for Call Server Administration, Serviceability, User Pages, and Call Detail Record Analysis and Reporting Tool. Should support Secure Sockets Layer (SSL) for directory.
39	Phone Security: TFTP files (configuration and firmware loads) are signed with the self-signed certificate of the TFTP server. The Call Server system admin will be able to disable http and telnet on the IP phones
System Features	
40	Hunt groups
41	Dial plan partitioning
42	The system should support at least 12 digit numbering scheme.
43	Distributed call processing
44	Hotline and private line automated ring down (PLAR)
45	Multi-Level Precedence and Pre-emption (MLPP)
46	Q.SIG (International Organization for Standardization [ISO])
47	SIP trunk (RFC 3261) and line side (RFC 3261 based services)
48	SIP trunk Call Admission Control (SIP CAC)

49	Time of day, day of week, and day of year routing and restrictions
50	The proposed system should support automatic route selection (ARS) and least Cost routing (LCR) features to route the calls based on priorities related to user profile, tariff, and network availability, along the most cost effective path. This service will be transparent for users and irrespective of the physical carrier connection.
51	Distinctive Ringing: The system should provide audibly different station ringing patterns to distinguish between internal and external calls
52	IP Phone Address Book Synchronizer—allows users to synchronize Microsoft Outlook or Outlook Express address books with Personal Address Book.
User Features	
53	User should be able to log in from any IP Phone using username and password and all the privilege should extend to that physical IP phone
54	Mobility features providing Simultaneous ringing on both Desk phone and GSM Mobile phone. This feature should allow for seamless transfer of a live call from Mobile phone to desk phone and vice a-versa.
55	Should support at least 8 party Ad-hoc conferencing on IP phones.
56	Message waiting indicator (MWI)
57	Abbreviated Dial
58	Call park and pickup
59	Call status per line (state, duration, number)
60	Calling Line Identification (CLID)
61	Calling party name identification
62	Direct inward dial (DID)
63	Direct outward dial (DOD)
64	Directory dial from phone—corporate, personal

65	Directories—missed, placed, received calls list stored on IP phones
66	Distinctive ring (on net vs. off net)
67	Shared Line support
68	Multiple line appearances per phone
69	Station volume controls (audio, ringer)
70	Transfer
71	Video (SIP and H.323)
72	Boss secretary feature support
73	On hook dialling
74	Call waiting
75	Call Conference
	Soft Client with Presence Services
76	Solution should provide a "presence" application for users, so that they can see the availability status of their contacts in their contact list.
77	The common supported status for this application should be available, busy, idle, away etc.
78	Should support the users to see other user's IP phone's on/off hook states.
79	The instant messaging application should support manual setting of user status to: Available, Away, Do Not Disturb (DND) etc.
80	Shall provide support for open protocols like XMPP.
81	Presence based IM client should be available for Desktops (Windows & Mac), as well as for Mobile phones (Android / iPhone)

82	Should support management of contact list and personal settings from Presence based desktop application
Video Telephony Features and Support	
83	The call control system should provide integrated video telephony features to the users so that user with IP Phone and video telephony end point should be able to place video calls with the same user model as audio calls.
84	The users should be able to transfer video calls to other Video phone users.
85	Call Server should provide a common control agent for signalling, configuration, and serviceability for voice and video end points.
86	Call control system should handle CODEC and video capabilities of the endpoints, bandwidth negotiation to determine if video/audio call can take place.
Required Hardware	
87	Bidders should include Upgrade Protection for all the Software Licenses quoted for this requirement. During this period the bidder should provide software upgrade of any major and minor release free of cost to customer. The required server for the IP PBX should be from the same OEM as the SIP based IP PBX

5.2.12 City Operation Centre Infrastructure

The City Operations centre consists of various infrastructure components that needs to be built as per customer requirement for an effective operation.

5.2.12.1 Video Wall Solution

5.2.12.1.1 Video wall Screen

NO.	Item	Specifications
1.	Display Wall Screen Size	70" Video Wall (along with hardware & software) Solution - 4x2 Display

NO.	Item	Specifications
2.	Projection Technology	DLP Rear Projection
3.	Native Resolution per cube	1920x1080
4.	Aspect Ratio	16:9
5.	Light Source	LED
6.	Brightness	on screen brightness 320 cd/m2
7.	Brightness Uniformity	95%
8.	Contrast ratio	Typical 1600:1
9.	Color	shall offer in excess of 16 million colors.
10	Full viewing angle	180°
11	Lifetime	Normal mode: 60 000h
12		Eco mode: 80 000h
13	Inputs	Dual link DVI-D in/out with loop-through with 320 Mhz Pixel clock
14	Power	100 - 240 VAC, 60 - 50Hz, (below values are for 230V; 110V +5%)
15	Eco mode	90 W
Heat Dissipation		
16	Eco mode	310 BTU/h
Operating conditions		
17	Humidity	**Up to 80% non-condensing**

NO.	Item	Specifications
18	Temperature	10°C-40°C | 50°F-105°F
Storing conditions		
19	Temperature	0°C-40°C | 32°F-105°F

5.2.12.1.2 Video Wall Controller

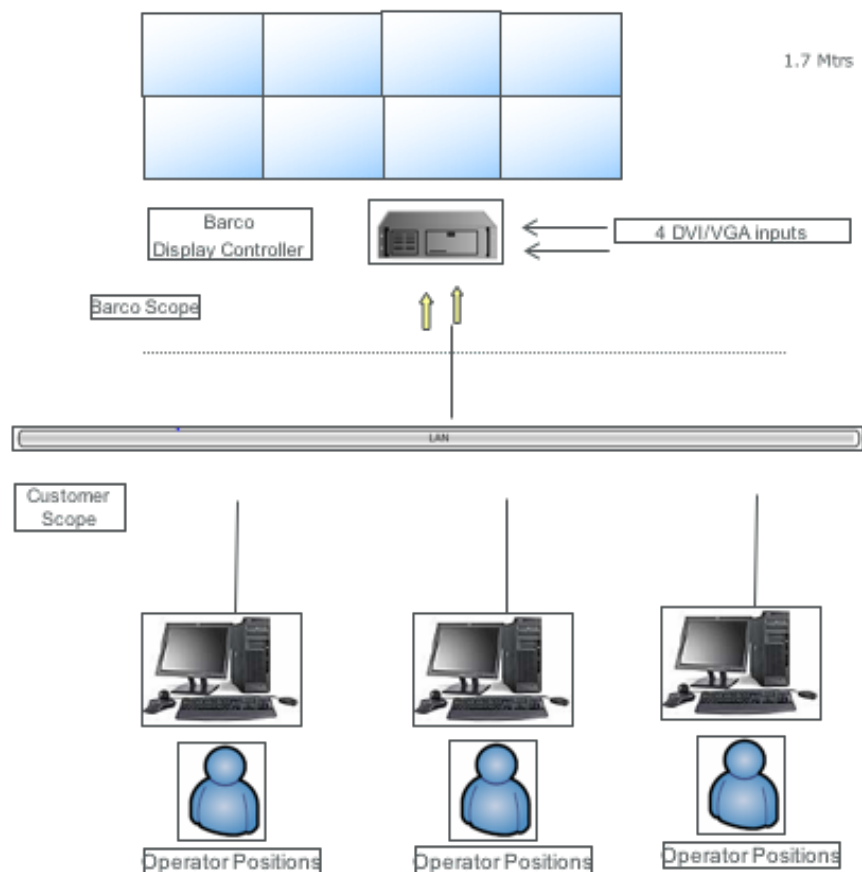| NO.	Item	Specifications
1	Display controller	Controller to be able to control min 8 cubes
2	Redundant Controller	The controller should be based on the latest architecture.
3	Platform	Windows 7 Professional (64 bit) or higher
4	Processor	i7 with 3 GHz or higher processor
5	RAM	Minimum 16 GB
6	Chassis Type	19" Rack mount industrial chassis
7	Network	2 Network Ports
8	Resolution Support For Outputs	Minimum1920 x 1080 or higher
9	RSS Feed	The controller should be able to show the RSS feed as required
10	Ticker	There should be a possibility in the controller to create user defined multiple tickers. It should also be possible to place these tickers anywhere on the wall
11	Scalability	The system should be able to add additional inputs as required in the future

12	Control	System should have the capabilities of interacting (Monitoring & Control) with various applications on different network through the single Operator Workstation. It shall be possible to launch layouts, change layouts in real time using Tablet
13	Fans	Chassis should have minimum 2 fans for adequate cooling
14	Redundancy	Redundant Hot Swappable HDD in RAID 1 Configuration
15	Redundancy	Redundant Hot Swappable Power Supply
16	Keyboard & Mouse Extension	Keyboard and Mouse along with mechanism to extend them to 20 Meters. operator desk from display controller to be provided
17	24 x 7 operation	The controller shall be designed for 24 x 7 operation
18	Others	The Video Wall and the Controller should be of the same make to ensure better performance and compatibility
19	OEM Certification	All features and functionality should be certified by the OEM. The Display Modules, Display Controller & Software should be from a single OEM.

5.2.12.1.3 Display Wall Management Software

NO.	Item	Specifications
1	Client & Server based Architecture	Should support Multiple clients / Consoles to control the Wall layouts
2	Collaboration	The Software should be able to share layouts comprising of multiple sources with workstations / Displays over LAN for remote monitoring
3	Scaling	Software should enable the user to display multiple sources (both local & remote) up to any size and anywhere on the display walls (both local & remote).
4	Display	The software should be able to create layouts and launch them as and when desired
5	Remote Control	Display Wall and sources (both local & remote) should be controlled from Remote PC through LAN without the use of KVM Hardware.
6	Layout Management	Should support for Video, RGB, DVI, Internet Explorer, Desktop Application and Remote Desktop Monitoring Layouts
7	Support of Meta Data	Software should support display of Alarms
8	Authentication	The software should provide at least 2 layer of authentication
9	Scenarios	Software should able to Save and Load desktop layouts from Local or remote machines
10	Layout Scheduler	All the Layouts can be scheduled as per user convince.
11	Layout Scheduler	Software should support auto launch of Layouts according to specified time event by user
12	User friendly	Software should be user friendly

NO.	Item	Specifications
13	OEM Certification	All features and functionality should be certified by the OEM. The Display Modules, Display Controller & Software should be from a single OEM.

Indicative Layout

5.2.12.2 Guidelines for Control Room Design & Setup

#	Parameters	Quantity
1	Wall Size for Video Wall	Video-wall with Single Controller
2	Cube Size	70 Inch Each for each operator
3	Workstations	As per BOQ

General Requirements and Specifications for Console System

The following specifications detail the minimum requirements of the Console System. Bidders must respond on the enclosed chart. This allows for a point-by-point technical response stating compliance, taking exception or providing requested information. Bids submitted without this chart will be considered non-responsive.

Vendor shall supply the following to obtain project level approval

a) Copy of ISO 9001:2008 Certification & ISO 14001:2004

b) Copy of Green guard certifications for full console.

c) Copy of FSC certification (Forest Stewardship Council) for Wood Components. Certificate for compliance towards sustainable forest initiative ensuring wood used is from sustainable forest harvesting.

The console(s) design shall be proven in service.

1) The consoles shall be of modular design, facilitating future equipment retrofits and full reconfigurations without major modification to structure or exterior elements.

2) The consoles shall have rigid independent frames.

3) Mechanical fasteners shall connect adjacent modules to maintain perfect alignment.

4) Depending upon the evolution of needs and technology, the construction shall provide easy and fast removal and installation of all equipment items.

5) The console frame shall have the sit stand actuator mechanisms incorporated into the structural frame and these actuator mechanisms will not be free standing on the floor.

6) The console frame shall have provisions for leveler legs to be incorporated into the frame. In addition, the frame will be pre-designed to install optional anti-vibration dampers (upon request) or anchoring brackets for applications where vibration is a factor or for applications located in seismic zones.

7) The console frame structure shall have fully integrated cable management. The base structure will have a minimum of 2 lateral raceways; the transition from the base to the work surface will have a minimum of 2 vertical raceways; and the work surface will have a lateral raceway location depending on the size of equipment being mounted in the console.

8) The cable raceways shall be continuous throughout the entire console layout thus allowing uninterrupted cable management.

9) The console design shall be acoustically acceptable and minimize noise reflection.

10) Consoles shall be properly finished to prevent glare and reflection.

11) No sharp edges shall be present that may lead to injury to the operators.

12) The color of the console shall be such that users can work for a long duration without eye strain or other stress.

13) The console finish shall be resistant to rubbing and liquids, impact-proof and easy to clean.

14) The surface of the work area shall be non-scratch able

15) The work surface should be smooth and level and take into consideration all accepted human factor criteria, including view, reach distances, keyboard height and knee well space. The work surface height shall be adjustable.

16) Full console sit to stand height adjustment shall be available via an electric actuator. The top section of the console raises both the upper viewable equipment and the work surface together.

17) Detailed CAD (PDF format) drawings of console and equipment layouts for coordination of site measurements, architectural, mechanical, and electrical project elements for each console type will be provided.

18) All Board Cladding (Laminates) must be 1MM & the Laminate supplier must be Green Guard Certified, Certificates of which must be provided on request

19) Renderings of consoles and room must be provided on request...

20) Pre-production review, to include a drawing submittal and component listing complete with samples of selected finish materials must be provided on request...

21) Samples of the following material components, which demonstrate workmanship, shall be provided upon request:

a. Work surface sample.

b. Sample panel construction and finish materials.

Modular Control Desk

Bidder should refer the control desk design for any clarification of items.

Structure

a) Console System must be of modular design. The Console design shall address the functional, ergonomic and aesthetic requirements of the particular working environment while complying with accepted human factor design and ergonomic standards for viewing distance, angle, keyboard height, and knee space requirements.

b) Standard top height of modular control desk shall be 750 mm in sitting position and have to go till 1100 mm for Standing Position. The Console Table Top / Working Surface should be made in 12mm mm Solid Acrylic Panel (ASS) Cladded on 25mm MDF Board. Drawing is enclosed.

c) Size of modular control desk shall be as per drawing and it should have arrangement for placing of 2 workstations monitor for 2 Users on each control desk.

d) The Basic Structure should consist of Extruded AL Profiles (6063T6 grade) binded by Top & Bottom (min 2mm) MS Frames formed in such a way as to provide maximum buckling and torsion resistance. The Front & Back Panels should be openable / removable (with Locks) made of laminated MDF Board in min thickness of 18mm. The front Shutter will be of Toughed Glass (min. 4mm Thick) cladded on 18 mm MDF and Back shutter in 18 mm MDF Boards with Fan for Heat decapitation.

e) The Side Panels should be fixed type, made in 26mm MDF Board Cladded on 18mm MDF Board. All panels must be attached to the frame with concealed fasteners. Console access panels (Front & Rear Panels) must be removable without the use of tools. The Front panel should be positioned in such a way that there should be sufficient leg space (min of 400mm from the front edge of the Table Top).

f) All sheet metal / aluminum parts must be finished with electrostatic powder coating with average of min 80 microns over all surfaces.

g) Console frame shall have provisions for leveler legs to be incorporated into the frame.

Work Surface

h) Console Table Top should be made of 12mm Solid Acrylic Panel (ASS) over 25mm MDF Board, with no sharp Edges. The work surface platform shall have smooth edges and transitions, thus avoiding sharp corners or potential rib catchers for operator safety.

Modular Rear Wall (Slat Wall)

i) Wall should be of min 86 mm (Height) and approx. 200-300 mm high from the Monitor Base.

j) Modular walls shall be made of 2mm thick Extruded Aluminum (6063T6 aluminum alloy).

k) It should have high Load bearing capacity. Minimum weight carrying capacity has to be 20 KGs per Meter.

Monitor Arms

l) It shall be capable for mounting all type of existing LCD monitor with dimensions between 17" to 27" using suitable adopter/additional base plate, if required any.

m) Vendor shall provide the suitable adopter/additional base plate for mounting the existing LCD monitors.

n) It shall allow the rotate/ tilt/ raise/the monitors as well as fix their adjustment.

o) The monitor arm should be Articulating monitor arm

Miscellaneous

p) There shall be a closed cabinet (02 no in one Modular Control Desk) below the modular control desk for placing of CPU. Cabinet should have proper cooling system. CPU needs to be accessible from front as well as rear side of control desk for easy working and maintenance.

q) The cabinet shutters shall be of Butt Hinged type with 18mm thick MDF.

r) Rear shutters of each console should have provision of Airflow opening for cooling and heat dissipation effect.

s) Rear panel shall have ventilation fans mounted on it.

t) It shall have proper arrangement for flow of cables i.e. LAN Cable, Power cable, VGA cable, Mouse cable, Keyboard etc.

u) Design of control desk shall allow cables from the floor cable channel.

v) Control desk shall be equipped with individual power distribution unit (PDU) (06 no for one Modular Control Desk) and capable of being switched on/off individually. Power supply socket should be dual type i.e. Universal type.

w) All bolts must be of SS material to avoid rust due to environment.

Prospective View of Control Room

PROSPECTIVE VIEW OF CONTROL DESK

HIGH BACK CHAIR

CHAIR:

Structure: High back chair

Mechanism: Recline-Glide Motion MB Mechanism

Armrest: Adjustable Armrest

Base: Grey Epoxy Aluminium Base (VG)

Base: V Base for Mesh Series

BIFMA & GREEN GUARD certified

Seat Back Adjustment, Height Adjustment, and Button less chair

5.2.13 IP CCTV camera for Control Room

NO.	Camera Characteristics	Specification
1	Requirement Overview	IP Camera should be a high-definition, full-functioned video endpoint with industry-leading image quality and processing power. The camera is capable of resolutions up to 1920 x 1080 at 30 frames per second (fps) while optimizing network usage with either H.264 or MJPEG compression.
2	Sensor Type	1/3" progressive-scan CMOS with Vandal-Resistant Dome
3	Max Resolution	1920 x 1080 @ 30 FPS
4	Dynamic Range	100 dB
5	Lens/Iris	3-10 mm p-Iris , Remote focus and zoom
6	Minimum illumination	● Color mode: 0.16 lux ● Black-and-white mode: 0 lux with illuminator active
7	Remote Autofocus	Yes

NO.	Camera Characteristics	Specification
8	Field of View	33° to 104° (horizontal) 19° to 56° (vertical) 39° to 121° (diagonal)
9	Camera Adjustment	Pan: 350° Tilt: 80° Rotate: 350°
10	Privacy regions	Camera supports up to four user-defined privacy regions. Any video within a privacy region is masked in the video stream.
11	Audio I/O	Audio in x 1
12	Digital I/O	DI x 1, DO x 1
13	Number of streams	● Single-stream H.264 up to 1920 x 1080 at 30 frames per second (fps) ● Single-stream MJPEG up to 1920 x 1080 at 30 fps ● Dual-stream H.264 and MJPEG: ◦ Primary stream programmable up to 1920 x 1080 at 30 fps ◦ Secondary stream programmable up to 1024 x 576 at 15 fps
14	Day/Night	Automatic, manual, scheduled
15	Local Storage	MicroSD
16	Video Compression	H.264 & Motion JPEG
17	ONVIF	ONVIF
18	External Power	12V DC /24 VAC
19	Environmental Certification	IK10 and IP67-rated enclosure for outdoor mounting.
20	Power Consumption	Max 16 Watts at PoE
21	Operating Temperature	-20 to 50°C (-4 to 122°F) using PoE

NO.	Camera Characteristics	Specification
22	Protocols	Dynamic Host Control Protocol (DHCP), Hypertext Transfer Protocol (HTTP), Secure HTTP (HTTPS), Network Time Protocol (NTP), Real-Time Transport Protocol (RTP), Real-Time Streaming Protocol (RTSP), Simple Mail Transfer Protocol (SMTP), Secure Sockets Layer/Transport Layer Security (SSL/TLS), Transmission Control Protocol/Internet Protocol (TCP/IP), Secure Real-Time Transport Protocol (SRTP), Discovery Protocol, Bonjour, Simple Network Management Protocol (SNMP), and Secure Shell (SSH)
23	Camera Tamper	The camera should support tamper feature when any of the following events occur and persist for a designated period: • The IP camera view is changed • The IP camera view is blocked • The IP camera view is substantially out of focus
24	Quality of service (QoS)	Differentiated services code point (DSCP) marking and class of service (CoS) marking
25	Certifications Safety	UL60950-1 second edition CSA22.2-No.60950-1 IEC/EN60950-1 second edition IEC/EN60825
26	Certifications EMC-Requirements	CISPR22 Class B ICES-003 EN50121-4 EN50155 EN50130-4 EN55022 EN55024 EN61000-3-2/-3-3 Class A VCCI Class B KN22 Class B KN24

5.2.14 Integrated building management system

No.	RFP specifications
A	**Solution for iBMS:** Solution should provide a pre-integrated, centralized and consolidated platform for end to end management of a building, which includes Facility infrastructure (HVACs, LT Panel- AMF, DG, UPS, Fuel Tank, CCTV, Fire Alarm and suppression system). The system should have the service dependency engine that allows to take intelligent decisions, as per the business needs/requirements. The tool should have the service oriented architecture layer and the mediation layer in a single plane. iBMS should be open for third party integration via (soap, xml, web service, snmp-v1,v2,v3). NO/NC ports (IO ports) and Modbus (TCP/IP&RTU) integration should be standard. For other industrial protocols, gateway integration should be available. The solution should perform the following general functions. But should be scalable with ready device certifications to accommodate new infrastructure getting added to the building
1	**Visibility –** It should get a single platform to manage the entire building and its components. The way ahead should be drilling down to the component, which is under performing / about to fail or has failed. The impact of the failed equipment on others should get highlighted. We should get a Hawkeye view to know, how are all the building components working at any point of time. So that issues are addressed as quickly as possible.
2	**Capacity Planning -** End equipment's in the building, should be set with thresholds to get an idea of how well they are rendering services to the people in the building. It should be able to proactively Identify potential area's which may need to be upgraded/downgraded (cooling, power, storage, etc.) with time. All vendor (end equipment vendors) SLA's and their respective maintenance contracts would be part of the OMS (operations and maintenance) plan.
3	**Third Party Integration -** Seamless Data Sharing to build a "Collaborative Decision making System".
4	**Salient Dependencies -** Monitor & Control salient interdependencies between safety and security systems like: In case of fire, other than a fire alarm, we could get confirmatory information from the zonal camera. Multiple current surges in any particular zone should lead to an inspection of the electrical cables in the zone. Any

No.	RFP specifications
	sectional power failure, should help us to find the failure of the end equipment, by tracing down the LT panel SLD to the end equipment.
5	**System with CMDB -** Integrate people, process & technology. Decreasing the likelihood of downtime in the building by facilitating communication across all equipment's (part of the facility). A definite inventory management tool with a workflow system connecting responsible people, should be part of the solution.
6	**Root-Cause Analysis -** Isolate and pinpoint problem area before it impacts the building operations & business continuity while suppressing down the unwanted events.
7	Energy sources should always keep in check on the rated power consumption vs the power available for consumption. Since one of the big reasons for fire is higher load than the power distribution capability.
8	The system should be capable enough to store the raw data or as polled data, for at-least for 365 days. It should also have the facility to automate the backup process or allow to take manual backup, in case if it is required.
9	The system should be capable of getting supported by the administrators at different levels. The system should provide individual and group rights and privileges. Normal users may have read access only, that too only to specific areas.
10	Support for email and SMS both (integration with SMS-gateway and GSM communication).
B	**Energy Management**
1	The system should be capable of integrating with the mains (LT panel), DG, UPS, PDU, rectifier, energy meters for continuous monitoring of its health. The battery health of the UPS would also be needed.
2	System should be able to do continuously monitor the quality of power, supplied to the electricity board and by the Generators (PF, frequency, harmonics distortion etc.), in order to avoid downtime.

No.	RFP specifications
3	System should have the feature to setup thresholds on each of the monitored energy parameter.
4	System should be able to clearly provide load trend for each rack, if need be in the building which would enable setup practical thresholds to get alerted on overload situations, in order to avoid any breakdown.
C	**Fire Alarm System Monitoring and Management**
1	Should proactively alert in case there is a possibility of a electrical fire (short circuit or over current)
2	The system should have the capability to integrate with different makes of fire alarm systems in the DCs and provide the alarms generated by the system on the centralized Dashboard.
3	The system should be able to plan and process a proper evacuation plan in case of fire
4	Trigger Audio and Visual alarm
5	Co-relate with the nearest camera in the site with the zone of the FAS.
6	Switching ON of lights on the evacuation pathway.
D	**Centralized Reporting & Dashboard**
1	The dash board and reporting engine should provide centralized view for the entire infrastructure (physical security, safety & energy) in the building.
2	It should provide business users with highly interactive and power-users with highly sophisticated, pixel-perfect reports.
3	It should provide Web-based interactive reporting for business users, Rich graphical report designer for power users, Parameterized reports with powerful charting, Output in popular formats: HTML, CSV, PDF.
4	It should provide Analysis to explore data by multiple dimensions such as customer, product, network and time into the hands of business users.

No.	RFP specifications
5	It should provide Intuitive & rich graphic designer to create customized reports, such as: DC-PUE (enables to measure how much energy is getting consumed in IT and how much in DC infrastructure).
6	Solution should provide a comprehensive centralized dashboard for health monitoring of DC (Infrastructure) components like: Electrical Panels, PAC, UPS, DG, Fuel etc.)
E	**DG Monitoring**
1	Proposed system should be able to integrate with diesel generators for measuring fuel level and run hours of the DG. System should also allow monitoring of various alarms (like: LLOP, dg on, etc.) including quality of power of the DG.
2	System should be capable to do fuel level monitoring of the diesel tanks installed for the gen-sets in the DC' building, in order to have a proactive estimation of fuel availability.
3	Parameters - Generator and Fuel supply Automation • Mains Fail • DG On • DG Failed to start • DG Failed to stop • DG Fuel Level Low • High Water Temperature • High Coolant Temperature • Low Battery Voltage • Low Lube Oil Pressure(LLOP) • Automate Fuel Supply Process to reduce fuel consumption cost.

5.2.15 UPS

No.	Parameter	Minimum Specifications
1.	Capacity	Adequate capacity to cover all above IT Components at respective location
2.	Output Wave	Pure Sine wave
3.	Input Power Factor at Full	>0.90
4.	Input	Three Phase 3 Wire for over 5 KVA
5.	Input Voltage	305-475VAC at Full Load
6.	Input	50Hz +/- 3 Hz
7.	Output Voltage	400V AC, Three Phase for over 5 KVA UPS
8.	Output	50Hz+/- 0.5% (Free running); +/- 3% (Sync. Mode)
9.	Inverter	>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
12.	Battery	As per BOQ
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	0 to 40 degrees centigrade

5.3 One Belagavi App / One Belagavi Web Site.

5.3.1 Overview

All smart city components will have a mobile/browser facing interface. This will have a consolidated view which will be provided to public. This application should be able to provide all KPI's as applicable to public.

The Citizen app is a one-stop solution for citizens that bring citizen relevant, real time & interactive city information to help plan their day, and in turn crowd sources inputs from citizens to enhance the services to suit the citizens needs better.

5.3.2 Scope

Citizens can use Citizen App to view real-time data on their mobile phones / tablets for a variety of details. Some of them include below information and may not be limited to this:

- This App will have all the functionalities of the Smart Map being developed on ARC GIS platform for the City. This can be achieved by way of taking API from the said application

- Complaint registration & status tracking (Integration with Janahitha of MRC through APIs)

- Utility Bill payments (integration with Belagavi one)

- Special government messages to citizens, tourists on notification basis.

- Special services for citizens such as information on Voter ID and Aadhar cards.

- Live information of the city transport buses.

- Allows users to report Panic or danger which will be reported to the government and police officials for immediate help.

- Citizens / Tourists will also be provided with Current Weather information and Weather history on a date range and future weather information based on reliable weather sources.

- Smart Parking for the Customers which will have

    - Viewing real-time parking availability, visually displayed on mobile devices.

    - Provides turn-by-turn directions all the way to the parking space.

    - The app also allows making payment for the Parking space that is being utilized.

5.3.3 Functional Specifications

1) Application should have an appropriate administration interface to load information and track usage

2) Application should have analytics installed to check the usage and functionality accessed

3) Application should have notifications facility

4) Application should be able to conduct poll as and when required.

5) Application should be built in such a way that future integrations and enhancements can be done easily.

5.3.4 Technical Specifications

1) Mobile application be developed in Android and IOS (native based)

2) Browser based application should be developed in general platforms as chosen by SI – it could be in java /. net

3) The application should have integration layer and should be able to pull information necessary from system

5.4 Data Centre and DR

5.4.1 Overview

- SI will use the state data center located in Bangalore for co-locating the DC for ICT Components. However, the system SLA as defined in the tender to be met solely by the SI.
- The SI consider the cost of co-locating the DC in his tender as a part of Capex and Opex cost, considering the requirement of Rack space, seating space for the technical/Project team and the electricity charges on yearly basis.
- DR to start with shall be based on cloud solutions

5.4.2 Scope & Functional Specifications

1. SI is required to co-locate all the hardware/software and related items as per the design offered for the smart city infrastructure including SLA monitoring and Help desk management, in a Tier III or above data Center complying with standard guidelines as per Telecommunications Infrastructure UPTIME/TIA-942.

2. The Data center shall be available for 24x7x365 operation.

3. The smart city infrastructure shall have built in redundancy and high availability in compute and storage to ensure that there is no single point of failure.

5.4.3 Technical Specifications

5.4.3.1 DC Core/Aggregation Router

Minimum Requirement Specification
Chassis should have a minimum 6 x 1G SFP or more ports populated with Multi-mode transceivers from day 1. It should also support 10G interface on the same chassis without additional hardware.
The Fixed Router shall have integrated route processor, embedded services processor, and Interface modules and adaptors for future scale. Router should support a dedicated Processor for forwarding and encryption functions, independent of the Route Processor. Route Processors should have minimum 1GB of internal memory to support multiple software images for backup purposes and future scalability
The router should have processor bandwidth scalable up to 20 Gbps
All modules, fan trays & Power supplies should be hot swappable and must support online insertion and removal. Shall have the support for redundant power supplies.
The router must be able to provide accessibility even if the core operating system is down.
Network Protocol: Should support RIPv2, OSPF, IS-IS and BGP4 routing protocols, with support for all the features like OSPF on demand etc. & IP multicast routing protocols: PIM Version 2 (Sparse Mode & Dense Mode), IGMP v1, v2,v3 Should have support for protocols like Multiprotocol Label Switching (MPLS) & Virtual Route Forwarding (VRF)
High Availability: Shall support dual IOS Software redundancy. Should have modular software images, so that each software process runs independent of the other thus allowing for higher stability. Should also support online upgrade of patches for specific processes without affecting traffic forwarding operations on the router.
Router Security: The chassis shall optionally support MD5 authentication for routing protocols. The chassis shall function as a full fledge firewall & VPN concentrator upon activation of licenses.

Minimum Requirement Specification
The router should optionally support IPsec encryption for data confidentiality. The router should optionally support 3DES and AES encryption standards with the activation of Security license.
Quality of Service: The router should be able to support IP precedence and able to configure six classes of service. Should be able to do accounting based on IP precedence. The router should support congestion management techniques like RED and Weighted Random Early Detection. The router should support wide variety of queuing technologies like Weighted faire queuing, Low Latency Queueing etc.
Management Features: The router should support in-band and out of band management. The router should be able to support multiple Operating System images for smoother up gradation. Should support fine-grained data collection including detail traffic statistics by protocol and IP address. The Services Processor should additionally support the following functions in hardware & should be enabled using appropriate software license's only if required, without the need for additional hardware Firewalls & intrusion prevention with flexible pattern matching for deep-packet inspection. Network Based Application Recognition Network Address Translation Interfaces Support Should support the following LAN interfaces: Fast Ethernet and Gigabit Ethernet, 10Gigabit Ethernet with ports in compliance with 802.3 standards. Shall be capable of supporting 802.1q VLANs and VLAN trunking. Shall support port aggregation for higher bandwidth and redundancy. The Gigabit Ethernet port should support multimode and single mode fiber connectivity

Minimum Requirement Specification
Adapters holding interface modules should be optimized for high performance having a minimum of 1GB dedicated memory per interface module; for support of large routing tables, rich Quality of Service features, and increased scalability.

5.4.3.2 Firewall with IPS

Parameter	Minimum Requirement Specification
Architecture	• The appliance based security platform should be capable of providing firewall, IPS, Application control and VPN (both IPsec and SSL) functionality in a single appliance. • Redundant hot swappable power modules
Operational Metrics	• Should support minimum 1500 Mbps of production performance / multiprotocol firewall throughput. • Should support at least 350 Mbps of NGFW (FW, IPS and Application combined) throughput. • Support 3Des/AES IPSec VPN throughput of minimum 400 Mbps
Hardware & Interface	• The appliance should support minimum 8 * 10/100/1000 Gigabit ports from Day one and free slot for future expansion
Security	• Support static Source NAT,NAT 64, NAT 46 • Support source/destination NAT with PAT, • Support for Site to Site IPSEC and Remote Access with 100 user license • Policy based routing • Equal cost forwarding • Ipv4 and IPv6 routing support
Application Visibility	• The solution should have the capability of passively gathering information about virtual machine traffic, network hosts and their activities, such as operating system, services, open ports, client applications, and vulnerabilities, to assist with multiple activities, such

Parameter	Minimum Requirement Specification
	as intrusion event data correlation, elimination of false positives, and policy compliance. • The solution must be capable of passively gathering information about session flows for all monitored hosts, including start/end time, ports, and services. • The solution must provide a detailed, interactive graphical summary that includes data on applications, application statistics, connections, intrusions events, hosts, servers, users, file-types, malwares and relevant URLs. These data should be presented in the form of vivid line, bar, pie and donut graphs accompanied by detailed lists (Administrator should easily create and apply custom filters to fine-tune the analysis). • Should support more than 3000 application layer and risk-based controls that can invoke tailored intrusion prevention system (IPS) threat detection policies to optimize security effectiveness
Next Generation IPS	• The solution must support creation of user-defined application protocol detectors. • The solution should support content awareness with comprehensive file detection policies and blocking of files by types, protocols and directions. • The detection engine should have capability of detecting and preventing a wide variety of threats (e.g., malware, network probes/reconnaissance, VoIP attacks, buffer overflows, P2P attacks, zero-day attacks etc.) • The detection engine should have the capability of detecting variants of known threats, as well as new threats (i.e., so-called "unknown threats"). • Solution must be capable of detecting and blocking IPv6 attacks. • Solution must be capable of dynamically tuning IDS/IPS sensors with minimal human intervention
Deployment Architecture	• Active/Active or Active/Passive • Device failure detection

Parameter	Minimum Requirement Specification
Manageability	• Console, Telnet and Browser based Configuration, SNMP v1, v2 & v3 • Ability to deploy a Firewall management server for centralized management of firewall policies

5.4.3.3 Core Switch

Parameter	Minimum Requirement Specification
Architecture	• The Switch should support non-blocking Layer 2 switching and Layer 3 routing • There switch should not have any single point of failure like CPU, switching fabric, support module, power supplies and fans etc should have 1:1/N+1 level of redundancy. • Switch support on line hot insertion and removal of different parts like modules/power supplies/fan tray should not require switch reboot and disrupt the functionality of the system • Switch should support the complete STACK of IP V4 and IP V6 services • Switch and different modules used should function in line rate and should not have any port with oversubscription ratio applied
Performance Requirement	• Switch should support 12,000 IPv4/IPv6 routes entries in routing table and should support at least 20,000 multicast routes • Switch should support Graceful Restart for OSPF, BGP etc. • Switch should support minimum 500 VRF instances • The switch should support Hardware based Multi-Terabit/s L3 and L4 load-balancing at wire-speed. It should support weighted load balancing, L4 Port Load balancing as well as DNS based probe etc • Switch should support up to 2.4 TBps of switching capacity including the services: a. Switching b. IP Routing (Static/Dynamic) c. IP Forwarding d. Policy Based Routing

Parameter	Minimum Requirement Specification
	e. QoS f. ACL and Other IP Services g. IP V.6 host and IP V.6 routing
Advance Features	• Switch should support Network Virtualisation using Virtual Over Lay Network using VXLAN (RFC 7348) and NVGRE as per RFC 2890 • Switch should support VXLAN (RFC7348) and EVPN as draft-ietf-l2vpn-evpn-04 for supporting Spine - Leaf architecture to optimise the east - west traffic flow inside the data centre • Switch should support container to run customise application agent like Puppet, Chef, Ansible, Salt etc. • Switch should support Python, NetConf, XML, Bash etc.
Layer2 Features	• Spanning Tree Protocol (IEEE 8201.D, 802.1W, 802.1S • Switch should support VLAN Trunking (802.1q) and should support 4096 VLAN • Switch should support basic Multicast IGMP v1, v2, v3 • Switch should support Industry Standard Port/Link Aggregation for All Ports across any module or any port. • Switch should support Jumbo Frames up to 9K Bytes on 1G/10G Ports • Support for broadcast, multicast and unknown unicast storm control to prevent degradation of switch performance from storm due to network attacks and vulnerabilities • Switch should support Link Layer Discovery Protocol as per IEEE 802.1AB for finding media level failures
Layer3 Features	• Switch should support all physical ports to use either in Layer2 or Layer 3 mode and also should support layer 3 VLAN Interface and Loopback port Interface • Switch should support static and dynamic routing using: a. Static routing b. OSPF V.2 using MD5 Authentication c. ISIS using MD5 Authentication d. BGP V.4 using MD5 Authentication e. Should support route redistribution between these protocols

Parameter	Minimum Requirement Specification
	• Switch should recon verge all dynamic routing protocol at the time of routing update changes i.e. Non-Stop forwarding for fast re-convergence of routing protocols • Switch should connecting multiple MPLS service provider using multi instance routing using VRF, VRF Edge routing and should support VRF Route leaking functionality • Switch should be capable to work as DHCP server and relay • Switch should provide multicast traffic reachable using: a. PIM-SM b. PIM-SSM c. IGMP V.1, V.2 and V.3 • Switch should support Multicast routing of minimum 16 way Equal Cost Multi Path load splitting
Quality of Service	• Switch system should support 802.1P classification and marking of packet using: a. CoS (Class of Service) b. DSCP (Differentiated Services Code Point) • Switch should support for different type of QoS features for ream time traffic differential treatment using a. Class- Based Weighted Random Early Detection b. Strict Priority Queuing • Switch should support to trust the QoS marking/priority settings of the end points as per the defined policy • Switch should support Flow control of Ethernet ports to control traffic rates during congestion by allowing congested nodes to pause link operation at the other end for receiving traffic as per IEEE 802.3x
Security	• Switch should support for deploying different security for each logical and physical interface using Port Based access control lists of Layer-2 to Layer-4 in IP V.4 and IP V.6 and logging for fault finding and audit trail • Switch should support control plane i.e. processor and memory Protection from unnecessary or DoS traffic by control plane protection policy

Parameter	Minimum Requirement Specification
	• Switch should support for stringent security policies based on time of day of Layer-2 to Layer-4 • Switch should support for external database for AAA using: • TACACS and RADIUS • Switch should support DHCP Snooping, Dynamic Arp Inspection, IP Source Guard. • Switch should support for Role Based access control (RBAC) for restricting host level network access as per policy defined
Manageability	• Switch should support for embedded RMON/RMON-II for central NMS management and monitoring • Switch should support for sending logs to multiple centralised syslog server for monitoring and audit trail • Switch should provide remote logging for administration using: Telnet and SSH • Switch should support for management and monitoring status using different type of Industry standard NMS using: • SNMP v1,v2 and v3 • Switch should support Real time Packet Capture using Wire shark in real time for traffic analysis and fault finding • Switch should support central time server synchronisation using Network Time Protocol NTP V.4 • Switch should support for providing granular MIB support for different statistics of the physical and logical interfaces • Switch should support for predefined and customised execution of script for device mange for automatic and scheduled system status update for monitoring and management • Switch should provide different privilege for login in to the system for monitoring and management
IPv6 features	• Switch should support for IP V.6 connectivity and routing required for network reachability using different routing protocols such as: a. OSPF V.3 b. BGP with IP V.6

Parameter	Minimum Requirement Specification
	c. IP V.6 Policy based routing d. IP V.6 Dual Stack etc • Switch should support multicast routing in IP V.6 network using PIMv2 Sparse Mode • Switch should support monitoring and management using different versions of SNMP in IP V.6 environment such as: • a. SNMPv1, SNMPv2c, SNMPv3 • b. SNMP over IP V.6 with encryption support for SNMP Version 3.

5.4.3.4 Access/L2 Switch

Parameter	Minimum Requirement Specification
Architecture	• The switch should support a minimum of 48 nos. 10/100/1000 Ethernet Ports • The switch should support a minimum of 2*10G SFP+ Uplinks • The switch should support 10G SFP+ modules which are compatible with 1G SFP transceivers
Performance and Scalability	• The switch should support Forwarding bandwidth of 108 Gbps • The switch should support Full-duplex Switching bandwidth of 216 Gbps • The switch should support 64-Byte Packet Forwarding Rate of 130 Mbps • The switch should support multi Core CPU • The switch should support minimum 128 MB of Flash memory • The switch should support minimum of 512 MB of DRAM • The switch should support 1000 Active VLANs • The switch should support 4000 VLAN IDs • The switch should support Jumbo frames of 9216 bytes • The switch should support up to 16000 Unicast MAC addresses
Stacking	• The switch should support Stacking

	• Stacking should enable all switches to function as a single virtual switch • The switch should support dedicated Stacking Port • Stacking module should be Hot-swappable • Stacking should support a minimum of 5 Switches • Stacking should support 80 Gbps of bi-directional throughput • Stacking should support single IP address management for the group of switches • The switch should be stackable with older switch models that use similar stacking technology
PoE & PoE+	• The switch should support PoE (IEEE 802.3af) and 802.3at • The switch should support flexible power allocation across all ports • The switch should have 370W of Available PoE Power • The switch should support 24 ports up to 15.4W • The switch should support user configurable maximum PoE power per port • The switch should support reporting of actual PoE drawn per port
Power Supply	• The switch should support an auto-ranging power supply with input voltages between 100 and 240V AC

5.4.3.5 SAN Switch

Parameter	Minimum Requirement Specification
Architecture	• 19" Rack mountable • Power supply for 230 V AC 50 Hz with Redundant power supply • Redundant and hot swappable
Interface	• 24 FC Ports enabled with license (in single chassis) with 16 GB Speed in Each Ports and scalable to 48 ports • 16 Gbps Full Duplex for each FC port • Support for 16 Gbps HBA

Software	• Fabric Management software
Functional Features	• Fibre channel protocol support (FC protocol) • Supports leading SAN and NAS disk arrays • Capability to interface with HBA from multiple OEM's and OS • Non-disruptive firmware update • Hardware based Inter Switch linking ISL for higher bandwidth throughputs • Adaptive networking QoS • Dynamic Load Balancing
Security	• Hardware and Software Zoning • Centralized fabric management • POST and online diagnostics • Encryption and FC authentication • RADIUS, SSH, SNMP • Port binding and masking
Diagnostics	• Online Diagnostics • Internal Loopbacks • SPAN • FC Debug • Syslog • Online system health • Power on self-test (POST) diagnostics
Management Software	• Fabric View with Topology mapping • Network diagnostics and alerts • Web based GUI for management

5.4.3.6 Tape Library

Parameter	Minimum Requirement Specification
Technology	• LTO 6
Number Drives	• Two LTO 6 Drives
Media Slots	• Minimum 45
Interface	• Minimum 8 Gbps FC Interface
Power Supplies	• Redundant Hot Swap Power supply
Fans	• Redundant Hot Swap cooling fans
Software	• Security and Remote Management Software
Accessories	• With all required cables and accessories to install and configure in standard • 19" rack and to connect to Server/SAN switch

5.4.3.7 Back Up S/W

- The proposed backup solution shall have same GUI across heterogeneous platform to ensure easy administration and available on various OS platforms such as Windows, Linux and UNIX platforms and be capable of supporting backup/ restores from various supported platforms.

- Backup Solution should have ability to backup data from one server platform and restore it to another server platform to eliminate dependence on a particular machine and for disaster recovery purposes.

- Backup Solution should support various level of backups including full, incremental, and user driven backup along with various retention period.

- Backup clients should be updated automatically using the client push feature

- Backup should support agentless backup for virtualization platform with non-staged granular recovery.

- Backup Software should support intelligent policy for virtualization.

- Backup Software must provide Source (Client & Media Server) & Target base data Deduplication capabilities.

- Backup Solution should Integrate with third party VTL, NAS, SAN which has data deduplication capabilities and Robotic/automated Tape library

- Backup Solution must have Wizard-driven configuration and modifications for backup, restoration and devices.

- The proposed backup solution shall have in-built frequency and calendar based scheduling system.

- Backup Solution must have Optimized way for data movement from client to disk target.

- Backup Solution should support (inflight & at rest) encryption.

- The proposed backup solution shall support tape mirroring of the same job running concurrently with primary backup.

- The proposed backup solution shall allow creating tape clone facility after the backup process.

- Backup Solution should have Capability to do trend analysis for capacity planning of backup environment.

- The proposed Backup Solution must offer capacity-based licensing. The license should be for the front-end capacity rather than back-end. There should be no incremental cost associated with longer retention periods.

- The solution should not require purchase of additional licenses for DR sites (copies of original data), also should not require purchase of additional licenses for replication to DR sites.

- The proposed backup deduce license should be independent of hardware so replacing hardware should not incur new software license cost.

- The proposed backup solution must include Agent/Modules for online backup of files, applications and databases such as MS SQL, Oracle, DB2, Sybase, Exchange, SharePoint and File share backup(SMB)

- The proposed backup solution should provide recovery from physical servers to Virtual and image level recovery.

- The proposed backup solution should have Cloud plug-ins for backup data replication.

- Backup Solution should have Inbuilt feature for extensive alerting and reporting with pre-configured and customizable formats.

- Backup Replication at DR site, Cloud. Replication license should be included as part of solutions.

- Backup software should support multiplexing and multi streaming and shall support the capability to write up to Min 32 data streams.

- Backup Solutions should have capabilities to tape/disk out backup catalogue and deduplication catalogue.
- Backup solution should have integrated data de-duplication engine with multi-vendor storage support to save de-duplication data. The de-duplication engine should also facilitate IP base replication of de-dupe data; without any extra charge.

5.4.3.8 Virtualization Software

Solution	Sits directly on the server hardware with no dependence on a general-purpose OS for greater reliability and security.
Guest OS Support	Windows client, Windows Server, Linux (at least Red Hat, SUSE, Ubuntu and CentOS, Solaris x86) etc.
VM Capability	Create Virtual machines with up to 128 virtual processors, 6 TB virtual RAM and 2GB Video memory in virtual machines for all the guest operating system supported by the hypervisor.
VM Live Migration	Live Virtual Machine migration between different generations of CPUs in the same cluster and without the need for shared storage option and between servers in a cluster, across clusters as well as long distances from one site to another (up to 150 milliseconds round trip time) with no disruption to users or loss of services, eliminating the need to schedule application downtime or business downtime.
Storage Live Migration	Live migration of VM disk from one storage array to another without any VM downtime. Support this migration from one storage protocol to another eg: FC, NFS, iSCSI, DAS.
High Availability	Proactive High availability capability that utilizes server health information and migrates VMs from degraded hosts before problem occurs.
Always Available	Zero downtime, zero data loss and continuous availability for the applications running in virtual machines in the event of physical host failure, without the cost and complexity of traditional hardware or software clustering solutions.

Resource Addition	Add CPU, Memory & devices to virtual machines on the fly when needed, without disruption or downtime of working VMs for both windows and Linux based VMs.
Resource Scheduler	Dynamically allocate and balance computing capacity across collections of hardware resources aggregated into one unified resource pool with optional control over movement of virtual machines like restricting VMs to run on selected physical hosts. Create a cluster out of multiple storage data stores and automate load balancing by using storage characteristics to determine the best place for a virtual machine's data to reside, both when it is created and when it is used over time.
Security	VM-level encryption with no modifications in guest OS to protects unauthorized data access both at-rest and in-motion and also provides secure boot for protection for both the hypervisor and guest operating system by ensuring images have not been tampered with and preventing loading of unauthorized components. Integration of 3rd party endpoint security to secure the virtual machines with offloaded Firewall and HIPS solutions without the need for agents inside the virtual machines from day 1.
Storage support	Support boot from iSCSI, FCoE, and Fibre Channel SAN. Integrate with NAS, FC, FCoE and iSCSI SAN and infrastructure from leading vendors leveraging high performance shared storage to centralize virtual machine file storage for greater manageability, flexibility and availability. Virtual Volumes which enables abstraction for external storage (SAN and NAS) devices making them Virtualization aware. Integration with Storage API's providing integration with supported third-party data protection, multi-pathing and disk array solutions.
Virtual Switch	Span across a virtual datacentre and multiple hosts should be able to connect to it. This will simplify and enhance virtual-machine networking in virtualized environments and enables those environments to use third-party distributed virtual switches.

| | In-built enhanced host-level packet capture tool which will provide functionalities like SPAN, RSPAN, ERSPAN and will capture traffic at uplink, virtual switch port and virtual NIC level. It should also be able to capture dropped packets and trace the path of a packet with time stamp details.

"Latency Sensitivity" setting in a VM that can be tuned to help reduce virtual machine latency.

Link aggregation feature in the virtual switch which will provide choice in hashing algorithms on which link aggregation in decided and this should also provide multiple link aggregation groups to be provided in a single host. |
|---|---|
| VM based Replication | Efficient array-agnostic replication of virtual machine data over the LAN or WAN. This Replication should simplify management enabling replication at the virtual machine level and enabling RPOs as low as 15 minutes. |
| VM Backup | Simple and cost effective backup and recovery for virtual machines which should allow admins to back up virtual machine data to disk without the need of agents and this backup solution should have built-in variable length de-duplication capability. |
| I/O Control | Prioritize storage access by continuously monitoring I/O load of storage volume and dynamically allocate available I/O resources to virtual machines according to needs.

Prioritize network access by continuously monitoring I/O load over network and dynamically allocate available I/O resources to virtual machines according to needs. |
| OEM Support | Direct OEM 24x7x365 days with unlimited incident support and 30mins or less response time including the unlimited upgrades and updates. |

5.4.3.9 Internet Router

- The router should support IP routing, IP multicast, QoS, IP mobility, multiprotocol label switching (MPLS), VPNs and redundant power supply.
- The router should support a minimum bandwidth of 1Gbps and scale up to 2Gbps with license upgrade

- Routers should have at least 1 or more free slots for LAN or WAN modules after populating all interfaces. Router should have minimum 4 GB of DRAM/RAM & should support increasing of flash/compact flash size to hold multiple image, data etc.

- Router should have minimum 4 or more 1GE SFP ports populated with 1G single mode SFP and should be scalable to additional Ethernet options. Router should have support for E1, Chn E1, Serial V.35, G.703.

- The router should have a minimum performance of 2 Gbps or more

- The router shall support adaptive routing adjustments by doing routing path selection based upon advanced criteria like Response time, packet loss, delay, jitter and traffic load to intelligently control the traffic to maximize the quality of the user experience.

- Routers should support marking, policing and shaping

- IPv4 and IPv6 enabled from day one

- HSRP/VRRP, Static Routes, RIPv1, RIPv2, RIPng, OSPFv2, OSPFv3, BGP4, MBGP, BGp route reflector, BFD, Policy based routing IGMP V1/V2/V3, PIM-DM, PIM-SM enabled from day one

- Should support extensive support for SLA monitoring for metrics like delay, latency, jitter, packet loss

- Support for accounting of traffic flows for Network planning and Security purposes

- Routers should support SNMPv2 and SNMPv3

- Routers should support Software upgrades

- Extensive debugs on all protocols

- Shall support Secure Shell for secure connectivity

- Should have to support Out of band management through Console and an external modem for remote management

- Pre-planned scheduled Reboot Facility

- Real Time Performance Monitor – service-level agreement verification probes/alerts

- The Router should be NDPP or EAL3 certified at the time of bidding.

- The router should be certified for IPv6 Ready Logo Program Approved List.

- All necessary SFP's, interfaces, connectors, patch cords (if any) & licenses must be delivered along with the Router from day one.

- The Router should be 19" Rack mountable & should be supplied with Indian standard AC (5Amp) power cord.

5.4.3.10 Blade Servers

Parameter	Minimum Specifications
Processor	Latest series/ generation of 64 bit x86 processors E5- 2640V4 -with Ten or higher Cores. Processor speed should be minimum 2.4 GHz. 2 processors per each physical server.
RAM	Minimum 128 GB Memory per physical server
Internal Storage	2x1.2TB 12G SAS (10k rpm) hot swap disks
Network interface	Server should be configured with dual converged adaptor ports supporting Ethernet and FC. Minimum of 2 PCI expansions/Mezzanine expansions
RAID support	Hardware Raid Controller to supports Hardware Raid RAID 0, 1
Operating System	As per requirement/solution licensed version of 64-bit latest version of Linux/Microsoft Windows based Operating system)
Form Factor	Blade
Virtualization	Shall support Industry standard virtualization hypervisor like Hyper-V, VMWARE.

5.4.3.11 Blade Chassis Specifications

The blade chassis shall have the following minimum technical specifications:

1) Min 6U Rack mounted Chassis to house at least 8 Nos of 2 Socket Servers

2) Min 4 No. of interconnect bays or higher, capable of supporting Ethernet, FC or 2 Nos of Interconnect Bays / converged FCOE modules in case bidder is providing FCOE based converged solution.

3) Chassis should have a highly reliable mid plane for providing connectivity of the shared resources to the compute nodes in a highly reliable manner.

4) Have the capability for installing industry standard flavors of Microsoft Windows, and Enterprise Red Hat Linux Oss as well as virtualization solution such as VMware

5) 2 x Network switches with minimum 10 number of 10Gbps uplink ports per switch, up-linkable to the datacenter core switch.

6) 2 x FC switch with 8GbpsFC connectivity SFP should be supplied along with the switches.

7) If the Bidder is quoting converged solution then instead of separate 2 x Network switches and 2 x FC switches can quote for 2 x Nos of Converged FCOE Modules providing aggregated converged bandwidth for FC & Ethernet Traffic.

8) Hot plug/hot-swap redundant power supplies to be provided, along with power cables

9) Power supplies shall have N+N. All power supplies modules shall be populated in the chassis.

10) Required number of PDUs and power cables, to connect all blades, Chassis to Data Center power outlet

11) Integrated Dual redundant chassis Management Module / chassis providing virtual KVM feature. The management solution should be providing a centralized dashboard single pane of glass view of all the chassis and servers. Management software have to be from the OEM itself.

12) The Chassis should have LED panel / LED Indicators at every blade server for quick problem determination

5.4.3.12 Storage

Parameter	Minimum Specifications
Solution/ Type	• IP Based/iSCSI/FC/NFS/CIFS
Storage	• Storage Capacity should be minimum 10 TB (usable, after configuring in offered RAID configuration) • RAID solution offered must protect against double disc failure. • Disks should be preferably minimum of 3 TB capacity • To store all types of data (Data, Voice, Images, Video, etc.) • Storage system capable of scaling vertically and horizontally

Parameter	Minimum Specifications
Hardware Platform	• Rack mounted form-factor • Modular design to support controllers and disk drives expansion
Controllers	• At least 2 Controllers in active/active mode • The controllers / Storage nodes should be upgradable seamlessly, without any disruptions / downtime to production workflow for performance, capacity enhancement and software / firmware upgrades.
RAID support	• RAID 0, 1, 1+0, 5+0 and 6
Cache	• Minimum 128 GB of useable cache across all controllers. If cache is provided in additional hardware for unified storage solution, then cache must be over and above 128 GB
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
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

5.4.3.13 Server/Networking Rack Specifications

Parameter	Minimum Specifications
Type	19" 42U racks mounted on the floor - Floor Standing Server Rack - 42U with Heavy Duty Extruded Aluminum Frame for rigidity. Top cover with FHU provision. Top & Bottom cover with cable entry gland plates. Heavy Duty Top and Bottom frame of MS. Two pairs of 19" mounting angles with 'U' marking. Depth support channels - 3 pairs with an overall weight carrying Capacity of 500Kgs. - All racks should have mounting hardware 2 Packs, Blanking Panel. - Stationery Shelf (2 sets per Rack) - All racks must be lockable on all sides with unique key for each rack - Racks should have Rear Cable Management channels, Roof and base cable access
Wire managers	Two vertical and four horizontal
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
Doors	- The racks must have steel (solid / grill / mesh) front / rear doors and side panels. Racks should NOT have glass doors / panels. - Front and Back doors should be perforated with at least 63% or higher perforations. - Both the front and rear doors should be designed with quick release hinges allowing for quick and easy detachment without the use of tools.
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

Parameter	Minimum Specifications
	within the rack. The temperature setting should be factory settable. This unit should also include - humidity & temperature sensor
Metal	Aluminum extruded profile
Side Panel	Detachable side panels (set of 2 per Rack)

5.4.3.14 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.)

1) Ability to scan through all file types and various compression formats.
   a) Ability to scan 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)
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 defense
8) Shall have facility to clean, delete and quarantine the virus affected files.

Should support online update, where by most product updates and patches can be performed without bringing messaging server off-line.

6 Handholding and Training

In order to strengthen the staff, structured capacity building programs shall be undertaken for multiple levels in the organizational hierarchy like foundation process/ soft skills training to the staff for pre-defined period. Also, refresher trainings for Command Control Centre/City Operation Staff and designated Authorities & Police staff shall be a part of Capacity Building. It is important to understand that training needs to be provided to each and every staff personnel of such operation centres. These officers shall be handling emergency situations with very minimal turnaround time.

- SI shall prepare and submit detailed Training Plan and Training Manuals to Authority/authorized entity for review and approval.

- Appropriate training shall be carried out as per the User Training Plan prepared in detail stating the number of training sessions to be held per batch of trainees, course work for the training program, coursework delivery methodologies and evaluation methodologies in detail.

- SI shall be responsible for necessary demonstration environment setup of all ICT solutions in this RFP to conduct end user training. End user training shall include all the equipment including but not limited to all the applications and infrastructure at Operation centres, data centres & field Locations. End user training shall be conducted at a centralized location or any other location as identified by Authority with inputs from the SI.

- SI shall conduct end user training and ensure that the training module holistically covers all the details around hardware and system applications expected to be used on a daily basis to run the system.

- SI shall impart operational and technical training to internal users on solutions being implemented to allow them to effectively and efficiently use the surveillance system.

- SI shall prepare the solution specific training manuals and submit the same to Authority for review and approval. Training Manuals, operation procedures, visual help-kit etc. shall be provided in English language.

- SI shall provide training to selected officers of the Authority covering functional, technical aspects, usage and implementation of the products and solutions.

- SI shall ensure that all concerned personnel receive regular training sessions, from time to time, as and when required. Refresher training sessions shall be conducted on a regular basis.

- An annual training calendar shall be clearly chalked out and shared with the Authority along with complete details of content of training, target audience for each year etc.

- SI shall update training manuals, procedures manual, deployment/Installation guides etc. on a regular basis (Quarterly/ Biannual) to reflect the latest changes to the solutions implemented and new developments.

- The SI shall ensure that training is a continuous process for the users. Basic computer awareness, fundamentals of computer systems, basic, intermediate and advanced application usage modules shall be identified by the SI.

- Systematic training shall be imparted to the designated trainees that shall help them to understand the concept of solution, the day-to-day operations of overall solution and maintenance and updating of the system to some extent. This shall be done under complete guidance of the trainers provided by the SI.

- Time Schedule and detailed program shall be prepared in consultation with [the Authority] and respective authorized entity (Police). In addition to the above, while designing the training courses and manuals, SI shall take care to impart training on the key system components that are best suited for enabling the personnel to start working on the system in the shortest possible time.

- SI is required to deploy a Master Trainer who shall be responsible for planning, designing and conducting continuous training sessions.

- Training sessions and workshops shall comprise of presentations, demonstrations and hands-on mandatorily for the application modules.

- Authority shall be responsible for identifying and nominating users for the training. However, SI shall be responsible for facilitating and coordinating this entire process.

- SI shall be responsible for making the feedback available for the Authority/authorized entity to review and track the progress, In case, after feedback, more than 30% of the respondents suggest that the training provided to them was unsatisfactory or less than satisfactory then the SI shall re-conduct the same training at no extra cost.

Types of Trainings: Following training needs is identified for all the project stakeholders:

1. Basic IT training

This module shall include components on fundamentals of:

- Computer usage,

- Network,

- Desktop operations,

- User admin,

- Application installation,

- Basic computer troubleshooting etc.

2. Initial Training as part of Project Implementation

    I. Functional Training

- Basic IT skills

- Software Applications (City Operation Centre and Command & Control Centre)

- Networking, Hardware Installation

- Centralized Helpdesk

- Feed monitoring

    II. Administrative Training

- System Administration Helpdesk, FMS, BMS Administration etc.

- Master trainer assistance and handling helpdesk requests etc.

    III. Senior Management Training

- Usage of all the proposed systems for monitoring, tracking and reporting,

- MIS reports, accessing various exception reports

3. Post-Implementation Training

- Refresher Trainings for the Senior Management

- Functional/Operational training and IT basics for new operators

- Refresher courses on System Administration

- Change Management programs

7   Project Implementation Timelines & Deliverables

Authority intends to implement the project in phased manner approach, distributed in three phases as mentioned below:

Phase I – T + 7 months (*T is the date of signing of the contract with SI*)

Study & Reporting Activities

Phase 1		T + 8 months
Resource Mobilization	• Resource Mobilization • Inception Report	**T+0.5 months**
Detailed Project Study for all ICT solution proposed	• Feasibility Report • Detailed Survey of Sites Identified • Hardware Deployment plans · • Detailed Project Plan including Operations management, Contract management, Risk management, Information Security and Business Continuity • FRS, SRS, SDD Documents for all work streams	**T+1.5 months**

Field Level Activities

No	Smart Solutions	Milestone	Activity
1	Smart Water	1.5 -7 Months	• Development of Smart Water Application and installation of field devices in 25% of the identified junctions and shall be on Go Live Mode
2	ICT Enabled Solid Waste Management	1.5 -7 Months	• Installation of all CCTV camera • Installation of computerized weigh bride • Installation of 25% field devices for tracking of fleets • Development of unified Dash Board, mobile App and the Fleet Management Software

No	Smart Solutions	Milestone	Activity
3	Intelligent Traffic Management System	1.5 -7 Months	• Development of Adaptive Traffic Control Application and installation of field devices in 25% of the identified junctions and shall be on Go Live Mode
4	Intelligent transport System (ITS)	1.5 -7 Months	• Development of AVL & PIS Application and installation of field devices in 25% of the identified junctions and shall be on Go Live Mode
5	Intelligent Pole (with environmental sensors, public address system, variable messaging system, digital billboard, CCTV camera, panic button)	1.5 -7 Months	• Development of all concerned Applications and installation of field devices in 100% of the identified junctions and shall be on Go Live Mode

Phase II – T + 14 months (*T is the date of signing of the contract with SI*)

No	Smart Solutions	Milestone	Activity
1	Smart Water	7-14 Months	• Installation of field devices in 75% of the identified junctions and shall be on Go Live Mode
2	ICT Enabled Solid Waste Management	7-14 Months	• Installation of balance 75% field devices for tracking of fleets
3	Intelligent Traffic Management System	7-14 Months	• Installation of field devices in 75% of the identified junctions and shall be on Go Live Mode
4	Intelligent transport System (ITS)	7-14 Months	• Installation of field devices in 75% of the identified junctions and shall be on Go Live Mode

**Phase III – T1 + 60 months (*T1 is the date of Go Live of all application)*

Operations & Maintenance phase for a period of 60 months from the date of Go Live of the last solution.

Operation & Maintenance	SLA Compliance Report	Every Quarter

8 Payment Terms and Schedule

1. The request for payment shall be made to the Authority in writing, accompanied by invoices describing, as appropriate, the services performed, and by the required documents submitted pursuant to general conditions of the contract and upon fulfilment of all the obligations stipulated in the Contract.

2. Due payments shall be made promptly by the Authority, generally within sixty (60) days after submission of an invoice or request for payment by SI

3. The currency or currencies in which payments shall be made to the SI under this Contract shall be Indian Rupees (INR) only.

4. All remittance charges shall be borne by the SI.

5. In case of disputed items, the disputed amount shall be withheld and shall be paid only after settlement of the dispute.

6. Any penalties/ liquidated damages, as applicable, for delay and non-performance, as mentioned in this RFP document, shall be deducted from the due payments of the respective milestones.

7. Taxes, as applicable, shall be deducted / paid, as per the prevalent rules and regulations

Payment Schedule

Payments to SI, after successful completion of the target milestones (including specified project deliverables), shall be made as under: -

S. No.	Scope of Work	Timelines	Payment
1	Upon finalization of SRS, FRS & SDD	T+1.5 Months	10% of contract value
1.	Phase I Operationalization & Go Live	T + 7 Months	30% of contract value
2.	Phase II Operationalization & Go Live	T + 14 Months	20% of contract value
3.	Operations & Maintenance phase for a period of 60 months from the date of Go Live of the last solution	T1 + 60 Months	40% of Contract Value in equal quarterly instalments

Note:

T is the date of signing of contract

T1 is the date of Go Live of the last phase.