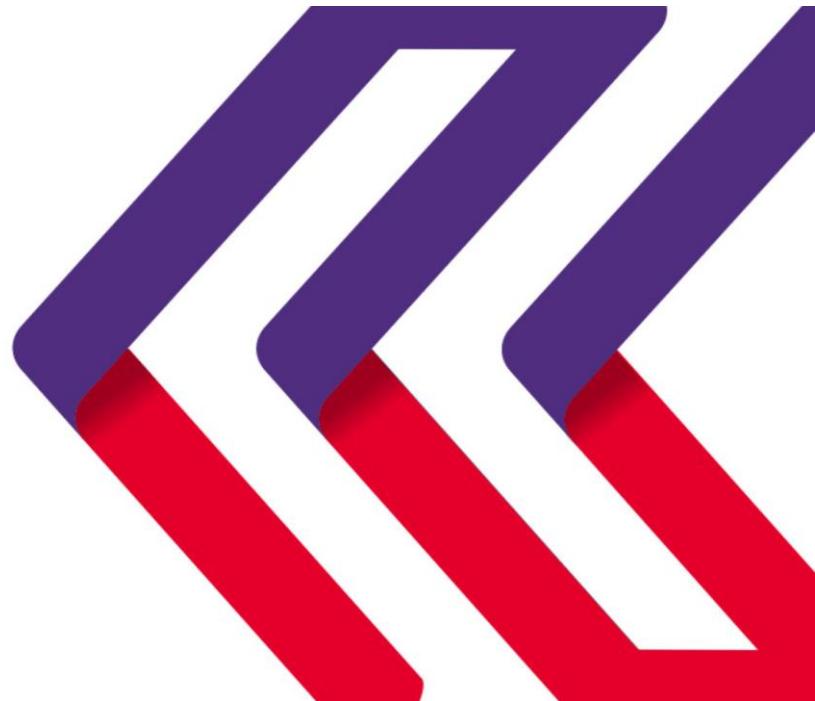




# Detailed Project Report (DPR)

## Integrated Command and Control Centre



**Project Management Consultants  
for  
Jalandhar Smart City Limited**

## **Disclaimer**

This report is based on our assessment of data & information collected from or provided by various government departments, officials, websites as on date and our expertise & past experience and is accordingly, given for the specific purpose of internal use by Jalandhar Smart city Limited. Any observation or data if not entirely correct or accurate, should be communicated to us immediately, as the inaccuracy or incompleteness could have a material impact on our conclusions. We have taken reasonable steps to ensure that the data obtained from reliable sources and this report is accurate and authoritative in all respects however, there can be no assurance that the authorities or regulators may not take a position contrary to our conclusions.

This report is for sole information of Jalandhar Smart city Limited and we accept no responsibility to any other party.

## Definitions/Acronyms

<b>Sl. No</b>	<b>Term/Acronyms</b>	<b>Description</b>
1.	<b>AAA</b>	Authentication, authorization, and accounting
2.	<b>ABD</b>	Area Base Development
3.	<b>ANPR</b>	Automated Number Plate Recognition
4.	<b>AVLS</b>	Automated Vehicle Locator System
5.	<b>BOM</b>	Bill of Material
6.	<b>JICCC</b>	Jalandhar Integrated Command and Control Centre
7.	<b>CCTNS</b>	Crime and Criminal Tracking Network & Systems
8.	<b>CCTV</b>	Closed Circuit Television
9.	<b>COP</b>	City Operation Platform
10.	<b>COP</b>	Common Operating Platform
11.	<b>DC</b>	Data Center
12.	<b>DNS</b>	Domain Name Server
13.	<b>DR</b>	Disaster Recovery
14.	<b>FRS</b>	Functional Requirement Specifications
15.	<b>GIS</b>	Geographical Information System
16.	<b>GoP</b>	Government of Punjab
17.	<b>GPRS</b>	General Packet Radio Service
18.	<b>GPS</b>	Global Positioning System
19.	<b>GSM</b>	Global Systems for Mobile Communications
20.	<b>GUI</b>	Graphical User Interface
21.	<b>ICT</b>	Information and Communication Technology
22.	<b>IDS</b>	Intrusion Detection System
23.	<b>IP</b>	Internet Protocol
24.	<b>IPS</b>	Intrusion Prevention System
25.	<b>ITIL</b>	Information Technology Infrastructure Library

## Detailed Project Report for Jalandhar Integrated Smart Solutions

26.	<b>JSCL</b>	Jalandhar Smart City Limited
27.	<b>LAN</b>	Local Area Network
28.	<b>LED</b>	Light Emitting Diode
29.	<b>MCJ</b>	Municipal Corporation Jalandhar
30.	<b>O&amp;M</b>	Operations & Maintenance
31.	<b>OEM</b>	Original Equipment Manufacturer
32.	<b>OFC</b>	Optical Fibre Cable
33.	<b>OS</b>	Operating Systems
34.	<b>OTP</b>	One Time Password
35.	<b>PA System</b>	Public Address System
36.	<b>PDU's</b>	Power Distribution Units
37.	<b>PoE/ PoE+</b>	Power over Ethernet
38.	<b>PoP</b>	Points of Presence
39.	<b>PTZ</b>	Pan Tilt Zoom
40.	<b>QR Code</b>	Quick Response Code
41.	<b>RF</b>	Radio Frequency
42.	<b>RFID</b>	Radio Frequency Identification
43.	<b>RLVD</b>	Red Light Violation Detection
44.	<b>RoW</b>	Right of Way
45.	<b>RPO</b>	Recovery Point Objective
46.	<b>RTO</b>	Recovery Time Objective
47.	<b>MSI</b>	Master System Integrator
48.	<b>SLA</b>	Service Level Agreement
49.	<b>SNMP</b>	Simple Network Management Protocol
50.	<b>SMPS</b>	Switched Mode Power Supply
51.	<b>SOP</b>	Standard Operating Procedure
52.	<b>UPS</b>	Uninterruptible Power Supply
53.	<b>VaMS</b>	Variable Message System

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

54.	<b>VLAN</b>	Virtual Local Area Network
55.	<b>VMS</b>	Video Management Software/System
56.	<b>WAN</b>	Wide Area Network

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# Project Background

## Project Background

“Smart City is referred as the safe, secure, environmentally green, and efficient urban center of the future with advanced infrastructures such as sensors, electronics and networks to stimulate sustainable economic growth & a high quality of life” (Hall, 2000).

Rapid growth in small and medium scale urban centres plays an important role in economic and societal progress. However, it also strains a city's infrastructure. Key challenges, such as traffic congestion, energy usage, public safety, and the building of sustainable communities are top of mind. Such challenges need to be addressed through the development and implementation of intelligent solutions. Smart cities are measured by the integration of their infrastructure and the intelligent ways by which they tackle challenges. A smart city puts emphasis on creating a system of networks to allow for a systematic flow of information and effective management of resources. Enabling integration and convergence with organizations and local authorities to provide solutions for the development of a smart city is crucial.

A Smart City offers decent living options to every resident. This would mean that it will have to provide a very high quality of life

i.e. good quality of affordable housing, cost efficient physical infrastructure such as 24 x 7 water supply, sanitation, 24 x 7 electric supply, clean air, quality education, health care, security, entertainment, sports facilities, robust and high speed interconnectivity, fast & efficient urban mobility etc.

Nearly 31% of India's current

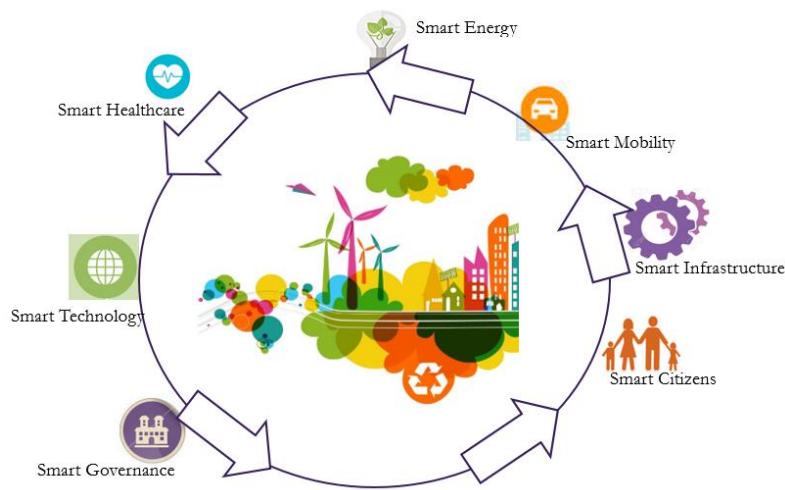


Figure 1: Smart Elements

population currently resides in cities and contribute to 63% of GDP (Census 2011). Urban areas are expected to house 40% of India's population and contribute 75% of India's GDP by 2030. This requires comprehensive development of physical, institutional, social and economic infrastructure. All are important in improving the quality of life and attracting people and investment, setting in motion a virtuous cycle of growth and development. Development of Smart Cities is a step in that direction.

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The Smart Cities Mission is an innovative and new initiative by the Government of India to drive economic growth and improve the quality of life of people by enabling local development and harnessing technology as a means to create smart outcomes for citizens.

The objective of the Smart Cities Mission is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions. The focus is on sustainable and inclusive development and the idea is to look at compact areas, create a replicable model, which will act like a lighthouse to other aspiring cities. The Smart Cities Mission was meant to set examples that can be replicated both within and outside the Smart City, catalysing the creation of similar Smart Cities in various regions and parts of the country.

### SMART CITIES MISSION STRATEGY

- Pan-city initiative in which at least one Smart Solution is applied city-wide
- Develop areas step-by-step – three models of area-based developments
  - City Improvement (Retrofitting),
  - City Renewal (Redevelopment),
  - City Extension (Greenfield)

The Smart City Mission is being operated as a Centrally Sponsored Scheme (CSS) and the Central Government proposes to give financial support to the Mission to the extent of Rs. 48,000 crores over five years i.e. on an average Rs. 100 Crores per city per year. An equal amount, on a matching basis, will have to be contributed by the State/ULB; therefore, nearly Rupees one lakh crore of Government/ULB funds will be available for Smart Cities development.

Accordingly, the purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially technology that leads to Smart outcomes.

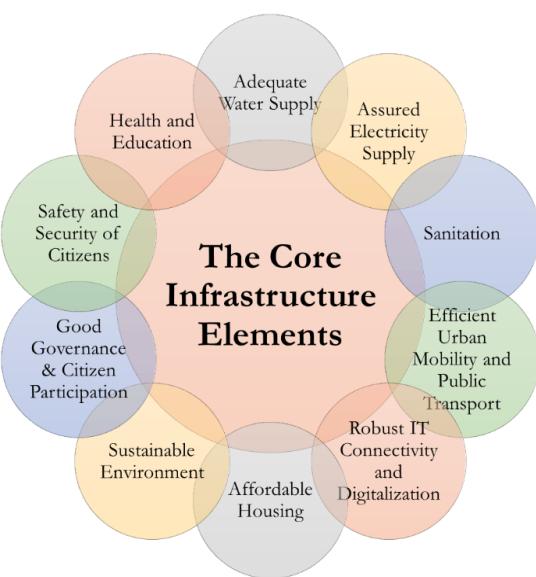


Figure 2: Smart City Infrastructure Elements

# Chapter 1: Introduction



## 1. Introduction

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The purpose of this document is to provide a common core set of city-needs-led requirements, co-developed and validated by Jalandhar city, to develop the Jalandhar city as a Smart City. The ambition is that adoption of these requirements of Jalandhar city will lead to reduced pre-procurement times, increased confidence in platform designs, greater levels of collaboration (particularly amongst various line departments), innovation in government models, more affordable solutions, and a more secure basis for Government to apply its innovations. This will lead to accelerated adoption of urban platforms by Jalandhar city, so that they can exploit the potential of the growing volumes of city data, and improve the services to and outcomes for their residents, line departments and visitors.

This document provides a primary input to the Smart City Platform (Platform implies an Integrated Solutions connecting all Smart Components of the Smart City) Supply-Side and Standardisation work streams as a reference for the development of further Functional, Technical and Operational guidelines. The requirements illustrate the purpose and complete declaration for the development of system, as well as system constraints, interface and interactions with other external applications. The scope of this document is limited to current situation in the city, its reengineering, common operations and services data platform requirements, and issues related to the management of city data within the Pan City area, Governance Structure and the funding requirements. This considers the full life-cycle of city data, including: the maintenance of the existing city data; development of functional requirements for common services data platform from a city-needs perspective identification of key beneficial areas related to the Smart City functioning.

There are number of clear trends that any city must recognise:

- The astounding increase in volumes of city data, driven notably by IoT/sensor/ICT implementations
- Citizen demand for efficient services
- The pressure to improve and make data available from public and private sources
- The continued reality of austerity that drives cities towards transformative solutions

## **1.1. About Jalandhar**

Jalandhar, is a city in the Doaba region of Punjab and is the oldest inhabited major city in the state. Previously, the capital of Punjab after independence, before conceding the status to Chandigarh in 1953, Jalandhar has now undergone rapid urbanization and developed into an industrial city known for being a center of commerce. It is situated about 145 Km from the capital, Chandigarh.

The population of Jalandhar is 873,725 (Census 2011) with nearly 75% of this population being Hindu, and the second largest religion being Sikhism at 21.39%. Jalandhar, being an industrial city, is well known for manufacture of several goods, particularly sporting goods, surgical equipment, hand tools, etc. Jalandhar is also renowned for the printing industry, which is among the largest in the Northern part of the country. Jalandhar also happens to be one of the prominent education cities in the region with the largest number of educational centres.

The city wishes to leverage its position as an industrial center with a focus on productivity, activity, business and liveability. In the pursuit to achieve the goals set by the authorities, Jalandhar smart city has kept the ethos of its vision aimed at (i.) Healthy Active City, (ii.) Sports City, (iii.) Entrepreneurial & Productive City, (iv.) Manufacturing based Economy, (v.) Sustainable & Liveable City. To realize the smart city mission, various projects under the Jalandhar Smart City initiative have been proposed according to the SCP. Projects ranging from Urban Sanitations, to improved walkability and projects ensuring higher quality of lifestyle have been envisaged. As a part of Smart City initiative, Integrated Command and Control Centre too has been proposed to improve the safety and security of its citizens. A few outlined demographics of Jalandhar are:

1. The popular spiritual places in Jalandhar include Baba Dasji Gurudwara, Tulsi Mandir, Devi Talab Mandir, Geeta Mandir and Gurudwara Chhevin Padshahi
2. Punjab Technical University (PTU) is one of the most reputed educational field.
3. Climate: Jalandhar city has a humid subtropical climate with cool winters and long, hot summers.
4. Population: Jalandhar city had a population of 8.62 lakhs;
5. Area: 2632 km<sup>2</sup>; Elevation: 228 m (748.03 ft.); Literacy: 82.4%.

Jalandhar is governed by a number of bodies, the most important being the Municipal Corporation Jalandhar (MCJ) which is responsible for the master planning of the city.

## **1.2. Jalandhar Smart City Limited (JSCL)**

The Jalandhar Smart City Limited (JSCL) is the Special Purpose Vehicle (SPV) constituted as per the directives of MoHUA, Govt. of India for executing SMART CITY MISSION (SCM) in Jalandhar.

JSCL is led by the CEO Jalandhar Smart City and works closely with the Municipal Corporation of Jalandhar (MCJ) and other nodal offices like Police, Fire etc. with the objective to achieve success in the implementation of Smart City Mission for Jalandhar.

JSCL has been established under the Companies Act, 2013 of the Ministry of Corporate Affairs, Government of India. It is supported by PMC and an agency for the implementation of the mission.

## **1.3. Vision Statement for Jalandhar Smart City and Associated Objectives**

Jalandhar: The Leading Sports and Manufacturing hub in Asia” The world of sports is a growing industry in India. A thriving sports sector has significant socio-economic impact, as it is instrumental in improving the physical health and mental agility of human resources, and in promoting unity and national pride. Sports as an industry have contributed 1%- 5% of the GDP of various countries. Manufacturing is the foundation of a strong economy. The most successful countries have a strong industrial and manufacturing presence underpinning the economic growth. Manufacturing has the potential to help take many residents, currently living in slums, above the poverty line by providing better paid and higher skilled jobs, goal highlighted in Make in India a successful mission. Jalandhar has the opportunity to build upon its existing sports and manufacturing base to create sustainable jobs, increase productivity and drive innovation. The city would benefit from taking a strategic approach that will focus on the sports and manufacturing sector, including:

- Becoming a leading hub for sports goods globally not just in manufacturing, so in research and development in terms of production methods and new cutting-edge sporting goods.
- Focusing on the potential of Small and Medium Enterprises ensuring they are ready to up-skill and expand from their current low-tech base to ensure their goods reach national and global consumers

In order to develop Jalandhar as envisaged and make it more liveable and sustainable, the strategic blue print for next 5-10 entails the following

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

1. Promote economic growth of the city by creating state of the art sports infrastructure that aggregates the youth and attracts national/international events, exhibitions, leagues & tournaments converging with the country's sports ecosystem.
2. To create public & recreational spaces for the benefit of the city's residents which can also host cultural events.
3. Investing in public transport and traffic management. This will increase accessibility, reduce congestion, promote walkability and ensure better parking provision leading to higher productivity.
4. Upgrading the city's poor public realm urban environment. Currently, a lack of safe and inclusive spaces means that citizens cannot engage in active and social lifestyle.
5. The city's aging physical infrastructure needs to be upgraded to cater for an increased population.
6. Improving urban governance by introducing smart technologies/ICT solutions that help bring systemic efficiency in infrastructure service provision and improved two-way communication.

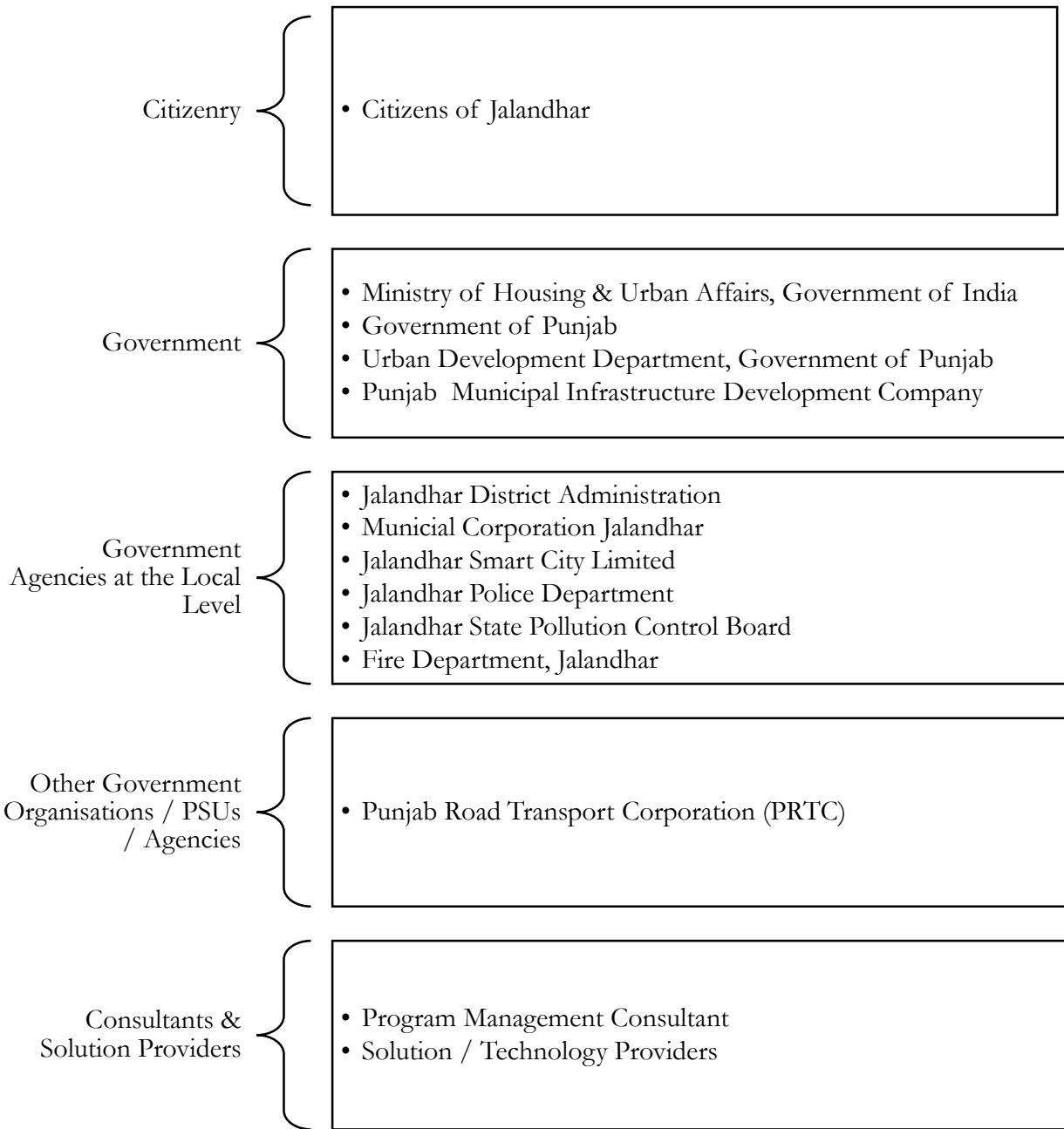
### **1.4. Project Structure**

The Government of Punjab has accorded approval for implementation of Smart Cities Scheme in the State. The High Power Steering Committee (HPSC) for Smart Cities Scheme has also been constituted under the Chairmanship of Chief Secretary with representatives of various State Government departments to guide the mission in the State.

The Government of Punjab has nominated Punjab Municipal Infrastructure Development Company (PMIDC) as the State Level Nodal Agency (SLNA) and Mission Directorate.

In Punjab, Jalandhar city among the one which is selected under Smart City that aimed at Transforming Jalandhar city to (i.) Healthy Active City, (ii.) Sports City, (iii.) Entrepreneurial & Productive City, (iv.) Manufacturing based Economy, (v.) Sustainable & Liveable City.

## 1.5. Stakeholder in Jalandhar Smart City Project



## 1.6. Surveys

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

Initial stage of the Project Cycle was started with the live city surveys with the objective of depth understanding of the current city situation in following aspects:

**a) City Traffic situations and the issues**

At present, there are 343 prominent junctions in Jalandhar city, which requires revamping and the intervention of Smart equipment for seamless traffic flow management. Out of the available multi legged junction a few are operational in traffic lights.

**b) Current Security and monitoring mechanisms**

With regards to city surveillance and security parameters the city devoid in proper infrastructure, which includes monitoring tools and video surveillance analytics.

**c) Approach for the Management of Solid Waste**

At present solid waste management is being done across the city through vehicles and adequate manpower deployment. It also includes vehicles, which are GPS enabled and mobile-based attendance of the working staff.

**d) Lighting arrangements at the streets**

The lighting arrangement at the streets is provisioned with multi wattage lights with LED based luminance across the city. However, these provisioned lights do not fall under smart category, as they are not compatible with the smart controlling units that can be governed centrally.

**e) Environment and Pollution Control mechanisms**

At present, Air pollution is a great menace for the city. The major causes of air pollution here are motor vehicle emissions, stubble burning in fields and illegal industrial activities, which have adverse effects on health of the population, especially children. From the desk of the Chairman, Punjab Pollution Control Board (PPCB), Mr. K S Pannu "The appropriate measures are being taken in order to maintain the AQI in the city"

**f) Parking Management Systems in the city**

There are a few open public parking's available in the city which does not work with the smart equipment like boom barriers, cameras and token/ ticket management, etc.

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

### **g) Network Connectivity**

At present, there are a few major Network Service providers across the city; those have laid down the OFC cabling across the city to fulfill city's network backbone requirements. The major players include BSNL and the likes.

# Chapter 2: Feasibility Study Assessment



## 2. Feasibility Study Assessment

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Infrastructure is the backbone of any successful place for living and working. A properly functioning Smart City is a direct consequence of meticulously planned and arduously maintained infrastructural system. This feasibility report may outline the different modules, viz. Smart Traffic Management, Citizen Services, Environment Monitoring, and Smart Parking Management for the Smart City. The project is expected to infuse high population growth in the project area based on the quality of life and infrastructure facilities proposed in the smart city. Conduct a detailed scoping study and develop a comprehensive project plan, including:

- Feasibility study for finalization of detailed technical architecture and project plan
- Development of traffic management plans for individual signal controls and groups of signal controllers along with pre-planned intervention strategies for special scenarios
- Site surveys to identify need for junction improvement, junction signage, lane markings and other necessary site infrastructure
- Site Clearance obligations & other relevant permissions.

### 2.1. Assessment Processes

As part of the assessment, PMC team conducted feasibility of implementing smart parking, video analytics and surveillance, and a central information hub for stakeholders of Smart City. PMC team also carried out stakeholder analysis, best practice survey and opportunity assessment during the study. The study is based on Citizen Centricity, Impact on Climate & Reduction in Carbon footprint, User Friendliness & Ease of usage, Economic Sustainability of Projects, Citizen Privacy and Continuous Innovation.

### 2.2. Study Parameters

The feasibility has been performed on following parameters:

**Use Case (Present and Future)** - Illustrative scenarios comparing the lives of stakeholders with and without the foundational initiative.

## Detailed Project Report for Jalandhar Integrated Smart Solutions

**Design Architecture-** Technical feasibility of the initiative including solution overview, architecture and location analysis.

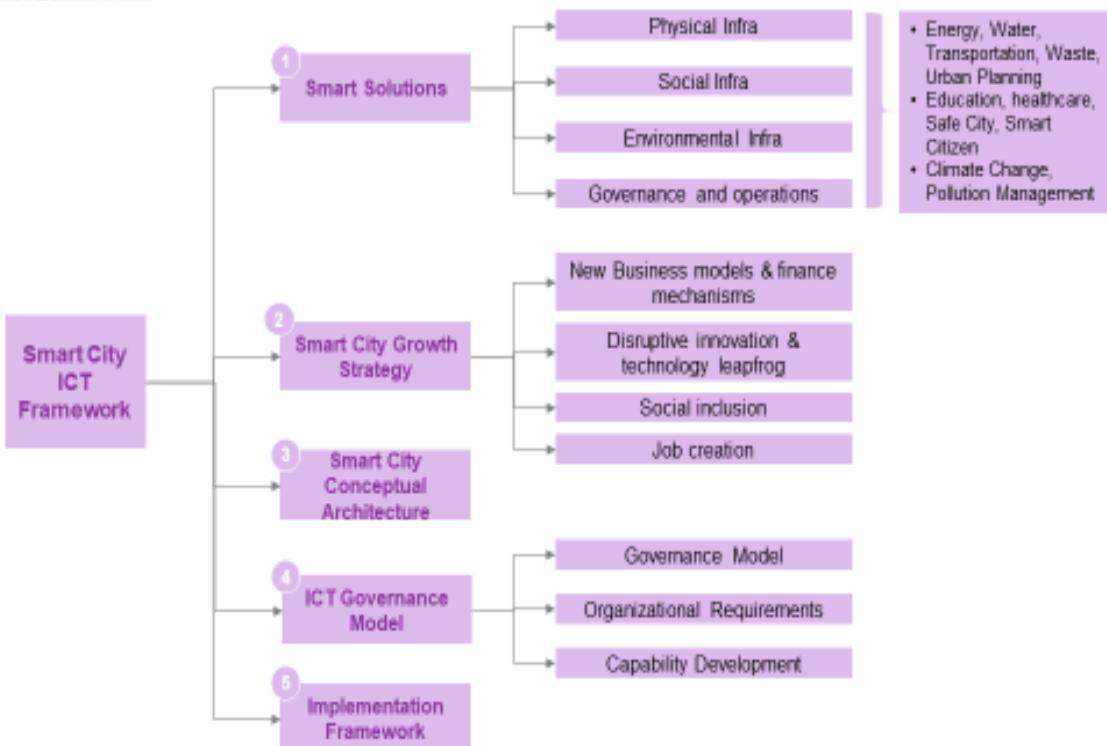
**Financial Viability-** Economic feasibility of the initiative including revenue modelling, Capex and Opex costs and cost benefit analysis.

**Stakeholder Benefits-** Qualitative benefits of important stakeholders including citizens, JSCL and the environment.

### 2.3. Envisaged Smart Solution

Smart City framework envisaged five main dimensions and implement various ICT solutions.

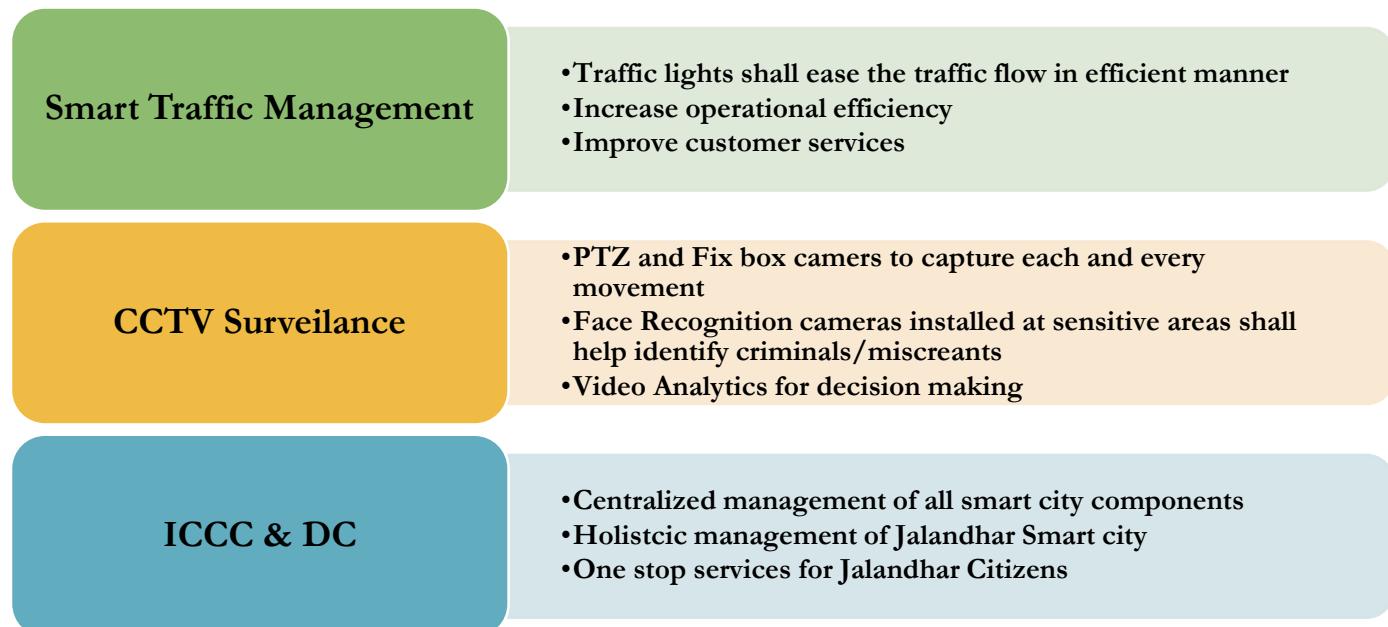
**The Smart City ICT framework is comprehensive and covers five main dimensions**



**Figure 1: Dimensions of ICT Framework**

## 2.4. Impact Assessment

Overall impacts of aforementioned initiatives are:



*Figure 2: Impact Assessment*

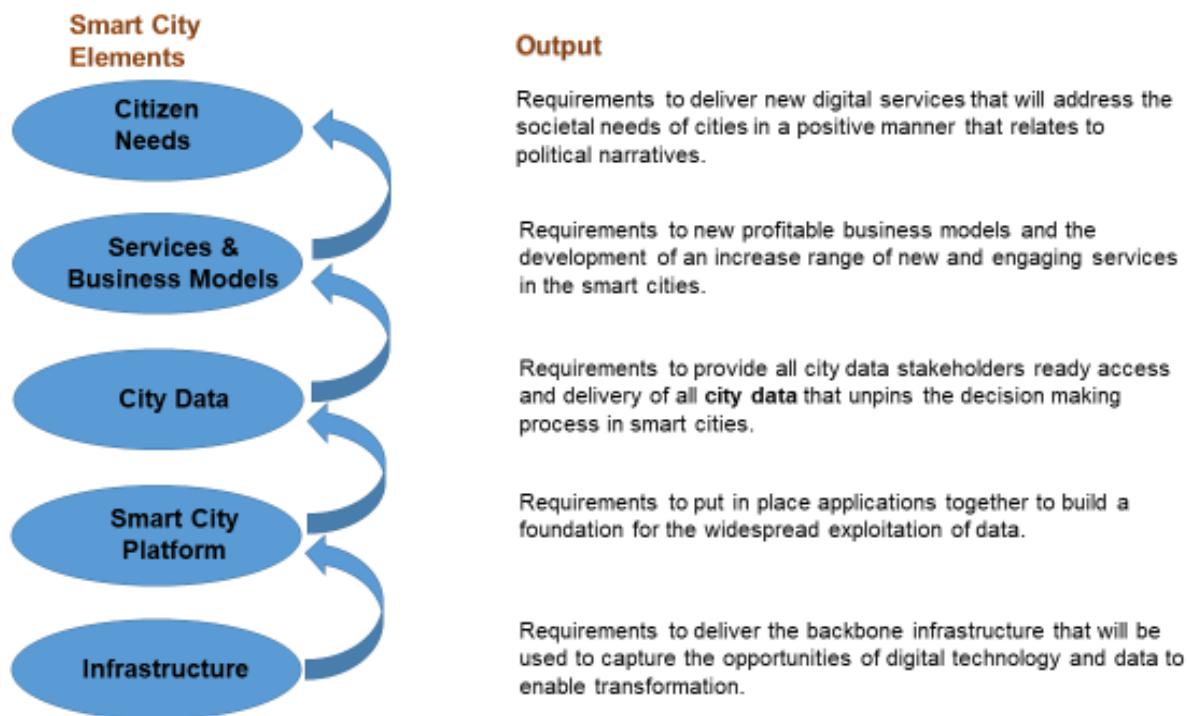
## 2.5. Envisaged Outcome of ICT Solution

The Pan City ICT infrastructure will support the inclusion of almost all digital assets onto a common platform, which will ensure confluence of data from multiple sources, applications, sensors, objects and people. The establishment of this project will provide high quality, reliable, cost effective and ICT Infrastructure to the city administration. It will be the provider of various smart solutions under the smart city mission for the city like smart surveillance system, Smart traffic monitoring system, Sensors, Digital boards, and availability of high-speed connectivity. This project will have multi fold benefits across the government departments and citizens will feel the effect. Some of the key benefits are:

- Strong ICT backbone for the area
- Automated services making resources available for other value added tasks
- Seamless experience for citizen/tourist and other stakeholders
- Increased safety and security
- Reduced energy consumption

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- Reduced environmental stress



*Figure 3: Smart City elements*

## Chapter 3: Our Approach



### **3. Our Approach**

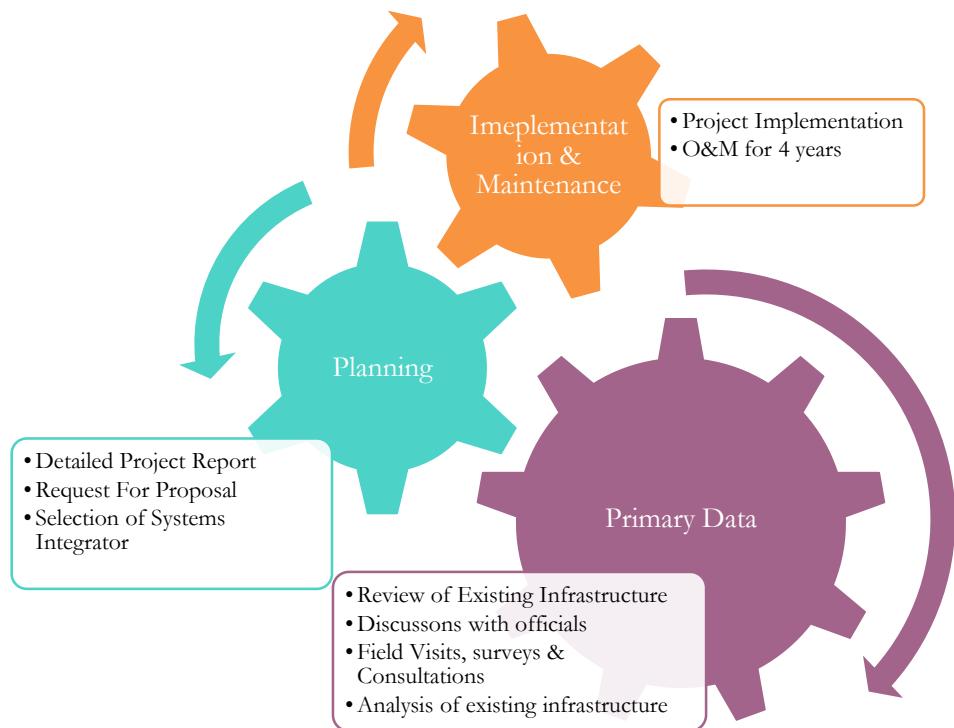
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Our Approach for this project comprises of three phases. Below we are elaborating the steps involved during the three phases, namely:

#### **3.1. Pre –Implementation Phase**

- a) Conducting site survey, Stakeholder Consultation, obtaining necessary permissions, developing functional & system requirements, standard operating procedures etc.
- b) Assessment of IT Infrastructure and Non IT Infrastructure requirements, assessment of business processes, assessment of software requirements, assessment of integration requirement, assessment of connectivity requirement at all location.
- c) Formulation of solution architecture, detailed design of smart city solutions, and development of test cases (Unit, System Integration and User Acceptance).
- d) Assessment and study of use cases and development of SOPs for all use cases of the respective department.

In order to accomplish the above, the approach taken is depicted in the chart below:



### **3.2. Implementation Phase**

- a) Setting up of Helpdesk, physical infrastructure, procurement of equipment, edge devices, COTS software and licenses.
- b) Installation of IT and Non IT Infrastructure, development, testing and production environment setup.
- c) Software Application customization, development of bespoke solution, data migration (if any), integration with third party services/application (if any).
- d) Preparation of User Manuals, training curriculum and training materials.
- e) Role based training(s) on the Smart City Solutions.
- f) SOP implementation, Integration with GIS, Integration of solutions with JICCC.
- g) Facilitating user acceptance testing and conducting the pre-launch security audit of applications.
- h) User training and rollout of solution.
- i) Integration Requirements:
  - Integration of the solution with existing / standalone systems.

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- Develop provisions for a scalable system which can integrate with more devices of the same kind (as those deployed today) and can integrate with future applications and sensors through open standards and data exchange mechanisms.

### **3.3. Post Implementation Phase**

- a) Deploying manpower for solution maintenance and monitoring support which includes change request management, bug tracking and resolution, production support, performing version and patch updates.
- b) Annual technical support for all hardware and software components for the O&M period.
- c) Detailing of SOPs and their optimization during operation and maintenance phase.
- d) Optimizing field infrastructure for better operations, e.g., shifting of cameras or changing their alignment / angle.
- e) Identifying, scripting and implementing the automation required to manage the IT during O & M phase.
- f) Continuously study the additional requirements, fine-tune the applications and implement features that will assist the line departments in carrying out the operations thereby stabilizing the overall infrastructure
- g) Preventive, repair, maintenance and replacement of hardware and software components as applicable under the warranty and AMC services during the project period.
- h) Provide a centralized Helpdesk and Incident Management
- i) Recurring refresher trainings for the users and Change Management activities.
- j) Conducting disaster recovery site testing through regular mock drills.

# Chapter 4: Integrated ICT Components



## 4. Integrated ICT Components

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The citywide network of Smart Elements will accomplish the following broad objectives:

- Make Jalandhar a better place by increasing safety and liveability of the people in the city by effectively providing the delivery of citizen services.
- Improve the situational awareness of the city administrators and residents.
- Provide administrators, citizens, tourists, businesses real time, and actionable information to aid their day-to-day decision-making.

The Overall project scope comprises of end-to-end ICT Solutions, which shall cater to the following primary components:

1. Jalandhar Integrated Command Control Center (**JICCC**)
2. Data Centre & Disaster Recovery (**DC & DR**)
3. Helpdesk
4. City Surveillance System & Intelligent Traffic Management System (**JITMS**)
5. Body Cameras
6. Disaster Management
7. Jalandhar Environmental Monitoring System (**JEMS**)
8. **GIS Maps** real time integration with Smart City Applications
9. **e-Governance**
10. **Network from Service Providers**
11. **Others:** Support the Management and Operations in infrastructure are Unified Communications, Integrated dashboard, Video Wall & Controller System, Operator work station, Standard Operating Procedure Tools (SOP), Security Management, Intrusion Detection, Antivirus Management, Remote Device Management, Internet Connectivity, IT Service Management (ITSM), Building Management System (BMS).

# Chapter 5: Project Undertakings



## **5. Project Undertakings**

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In order to execute the Project, the Master System Integrator (MSI) shall be selected through a transparent Bid Process. The Master System Integrator (MSI) is the agency that shall implement the project based on the scope of work provided in the Bid Documents its responsibilities shall include establishing a dedicated Data Centre and the State-of-Art, innovative ICT solutions to revive & revamp City of Jalandhar using Hi-Tech solutions.

The MSI shall be responsible for carrying out the following activities:

- A. Project Planning, Mobilization & Management and Maintenance of the project
- B. Survey and Detailed Design of all Smart Solutions Components
- C. Prototype Acceptance and Factory Acceptance Testing
- D. Hardware Supply and Installation Stage
- E. Software Development (if any)
- F. System Study, Design, Development, Integration, Testing and Certification
- G. System Integration
- H. Testing
- I. Third Party Acceptance Testing, Audit and Certification
- J. Capacity building & Training
- K. Change Management
- L. Final Deployment and Documentation
- M. Operational System Acceptance
- N. Comprehensive Maintenance for System and Services
- O. Support Staff Required

## **5.1. Team Mobilization, Project Planning & Management/ Maintenance Management**

MSI need to deploy a dedicated team of experts to execute the project. MSI shall be responsible for end to end project management for the Implementation and Operations & Maintenance of the Project. The Project team include but limited to Project Director, Project Manager along with Solution and Network Architect. The Project Manager shall be the single point of contact that shall assume overall responsibility of the Project and ensure end-to-end working of the project.

MSI shall be responsible for preparing a master schedule of work, which shall highlight implementation plan for all the Project Milestones. The schedule shall identify the manufacture, delivery, installation, integration of equipment (Software and Hardware), training programs, test procedures, delivery of documentation and the respective solutions. The schedule shall include JSCL and any third party responsibilities along with the activities in the timeline.

MSI shall also be responsible for effective risk and issue management and escalation procedures along with matrix as part of project management. MSI shall identify, analyse, and evaluate the project risks and shall develop cost effective strategies and action plan for mitigation of risks. As part of the Project, MSI shall monitor report and update risk management plans and will discuss during project meetings. MSI shall propose a suitable progress reporting mechanism for the project duration.

The Enterprise Project Management Tool needed to be deployed by MSI, which should cater to effective project management, configuration management, issue and risk management, escalation procedure and matrix document repository etc. Based on progress reports, MSI shall also accordingly update the master schedule of work on a continuous basis during the project period.

## **5.2. Survey and Detailed Design of all Smart Solutions Components**

MSI shall conduct end-to-end survey of the site area, based on the observations asses, and validate the present conditions, implementation approach and methodology, project challenges and mitigations and other project critical information. During the survey stage itself, MSI shall mobilize its entire staff and fully acquaint them with the site conditions. It is MSI's responsibilities to periodically survey the site and provide update on the project during the project period.

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During the design stage, MSI would also expected to:

- Conduct Workshops with different stakeholders for capturing business requirements, creating awareness of best practices, communicating the changes, building consensus on process design etc. Workshops need to be organized at different intervals and in different places throughout the duration of the projects as needed.
- Stake holder consultation - Other than the workshops with those stake holders, PMC & JSCL identified staff will provide critical inputs, reviews, suggestions, process description etc.
- Review sessions will be organizing with different stakeholders for signing off the deliverables, walking through the deliverables for facilitating quick understanding.

The MSI shall be responsible for the detailed design of the Jalandhar smart city solutions. MSI shall discuss in detail with the JSCL or its representatives the detailed design of the Jalandhar Smart City Solutions and fine-tune any requirements. It is the MSI's responsibility to satisfy the operational requirements of the JSCL and adopt industry best practices for implementation during the design stage itself. Based on the survey observation, analysis and discussion with the JSCL, the MSI shall submit a Detailed Design Report. The IT deliverables would include following details and not limited to JICCC design/layout, System Architecture, Data center Architecture, Network Architecture, Application Architecture, Security Architecture, Routing & Switching, Integration, Operational procedures etc.

The detailed design report shall include end-to-end design validation for the project including project understanding, analysis, detailed design, integration plan, and construction drawings. Complete set of design and construction drawing including method of installation as applicable shall also be included in the Detailed Design Report. Construction details shall accurately reflect actual job conditions.

All technical data sheets of the products must be submitted ahead of time by the MSI. It is MSI's responsibility to get all technical data sheets approved by the JSCL or its representative to meet the overall project schedule.

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Design and Construction drawings shall include the following at a minimum for drawings for all the elements as part of holistic solution:

- Overall design
- Cable requirements, routing and location (as applicable)
- Design of IP address and schematic architecture diagram
- Typical mounting details
- Single Line Diagrams (SLDs)
- Splicing diagrams
- Wiring diagrams with diagram
- 3D layouts and renderings
- Any other layouts

All drawings shall be updated/revised to “as-built” conditions when installation is complete. Design submissions should base on project requirements and shall include as applicable, but not limited to, the following:

- Complete listing of specifications to be used along with detailed technical data sheet
- Detailed engineering drawings
- Shop drawings including product data sheets
- Revisions to original design submissions.

MSI need to design requirement analysis documents for various components of the solution. This includes System Requirements Specification (SRS) and Functional Requirements Specification (FRS) documentation. The MSI shall be responsible for documenting any existing/planned ‘processes’ of the JSCL as part of these deliverables.

### 5.3. Prototype Acceptance and Factory Acceptance Testing

After approval of the technical data sheets by JSCL or its representative, MSI shall submit the prototype of all the material presented in the Detailed Design Report for its review and approval.

**Note:** It shall be MSI’s responsibility to get the prototypes approved in due course of time without affecting the overall schedule of completion of works.

Material provided as part of the Project shall undergo Prototype Acceptance Test (PAT) and Factory Acceptance Test (FAT) as per Project Plan. MSI shall present respected reports to the JSCL and its representatives the test results for PAT and FAT in the form of Test Result Documentation. JSCL at its own discretion shall visit any FAT site. MSI shall be responsible for organizing all logistics required for this site visit. For all the software components, MSI shall also propose prototype of solution components in this phase and get the required approvals.

#### **5.4. Hardware Supply and Installation Stage**

MSI shall be responsible for the supply and installation of all components as part of the Project to meet the Technical, Functional, Business and Performance requirements that will be mentioned in BID DOCUMENT. No deviations from these requirements shall be acceptable by JSCL. MSI shall deliver the project, install and handle the equipment in accordance with manufacturer's requirements. Installation process of the MSI shall be flexible and shall accommodate JSCL requirements.

MSI shall be responsible for all supply, storage and handling of the material as mentioned in Bid Document. The OEM proposed for the IT infrastructure shall be in line with the national security policy (as applicable).

If there is removal/change of any existing material during installation process and belongs to the JSCL, the material should handed-over to the JSCL. MSI shall also be responsible for reinstating any site in the project limits at no additional cost to JSCL. It shall be the MSI's responsibility to supply and install all hardware in compliance with the requirements. MSI shall be responsible for all implementation works on the project including any civil, structural, electrical, etc. works required to meet the project requirements.

#### **5.5. Software Development**

MSI shall be responsible for development and deployment of all software to meet the requirements of the project. It is preferred that MSI will use a world class Commercially Off The Shelf (COTS) or widely used software packages. However, some of the modules may require bespoke development. MSI shall be fully responsible for developing and implementing all software

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

required for the project. The development model should be Agile. The software development should base on the approved software and functional requirements specifications. The technology platform chosen for all software should be based on industry standards and shall be secure. Migration of data shall be the responsibility of the MSI. MSI is required to take the source data in the format, which is available with department. Subsequently, MSI is required to take complete ownership of data migration and develop a detailed plan for data migration. MSI will create SRS for application development and get approval from JSCL for UI design before commencing development and periodic review meetings should schedule for review of application and progress of the project.

### **5.6. System Study, Design, Development, Integration, Testing and Certification**

MSI would be responsible for development, adding functionality/Customizing over and above the applications (COTS product) or any bespoke software (If required) based on the unique requirements of JSCL/MCJ/Other Stakeholders. For the additional functionality that the JSCL wants to add, the MSI shall carry out a detailed systems study to refine the Functional Requirements Specifications that will be provide in Bid Document and formulate the System Requirements Specifications (SRS). The study should also include different integration points of JICCC with external agencies as per JSCL requirement. The MSI should also prepare a detailed document on the implementation of the customized or developed product with respect to configuration, customization and extension as per the requirement of JSCL. The MSI would also prepare a change/reference document based on changes or deviations from the base version of the application (COTS product).

MSI need to ensure the overall holistic operations. The MSI should also prepare a detailed document on the implementation of the customized or developed product with respect to configuration, customization and extension as per the requirement of JSCL. The MSI would also prepare a change/reference document based on changes or deviations from the base version of the application (COTS product).

The MSI will also be responsible for the following course of activities:

- Conducting Site preparation study for hardware, networking and office infrastructure

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- Preparation of System Requirements Specifications (SRS) for additional functionalities and different integration points with External Agencies.
- Preparation of implementation document with respect to Configuration, Customization and extensions as per the requirement of JSCL.
- Preparation of the Solution Design.
- Solution Development and/or Customization and/or Configuration and/or Extension as required.
- Development of reports
- Formulation of test plans and test cases for additional functionalities and different integrations with external agencies.
- Preparation of Change/Reference document which will include all the changes or deviations from the base version of the product.
- Testing of the configured solution and additional functionalities.

Enhancements of functions / additions of new modules / integration requirements to various interfaces (as and when they happen) should be incorporated in the SRS.

**Creation of Test Plans:** - Once the SRS is approved and design is started, the MSI would prepare all necessary Test Plans (including test cases), i.e., plans for Unit Testing, Integration and System Testing and User Acceptance Testing. Test cases for UAT will be developed in collaboration with domain experts identified by the JSCL. The Test Plans also include planning for the testing any integration with third party COTS solutions, any external agencies. The Test Plans should also specify any assistance required from the JSCL. The MSI should have the Test Plans reviewed and approved by JSCL. JSCL need to sign off on the test plans.

**High Level Design (HLD):** - Once the SRS will be approved, the MSI would complete the HLD and all HLD documents of the additional functionalities, integration with external agencies upon the approved SRS. The MSI would prepare the HLD and have it reviewed and approved by JSCL. JSCL will sign off on the HLD documents on the advice of JSCL.

**Detailed (Low Level) Design (LLD):** - The LLD would interpret the approved HLD to help application development and would include detailed service descriptions and

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specifications, application logic (including pseudo code) and UI design (screen design and navigation). The MSI would have the design documents reviewed and approved by JSCL.

**Application Development and Unit Testing:** - The MSI would develop the application in accordance with the approved requirements specifications and design specifications and according to the approved Project Plan; and carry out the Unit Testing of the application in accordance with the approved test plans. The MSI would also implement the changes proposed in the Change/Reference document and carry out a thorough regression testing for the functionality. The user acceptance testing and fine-tuning of the application would be at JSCL location.

**Regression, Integration, System and Functional Testing:** - After successful unit testing of all components, the MSI would conduct full-fledged integration testing, system testing and functional testing in accordance with the approved Test Plans for the configured/customized product, additional functionalities and also integration with external agencies. This would include exhaustive testing including functional testing, performance testing (including load and stress), scalability testing and security testing. The MSI's experts should do functional testing. Regression testing should be conducted for those functionalities identified in Change/Reference document to provide a general assurance that no additional errors have cropped up in the process of addressing the customizations and/or extensions. Making all necessary arrangements for testing including the preparation of test data, scripts if necessary and setup of test environment (across multiple platforms) shall be the responsibility of the MSI. The MSI along with JSCL should take the responsibility in coordinating with JSCL and other stakeholders for a smooth integration.

**Test Reports:** - The MSI shall create test reports from testing activities and submit to JSCL for validation.

**Test Data Preparation:** - The MSI shall prepare the required test data and get it vetted by JSCL. The test data shall be comprehensive and address all scenarios identified in the test cases. The MSI should also prepare the test data for all required integrations with external agencies.

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**User Acceptance Testing (UAT):** - Test Plans for UAT would be prepared by the MSI in collaboration with JSCL and his nominated domain experts. The MSI will plan all aspects of UAT (including the preparation of test data) and obtain required assistance from JSCL to ensure its success. JSCL will assemble representatives from different user groups based on inputs from the MSI and would facilitate UAT. The MSI would make the necessary changes to the application to ensure that the customized/developed product successfully goes through UAT.

### **5.7. System Integration**

MSI shall be responsible for the integration of all hardware and software supplied as part of this Project as per the technical and performance requirements that will be mentioned in BID DOCUMENT.

It shall be the responsibility of MSI to take approval of JSCL for the Integration of the overall system. Post systems integration, JSCL shall review and approve the overall performance of the integrated system as per the requirements of the BID DOCUMENT. MSI shall be responsible for fixing any requirements that do not comply with the overall requirements and approved detailed design at no additional cost to JSCL. MSI shall also carry out SMS Gateway Integration with the JICCC provided by Centre for e-Governance (CeG), Government of Punjab to send mass SMSs to groups/individuals, which can be either manual or system generated.

### **5.8. Testing**

All materials, equipment, systems, manufacturing or configuration processes, or other items under this project should be inspected and tested in accordance with the requirements. The testing shall include any existing civil infrastructure equipment or materials to be taken over by the MSI. Approvals or passing of any inspection by JSCL shall not, however, prejudice the right of JSCL or its representative to reject the material if it does not comply with the specification or requirements that will be mentioned in Bid Document. The MSI shall design and successfully complete tests to demonstrate that all equipment, materials and systems furnished and installed function in the manner intended and in full compliance with the

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requirements that will be mentioned in the BID DOCUMENT and the approved detailed design of the MSI.

All tests shall be subject to inspection or witnessing of tests by JSCL or its representative. MSI shall submit an Acceptance Test Procedures document (ATP), for JSCL approval prior to undertaking any testing.

The ATP shall clearly address:

- Type of testing and device to be tested
- How each testable specification requirement will be demonstrated, including the test environment and set-up, specific functionality to be tested, method for performing the test and quality assurance procedures;
- The results that will constitute success for each test
- The location for testing
- Personnel required to conduct the test
- Approximate time required to execute the test or set of tests
- Responsibilities of both the MSI and JSCL representatives during each test; and
- A cross-reference to which project requirements from the Compliance Matrix (to be developed by the MSI) are being addressed by each test procedure

The Compliance Matrix shall be used as a “punch list” to track whether requirements have not yet been demonstrated at each stage of testing. A requirement classified as having been “demonstrated” during a certain ATP stage can be subsequently redefined as having been “not demonstrated” if compliance issues emerge prior to System Acceptance. ATP shall be submitted to JSCL at least three (3) weeks in advance of any intended testing.

The equipment shall be inspected for standards of construction and electrical and mechanical safety. MSI will take appropriate certificate from the supplier. The MSI shall make test results available to JSCL or their designate for review immediately after completion of the tests.

ATP shall incorporate the following distinct stages for each deployed stage:

- **System Integration Testing (SIT):** The MSI is responsible for the proper and harmonious operation of all subsystems. Where connections of the new systems to

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existing subsystems or equipment supplied by others are required, the MSI is responsible for connection of equipment that will be specified in the Bid Document. Such a test will verify the full functionality of each subsystem, as they are interconnected. This will require testing to be coordinated by the MSI with JSCL or their designate. This work carried out under the direction of JSCL or their designate.

The MSI shall:

- Complete all equipment and subsystem tests
- Test each subsystem independently on the communications subsystem
- Add subsystems one at a time and monitor the overall performance
- Fail safe testing of all subsystems one at the time while monitoring overall systems performance

**Stress and Load Testing:** Comprehensive stress and load testing of e-Governance and Smart elements applications shall be conducted to demonstrate robustness and reliability of the system where necessary like Surveillance, Vehicle Tracking for SWM, Mobile App users etc.

**Security Testing (including penetration and vulnerability test):** Security test should be conducted to demonstrate security requirements at network layer and software applications. Components shall pass vulnerability and penetration testing for rollout of each phase. Components shall also pass web application security testing for portal, Mobile App, and other systems. Penetration test shall be carried out periodically and vulnerability analysis shall be carried half-yearly during maintenance phase. For all applications hosted on-cloud or hosted on premises, the security testing shall be a mandatory requirement.

**System Acceptance Tests (SAT):** SAT shall be conduct after the entire system has been installed, integrated and commissioned. Deficiencies, if any shall be rectified before the initiation of Burn-in Test. JSCL representatives shall witness SAT. SAT will carry out data migration, if any prior to commencement of this stage. SAT shall also include any performance and load testing for the software applications.

**Operational Acceptance Test:** It shall be conducted after successful SAT and Burn-in tests. Continuous fault free running of the System shall be tested. Post the completion of

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Operational Acceptance Test, System shall be considered for Operational System Acceptance and Defect Liability Period (DLP) shall commence. Operational Acceptance Test shall include the following

- Completion of all activities and fulfilment of all business, functional and technical requirements that will be listed in BID DOCUMENT
- Scrutiny of all inspection reports, audit findings, Contracts, licensing agreements etc.

MSI shall provide written Test Results Documentation (TRD) within one week of completing each stage of testing. The TRD shall document the results of each ATP procedure and provide an updated Compliance Matrix that indicates requirements that will be mentioned in BID DOCUMENT. The TRD must be approve before JSCL will grant System Acceptance. A sample format for the TRD is mention below:

Item #	Date		
Item Description	Tester		
Test			
Test Setup:			
Clause	Test Procedure	Expected Results	Actual Results
Witnessed: (This Does Not Constitute Approval) Reviewed and Approved:			

## 5.9. Third Party Acceptance Testing, Audit and Certification

The primary goal of Acceptance Testing, Audit & Certification is to ensure that the system meets requirements, standards, and specifications that will be mentioned in the BID DOCUMENT as needed to achieve the desired outcomes. The basic approach for this will be ensuring that the following are associated with clear and quantifiable metrics for accountability:

- Functional requirements
- Test cases and Requirements Mapping
- Infrastructure Compliance Review
- Availability of Services in the defined locations
- Performance and Scalability
- Security / Digital Signatures
- Manageability and Interoperability

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- SLA Reporting System
- Project Documentation
- Data Quality Review

As part of Acceptance testing, audit and certification should be performed through a third party agency. JSCL shall review all aspects of project development and implementation covering software, hardware and networking including the processes relating to the design of solution architecture, design of systems and sub-systems, coding, testing, business process description, documentation, version control, change management, security, service oriented architecture, performance in relation to defined requirements, interoperability, scalability, availability and compliance with all the technical and functional requirements. A different agency should be selected to conduct third party audit. Such an involvement of the Acceptance Testing & Certification agencies (STQC/CERT-IN Empanelled Agency), nominated/appointed by MSI with prior approval of JSCL, will not, however, absolve the MSI of the fundamental responsibility of designing, developing, installing, testing and commissioning the various components of the project to deliver the services in perfect conformity with the SLAs.

Following discusses the acceptance criteria to be adopt for system as mentioned above:

- **Functional Requirements:** - The system developed/customized by MSI shall be reviewed and verified by the agency against the Functional Requirements signed-off between JSCL and MSI. Any gaps, identified as severe or critical in nature, shall be addressed by MSI immediately prior to the deployment of the system in production. One of the key inputs for this testing shall be the traceability matrix to be develop by the MSI. Apart from Traceability Matrix, agency may develop its own testing plans for validation of compliance of system against the defined requirements. The acceptance testing w.r.t. both independent third party agency (external audit) as well as the selected internal department users (i.e. User Acceptance Testing) shall perform the functional requirements.
- **Infrastructure Compliance Review:** - Third party agency shall perform the Infrastructure Compliance Review to verify the conformity of the Infrastructure supplied by the MSI. Compliance review shall not absolve MSI from ensuring that proposed infrastructure meets the SLA requirements.

- **Security Review:** - The software developed/customized for system shall be audit by the agency from a security & controls perspective. Such audit shall also include the IT infrastructure and network deployed for system. Following are the broad activities to be perform by the Agency as part of Security Review. The security review shall subject the system for the following activities:
  - a) Audit of Network, Server and Application security mechanisms
  - b) Assessment of authentication mechanism provided in the application /components/modules
  - c) Assessment of data encryption mechanisms implemented for the solution
  - d) Assessment of data access privileges, retention periods and archival mechanisms
  - e) Server and Application security features incorporated etc.
- **Performance:** - Performance is another key requirement for system and agency shall review the performance of the deployed solution against certain key parameters defined in SLA that will be mention in the Bid Document. Such parameters include request-response time, workflow processing time, concurrent sessions supported by the system, Time for recovery from failure, Disaster Recovery drill etc. The performance review also includes verification of scalability provisioned in the system for catering to the requirements of application volume growth in future.
  - a) The MSI must provide System and Database Performance System for all servers in the Data center
  - b) The MSI must provision for End-User response time monitoring and transaction based deep-dive analysis for Web based applications.
  - c) The MSI must provision for Integrated Performance Management System for Monitoring Networks, Systems & Databases.
  - d) The MSI must provide a Traffic Analysis and Reporting System for deep-dive diagnostics.
- **Availability:** - The system should be designed to remove single point failures. Appropriate redundancy should be built into all the critical components to provide the ability to recover from failures. The agency shall perform various tests including network, server, security,

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DC/DR fail-over tests to verify the availability of the services in case of component/location failures. The agency shall also verify the availability of services to all the users in the defined locations.

### **5.10. Capacity building & Training**

Post the system integration, MSI shall train JSCL representatives to operate the equipment installed and to conduct any routine diagnostics and routine maintenance work. Training activity shall be done during Pilot Deployment and before Final Deployment. JSCL and MSI shall mutually agree upon the period of training. The actual number of each of above categories of trainees will be provided at Design Stage.

The main challenges to be addressed effectively by the MSI are the diverse trainee base, wide variability in education and computer proficiency and minimal availability of time. The MSI holds the responsibility for creation of a detailed and effective training strategy, user groups and classifications, training plan and guidelines, detailed training material, training program designed and their delivery to the target groups.

- **Develop Overall Training Plan:** MSI should do the finalizing of detailed Training Plan for the program in consultation with JSCL covering the training strategy, environment, training need analysis and role based training curriculum. MSI shall own the overall Training plan working closely with JSCL. MSI shall coordinate overall training effort. Following is the indicative list of the training programs that needs to be administered to the group of officials. The overall responsibility of administering the training program lies with the MSI.
  - Awareness and sensitization of benefits of IT
  - Basic Computer Awareness & Role based training for application users
  - Trainers Training
  - System Administration & Support Training

The Training Plan (TP) shall be developed for each component / module and shall include the training schedule and course outlines. The MSI must provide the Training Plan for review to JSCL at least three weeks in advance of the start of training. The Training Plan must be approved by JSCL before commencement of training.

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MSI shall deliver training to the end users utilizing the infrastructure at the designated Training Centres. Role based training for the Senior Officers shall be conducted at a suitable location by the MSI. Most of the training would be an Instructor-Led Training (ILT) conducted by trained and qualified instructors in a classroom setting. To maintain consistency across trainings, standard templates should be used for each component of a module.

- **Develop Training Schedule and Curriculum:** MSI shall develop and manage the training schedule in consultation with JSCL, aligned with the overall implementation roadmap of the project and coordinate the same with all parties involved. Training schedule shall be developed by solution and shall be optimized to reduce business impact and effective utilization of Training infrastructure and capacities. The training curriculum should be organized in modules.
- **Learning Management System and Training Portal:** Developing a Learning Management System and Training Portal for providing access to all training content online including documents, demo, audio, video, simulation and practice, assessment, self-learning and context sensitive help and monitoring, support and reporting. Learning management tool shall be a simple webpage comprising of training materials arranged in modular approach. The tool shall have user manuals, audio, video etc. with user specific roles and responsibilities.
- **Training Programs / Curriculum:** Following is the indicative list of the training programs that needs to be administer to the group of officials as identified below. The overall responsibility of administering the training program lies with the MSI.
  - Basic IT skills and use of computers to creating awareness about the benefits of ICT and basic computer skills
  - Role-based training on the COTS based applications (Basic and Advanced) - This training should be in a role based, benchmarked and standardized format, and shall be available in English/Hindi/Punjabi and lead to learning completion and assessment. It should also allow for self-learning and retraining. Training would include mechanism for demonstration using audio / video / simulated / demo practice exercises.
  - System Administrator training: a few members of the various departmental staff with high aptitude would be trained to act as system administrators and trouble-shooters for the system.

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- Customization of the Training Manuals, User Manuals, Operational and Maintenance Manuals provided along with the Software.

An indicative content structure for the training programs are list as below:

SL No.	Type of Training	Training Content	Days (minimum)
1	<b>Awareness and sensitization of benefits of ICT</b>	This module shall cover Principles of e-governance; it shall also cover the advantages of use of ICT in CCTV Surveillance, ITMS and MCJ etc. It shall briefly cover the technology trends and how it can be put to use by use of live examples of ICT use across the world	1
2	<b>Basic computer awareness</b>	This module shall cover the fundamental concepts of Computer, Internet, Peripherals, System software and Application Software. It shall also cover the use of Office suite in detail. It can also touch upon use of office tools such as printers, copiers and scanners as well as basics in use of computers (checking network connections, etc.).	1
3	<b>Role based system training on The JICCC Application Software</b>	This module is required to train the officials of various levels in operating the application. The training is to be provided to the staff depending upon their role and responsibilities in the workflow. During this training, the trainees could also be asked to carry out the routine functions using the software. The training should be module based and cover all modules of JICCC. Training materials should be provided to users	2

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SL No.	Type of Training	Training Content	Days (minimum)
4	<b>System Administration support and Trouble Shooting</b>	Skills in Troubleshooting vis-à-vis application, standard software and networking (for those with the aptitude and/or prior training)	3

MSI shall ensure that the training content meets all the objectives of the training course. The material shall be developed in English/Hindi/Punjabi language. MSI shall also develop the training material for delivery through Computer Based Training, Instructor Led Training, Online User Material/Help Manuals and Job Aids. MSI shall provide detailed training material providing step-by-step approach in soft and hard copies to all offices for reference.

**Trainees:** The MSI shall provide training courses for at least:

- Master trainers
- Decision Makers/ Management
- JSCL operations personnel
- Users of Various Systems/Applications developed as part of the project.

JSCL will also identify and nominate the master trainers and MSI shall be responsible to provide the training. These master trainers shall conduct all future recurring trainings. It is MSIs responsibility to ensure that the master trainers are well train and ensure that the master trainers have a better understanding of system through simple evaluation.

- **Training Material:** MSI shall provide all training materials in both Office Suite and Adobe PDF formats, consisting of graphics, video and animations on Digital Video Disc (DVD) with a permission to reproduce copies later on.
- **Training Effectiveness Evaluation:** MSI shall evaluate the effectiveness of all end user's trainings using electronic or manual surveys. MSI shall be responsible for analysing the feedback and arrange for conducting refresher training, wherever needed. JSCL will periodically monitor the training effectiveness through the performance metrics and Service levels and the MSI shall comply with the same.

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The indicative no. of trainees is as provided below.

<b>Department</b>	<b>No of Trainees</b>
<b>Police</b>	250
<b>Traffic Police</b>	150
<b>Municipal Corporation</b>	50
<b>District Administration</b>	10
<b>JSCL and PMC</b>	50
<b>Other</b>	20
<b>Total</b>	<b>230</b>

### **5.11. Change Management**

It is the responsibility of MSI to help the agencies with complete Change Management exercise, which is required to make this project a success. In fact, Change Management will have to subsume ‘training’ as a key enabler for change. Following outlines, the responsibilities of MSI with respect to designing and implementation of change management plan for the Project.

- Change Management initiative, to be designed & implemented by MSI, shall focus on addressing key aspects of Project including building awareness in personnel on benefits of new system, changes (if any) to their current roles & responsibilities, addressing the employee’s concerns & apprehensions w.r.t. implementation of new system and benefits that are planned for the employees.
- It is required that if MSI doesn’t operate in the Change Management, Communication and Training domain then he collaborates with/ hires services of a specialist agency who will be responsible for complete Change Management, Awareness and Communication implementation and monitoring.
- The agencies requiring Change Management as part of the project shall form various stakeholder groups to address the Change Management Initiative. Stakeholders are all those who need to be considered in achieving the project goals and whose participation and support

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

are crucial to its success. A key individual stakeholder or stakeholder group is a person or group of people with significant involvement and/or interest in the success of the project.

- Stakeholder analysis identifies all primary and secondary stakeholders who have an interest in the issues with which the Jalandhar Integrated Command & Control Center is concerned. The stakeholder groups will be the set of core users (Change Agents) who will directly participate in the awareness and communication initiatives, workshops, and provide feedback to the governance Committee

### **5.12. Final Deployment and Documentation**

After addressing the JSCL feedback and any deficiency observed during the Pilot deployment and upon completion of System Acceptance Tests (SAT), final deployment of the Jalandhar Smart City solutions shall be considered by the MSI. For achievement of final deployment, MSI shall also be responsible for development of a cutover strategy, which shall include initial data take on, sequence of data takes on, set up of support mechanisms to minimize business impact due to any cutover activities.

Post the final deployment, MSI shall handover detailed documentation that describes the site conditions, system design, configuration, training, as-built conditions, operation and maintenance. All documentation shall be in English, Hindi & Punjabi (as agreed with JSCL), shall utilize metric measurements, and shall be submitted directly to JSCL in paper hardcopy and electronically in Word/AutoCAD/Excel/Project and Adobe Acrobat that should be editable or updated.

All installation drawings shall be prepared in AutoCAD, GIS and Adobe Acrobat and provided on CD-ROM as well as hard copies. The drawings shall contain sufficient detail including but not limited to equipment dimensions, interfaces, cable details, equipment mounting and fire protection. Electrical and electronic drawings shall be supplied to show engineering changes made to any component or module any time during the project period.

‘As-built’ Documents delivered by the MSI shall include:

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- An inventory of all components supplied including model name, model number, serial number and installation location
- An inventory of all spare parts supplied including brand, model number, and serial number and storage location
- All reference and user manuals for system components, including those components supplied by third parties
- Point of Contact for each OEM for maintenance
- Warranties and Maintenance schedules for the hardware procured
- All warranties documentation, including that for components supplied by third parties
- As-built in CAD and GIS
- A diagram indicating the as-built inter-connections between components
- Software documentation which also includes the version number of all software, including that supplied by third parties
- Cable run lists and schedules
- All network and equipment details such as IP addresses, user names, and passwords
- Data communication protocols; and
- ‘As-Built’ drawings for all components installed

Maintenance documents shall include:

- Equipment installation and operating documentation, manuals, and software for all installed equipment
- System Installation and setup guides, with data forms to plan and record options and configuration information
- The schedule/procedures for preventative maintenance, inspection, fault diagnosis, component replacement and on-site warranty support administration on each system component
- Hard copies of manufacturer's product specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM or non-volatile memory stick of the hard-copy submittal
- Complete list of replaceable parts including names of vendors for parts not identified by universal part numbers (such as EIA codes)

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- Manufacturer's product specification sheets, operating specifications, design guides, user's guides & Permits
- Contractor names and telephone number lists for all project trades

MSI shall provide Systems Manuals (SM), documentation including:

- The configuration and topology of central systems hardware and software
- Central systems software functions and operations
- Scheduled maintenance required for the central systems; and
- Database structure and data dictionary

MSI shall also provide following documents for any be-spoke software development:

- Business process guides
- Program flow descriptions
- Data model descriptions
- Sample reports
- Screen formats
- Frequently Asked Questions (FAQ) guides
- User Manuals and technical manuals
- Any other documentation required for usage of implemented solution

Documentation shall require re-issues if any change or modification will be made to the equipment proposed. MSI may re-issue individual sheets or portions of the documentation that is affected by the change or modification. Each re-issue or revision shall carry the same title as the original, with a change in version number and issue date.

### **5.13. Operational System Acceptance**

At the completion of operational acceptance test, the system shall be considered for operational system acceptance. At the close of the work and before issue of final certificate of completion by JSCL, the MSI shall furnish a written guarantee indemnifying JSCL against defective materials and workmanship for a period of one (1) year after completion, which is referred to as Defect Liability Period. The MSI shall hold himself fully responsible for reinstallation or replace free of cost to JSCL during the Defect Liability period. MSI shall provide approved temporary replacement

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

equipment and material such that the system remains fully functional as designed and commissioned during repair or replacement activities at no cost to JSCL.

### **5.14. Comprehensive Maintenance for System and Services**

It is the responsibility of the MSI to perform the comprehensive maintenance of both hardware and software, required up-gradations in the system, expansion of the system, technical manpower, spares management and replenishment, performance monitoring and enhancements of the Jalandhar Smart City solutions deployed as part of this project and shall maintain service levels that will be defined in BID DOCUMENT. All equipment and material supplied by the MSI shall be provided with five warranty against defects of design and manufacturing and against faults and failures associated with workmanship of MSI and its sub-contractors commencing from operation acceptance of the system.

Any changes/upgrades to the software during comprehensive maintenance shall be subject to comprehensive and integrated testing by MSI to ensure that changes implemented in system meets the specified requirements and does not affect any other function of the system. Issue log for errors and bugs identified in the solution and any change done in solution (vis-à-vis the FRS, BRS and SRS signed off) shall be periodically submitted to JSCL. MSI shall also be responsible for operating City website, city portal, and city application including all support, content updates and upgrades throughout the duration of the project. Periodically, IT audits will be conducted by JSCL/PMC third party auditor during the support period.

MSI shall ensure OEM support during Comprehensive Maintenance stage for system performance, performance tuning, upgrades etc. MSI shall provide all support for formulation of all policies and procedures related to System Administration, Data Base Management, applications, archives, network management & security, back up and data recovery and archive, data synchronization after crash. Assistance to JSCL shall be provided as needed in management of legacy data interfaced, print spools, batch jobs, printer configuration etc.

The MSI shall also maintain the following minimum documents with respect to ICT components:

- High level design of system;
- Module level design of system;
- System Requirement Specifications (SRS);

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- Any other explanatory notes about system;
- Traceability matrix;
- Compilation environment

MSI shall also ensure Updating of following documentation of software system as applicable:

- Documentation of source code;
- Documentation of functional specifications;
- Application documentation is updated to reflect on-going maintenance and enhancement including FRS and SRS, in accordance with the defined standards;
- User manuals and training manuals are updated to reflect on-going changes/enhancements;
- Adoption of standard practices in regards to version control and management

The communication costs (Internet charges, telephone charges, 4G/GPRS connectivity charges) and any other incidental charges related to maintenance period shall be in the scope of the MSI and considered to be included in the proposal submitted by the MSI for the entire project period. Any planned and emergency changes to any component during maintenance period shall be through a change management process. For any change, MSI shall ensure

- Detailed impact analysis;
- Change plan with roll back plan;
- Appropriate communication on change required has taken place;
- Approvals on change;
- Schedules have been adjusted to minimum impact on production environment;
- All associated documentation is updated post stabilization of the change;
- Version control maintained for software.

## **5.15. Support Staff Required**

Three (4) types of support staff shall be provided by MSI during Operations and Maintenance phase:

- JICCC Operations Staff
- Helpdesk Support Staff
- Maintenance Support Staff

### **▪ JICCC Operations & Helpdesk Staff**

MSI shall depute JICCC Operators for maintaining the operations room on a 3-shift basis, according to the following:

#### **Operations Staff:**

- One (1) Day-Shift comprising of 4 personnel;
  - Other Management personnel during day shift
    - Project Manager
    - Application Integration Expert
    - Security expert
    - Intelligent Signalling & Surveillance expert
    - Project Management support
    - ICCC & IoT Expert
    - Network & Support Engineer
    - E-Governance expert
    - Operations Staff
    - Data scientists & AI Engineer
  - One (1) Evening-Shift comprising of 2 personnel;
  - One (1) Night-Shift comprising of 2 personnel

MSI shall also provide adequate support staff at Helpdesk. The support staff at Helpdesk shall provide 24\*7 services, work in a shift based system and provide full support coverage of Helpdesk and maintain the system as per SLAs defined. At a minimum, 4 support personnel shall be deputed at Helpdesk in first shift and two personnel in second and third shifts during maintenance phase.

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- **IT Helpdesk:**

Three (3) shifts comprising of minimum 2 personnel each for morning and evening and two for night shift.

- **Maintenance Support Staff**

Well-trained, efficient and effective Maintenance Support Staff shall be provided by the MSI during the maintenance phase of the project to support JSCL operational and technical requirements in day-to-day operations of the smart city solutions provided by MSI. The MSI Maintenance Support staff shall address any fault originating for the Jalandhar smart city components in the least time possible. The staff assigned shall be well qualified to attend to the emergencies and shall be able to communicate in an effective and efficient manner. The supports staff shall provide 24\*7 services, work in a shift based system and provide full support coverage of the Jalandhar smart city solution.

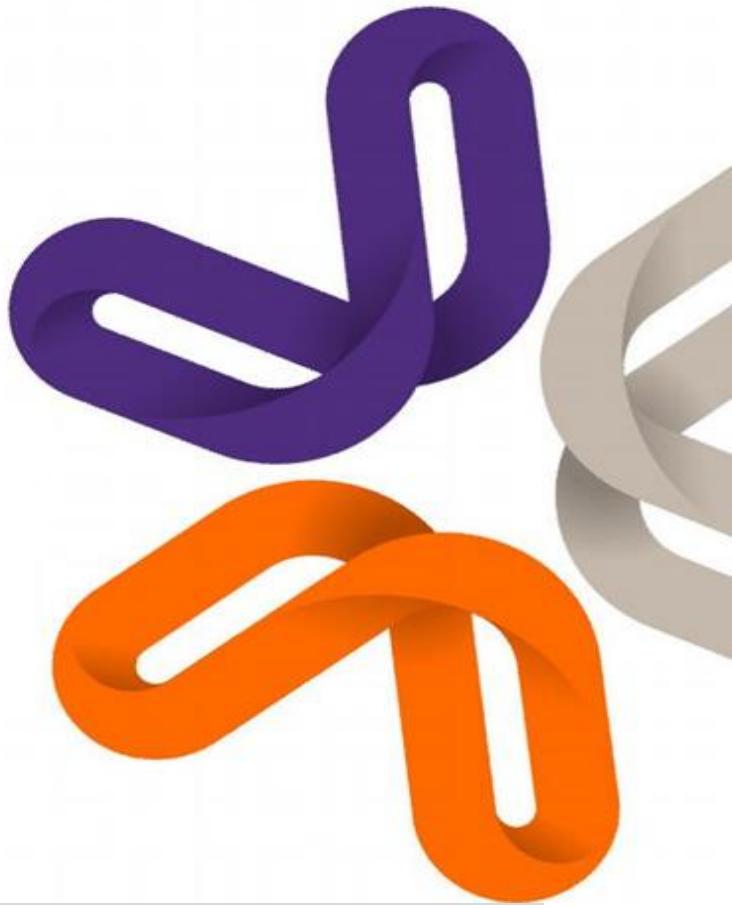
- **Facility Management Staff**

Facilities management include but not limited to building and grounds maintenance, cleaning, catering and vending, security, space management, utilities management etc. and associated manpower shall also be under the scope of the MSI. At a minimum, MSI shall depute Facility Management staff of at least 5 personnel, which shall work in a shift-based system to provide 24\*7 services. Staff requirement per each shift is as per below:

- Two (2) shifts comprising of 2 personnel each;
- One (1) Night shift comprising of 1 personnel each.

**Note:** The above-mentioned staffing is indicative and MSI need to depute additional staff as per the requirement of project.

# Chapter 6: Roles and Responsibility



## 6. Roles and Responsibilities

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**Below are the indicative roles and responsibilities of Master System Integrator, which need to fulfil during execution of Smart city Jalandhar Project.**

1. MSI shall engage early in pro-active consultations with all the respective stakeholders to establish a clear and comprehensive project plan, which is in line with the priorities of all project stakeholders and the project objectives.
2. MSI shall plan the bandwidth required for operationalizing each Smart Jalandhar City initiative until the operations and maintenance period. The bandwidth requirement shall be analysed and procured by the MSI and make a third party agreement with network/internet service period.
3. MSI will coordinate with the Network Service Provider, shall study the existing fibre layout and existing network in the Jalandhar City to understand the existing technology adopted in each of the following areas (not limited to):
  - OFC/Network/Wi-Fi
  - Surveillance Infrastructure – CCTV Cameras, Data Communication, Monitoring, Control Room and Infrastructure
  - Any other Smart City initiatives envisaged for Jalandhar
4. MSI shall assess existing infrastructure's current ability to support the entire solution and integrate the same with the solution wherever applicable and possible
5. MSI shall be responsible for planning and designing of the access network architecture (access controllers, backhaul connectivity, routers, switches, etc.) to meet the technical, capacity and service requirements for all smart Jalandhar City initiatives
6. MSI shall judiciously evaluate the resources and time planned for undertaking the current state assessment, given the overall timelines and milestones of the project.
7. Validate / Assess the re-use of the existing infrastructure if any with site identified by JSCL
8. Supply, Installation, and Commissioning of entire solution at all the locations
9. MSI shall Install and commission connectivity across all designated locations
10. MSI shall establish high availability, reliability and redundancy of the all the elements/components to meet the Service Level requirements which will be defined in BID DOCUMENT

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11. MSI shall be responsible for upgradation, enhancement and provisioning additional supplies of network (including active / passive components), hardware, software, etc. as requisitioned by JSCL
12. MSI shall ensure that the infrastructure provided under the project shall not have an end of life during the entire project duration.
13. MSI shall ensure that the end of support is not reached during the concurrency of the project and 4 years thereafter
14. MSI shall include periodic proactive maintenance of field level equipment's like cameras, junction boxes, switches etc. for O & M period of 4 years
15. Video feeds shall be stored at edge location for one day in case of failure of connectivity
16. All traffic data and metadata required for trend analysis shall be available for at least two years and CCTV videos shall be available for 30 days and meta data or flagged videos shall be available for two years on disaster site
17. MSI shall ensure compliance to all mandatory government regulations as amended from time to time
18. The MSI 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
19. All the software licenses that the MSI proposes shall be perpetual software licenses along with maintenance, upgrades and updates. The software licenses shall not be restricted based on location and JSCL shall have the flexibility to use the software licenses for other requirements if required. Software assurance may be considered.
20. The MSI shall ensure there is a 24x7 comprehensive onsite support for project duration for respective components to meet SLA requirement that will be define in BID DOCUMENT. The MSI shall ensure that all the OEMs have an understanding of the service levels required by JSCL. MSI is required to provide the necessary MAF (Manufacturer Authorization Form) as per the format that will be provided in the BID DOCUMENT in support of OEMs active support in the project
21. Considering the criticality of the infrastructure, MSI is expected to design the solution considering all the project requirement of no single point of failure with high level of redundancy and resilience to meet the system uptime requirements

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22. MSI shall be responsible for periodic updates & upgrades of all equipment, cabling and connectivity provided at all locations.
23. MSI shall be responsible for setting up / building / renovating the necessary physical infrastructure including provisioning for network, power, rack, etc. at all the locations
24. MSI 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 JSCL requirements
  - ii. Size and propose 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
  - iii. Size and provision the WAN bandwidth requirements across all locations considering the application performance, data transfer, DR and other requirements for smart Jalandhar City initiatives
  - iv. Size and provision the internet connectivity for Service Provider network and Network Backbone
  - v. Size and provision for bandwidth as a service for operations of JICCC
  - vi. Liaise with service providers for commissioning and maintenance of the links
  - vii. Furnish a schedule of delivery of all IT/Non-IT Infrastructure items
  - viii. JSCL may at its sole discretion evaluate the hardware sizing document proposed by the MSI. The. MSI needs to provide necessary explanation for sizing to JSCL
  - ix. Complete hardware sizing for the 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 MSI shall provide for all required features like support for multiple routing protocols, congestion management mechanisms and Quality of Service support
  - xii. The MSI 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

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25. MSI shall directly interact with electricity board for provision of mains power supply at all desired locations for any Field Infrastructure solution. The Jalandhar Smart City shall facilitate, if any documentation is required from its side.
26. All existing road signs, which are likely to be effect by the works, are to be carefully take down and stored. Signs to be re-erected shall be clean, provided with new fixings where necessary and the posts re-painted in accordance with Jalandhar Smart City guidelines. Road signs, street nameplate etc. damaged by the MSI during their operation shall be repaired or replaced at the MSI's cost.
27. It's the responsibility of MSI to integrate the ICCC system with the other application developed by / for Jalandhar Govt. department post taking required approval from authorized authority
28. 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 as required based on detailed study may need to be dismantled (where ever applicable) and replaced with the new systems proposed shall be done by MSI. The dismantled infrastructure shall be delivered at the Jalandhar Smart City designated location without damage, at no extra cost.
29. Prior to starting the site clearance, the MSI shall carry out survey of field locations. The Jalandhar Smart City shall be fully informed of the results of the survey and the amount and extent of the demolition and site clearance shall be agreed with JSCL.
30. Lightning Proof Measures:
  - a. The MSI shall comply with lightning-protection and anti -interference measures for system structure, equipment type selection, equipment earthing, power, signal cables laying.
  - b. Corresponding lightning arrester shall be erect 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.
  - c. 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 earthing.
  - d. The Internal Surge Protection Device for Data Line Protection shall be select as per zone of protection described in IEC 62305, 61643-11/12/21, 60364-

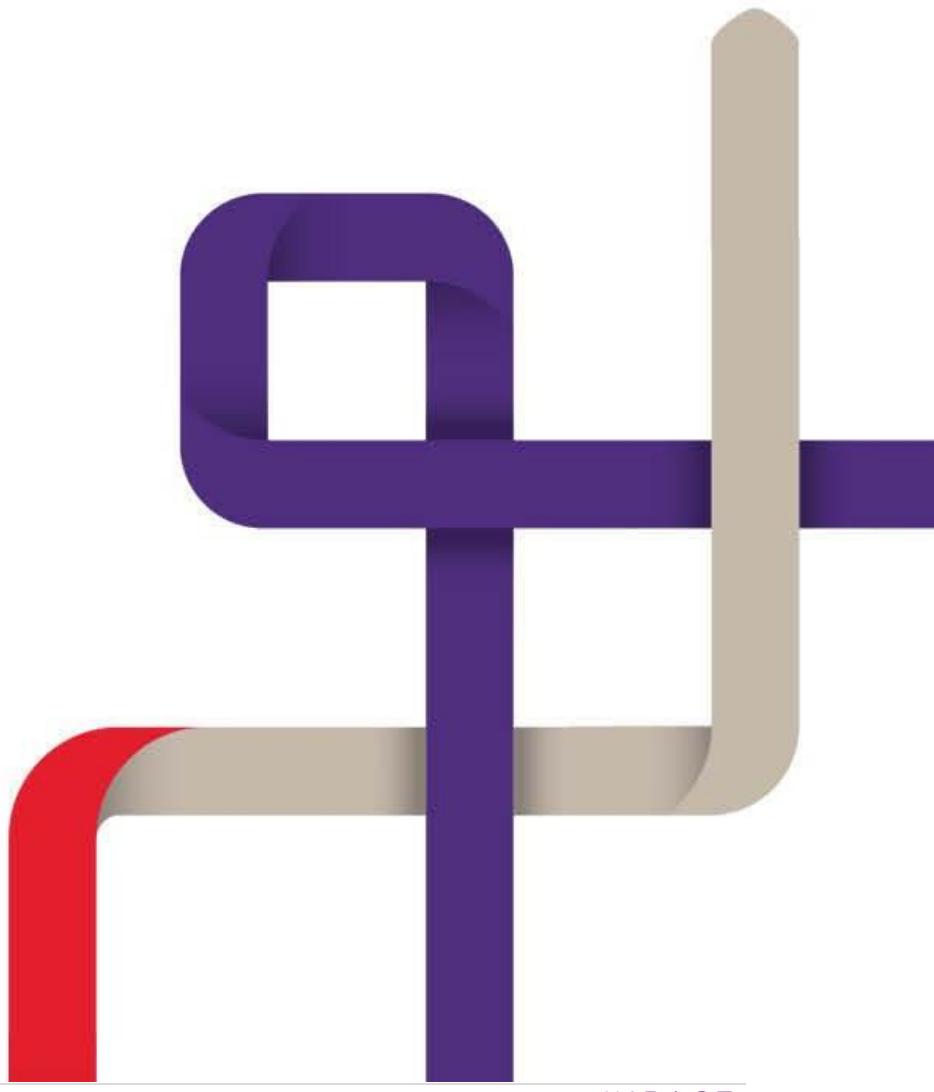
## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

- 4/5. Data line protection shall be used for security system, server data path and other communication equipment.
- e. Data line protection shall be installed as per zone defined in IEC 62305.
- Type 1 device shall be installed between zone 0B and zone 1.
  - Type 2 devices shall be installed before the equipment in zone 2 and 3.
31. Master Systems Integrator (MSI) needs to deploy the team proposed for the project and ensure that a Project Inception Report is submitted to JSCL which should cover following aspects:
- a. Names of the Project Team members, their roles & responsibilities
  - b. 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).
  - c. Responsibility matrix for all stakeholders
  - d. Risk and mitigation plan
  - e. Detailed Project Plan, specifying dependencies between various project activities / sub-activities and their timelines.
32. Feasibility Report for all ICT projects mentioned in the report should be conducted. Master System Integrator (MSI) should provide as part of feasibility report the detailed To-Be designs (Junction layout plans) specifying the following:
- a. High Level Design (including but not limited to)
  - b. Application architecture documents
  - c. ER diagrams and other data modelling documents
  - d. Logical and physical database design
  - e. 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)
      - i. Application flows and logic including pseudo code or GUI design (screen design, navigation, etc.)
      - ii. Database architecture, including defining data structure, data dictionary as per standards laid-down by Government of India/ Government of Punjab

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- Location of all field systems and components proposed at the junctions/other locations on GIS Map
- 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 (Pump Out Plug)
- Electrical power provisioning

# Chapter 7: Scope of Project



## 7. Scope of Project

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The location for JICCC is yet need to be finalize. A common Jalandhar Integrated Command Control Centre (JICCC) shall be implement in around ~ 5000 Sq. Ft area. The location where Viewing centres/ Video feeds as required shall finalized at the times of system study conducted by MSI.

**Note:** Smart city office & Jalandhar Traffic police office will be collocated with JICCC

The Floor Plan of JICCC and other details will be provided in BID DOCUMENT. The indicative details of sections and the office space which will be provided to respective section resource in JICCC is mentioned below

SECTIONS	DETAILS	AREA	AREA
		(sq.mt.)	(sq. ft.)
<b>Center - In Charge</b>	12 sq.mt. per cubicle	10	107.9
<b>JICCC Manager/Operations Manager</b>	12 sq.mt. per cubicle	6	64.74
<b>System Administrator</b>	12 sq.mt. per cubicle	6	64.74
<b>Helpdesk Manager</b>	12 sq.mt. per cubicle	6	64.74
<b>ICCC Solution Architect</b>	12 sq.mt. per cubicle	6	64.74
<b>GIS Expert</b>	12 sq.mt. per cubicle	6	64.74
<b>IT Manager</b>	12 sq.mt. per cubicle	6	64.74
<b>Analytics Center - Data scientists e-Challan(2), Forensic</b>	12 sq.mt. per cubicle	6	64.74
<b>Facility Staff</b>		8	86.32
<b>Command &amp; Control Room</b>	16 workstations, 7 X 3 = 21 screens, 50" on video wall	130	1402.7
<b>Data Center &amp; Network Operations Center</b>		16	172.64
<b>Conference Room</b>	Conference for 20 people - 2	30	323.7
<b>IT Team Room</b>	8 workstations	60	647.4

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<b>IT Store</b>		12	129.48
<b>Helpdesk Team Room</b>	10 workstations	80	863.2
<b>Rest Rooms for Male and Female &amp; Drinking Water</b>	1 W/C per 25 males, 1 W/C per 15 females, 1 urinal for 7-20 persons, 2 for 21-45 person	20	215.8
<b>Pantry</b>		12	129.48
<b>Power backup room</b>		10	107.9
<b>Reception, Waiting lobby, Stair case</b>		37	399.23
<b>TOTAL AREA REQUIREMENT (INDICATIVE)</b>		467	5038.93

### 7.1. Jalandhar Integrated Command Control Centre (JICCC)

With a view of enabling varied and respective stakeholders to operate specified Smart City Components, it is proposed to build Jalandhar Integrated Command Control Centre (JICCC), which will cater to the City Operations, City Surveillance, Emergency Response System, Helpdesk and the components.

While the entire Smart City initiative to build around various components of smart interventions for different citizen centric services and facilitating administration, Jalandhar Integrated Command Control Centre or JICCC brings all the outputs onto a single platform and give an integrated view. This works as a monitoring system that helps in decision-making process a lot simpler and comprehensive. It acts as support mechanism to the city administration/authorities in their daily routine activities as well as during exigency situations. This dynamic response to situations, both pre-active and re-active will truly make the city operations “SMART”.

Apprehending the huge volume of information generation with the help of Pan City ICT infrastructure, a centralized command control center is envisaged. All the smart solutions, network components will converge at the centralized command control center. Jalandhar Integrated Command Control Centre (JICCC) involves leveraging on the information provided by various departments and providing a comprehensive response mechanism for the day-to-day challenges across the city. JICCC shall be a fully integrated, web-enabled solution that provides seamless incident -response management, collaboration and geo-spatial display. Additional third party modules can be integrated as per solution requirements.

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- The JICCC shall facilitate the viewing and controlling mechanism for the selected field locations in a fully automated environment for optimized monitoring, regulation and enforcement of services. The JICCC shall be accessible by operators and concerned authorized entities with necessary role based authentication credentials
- Activities at the JICCC will comprise of monitoring services, incident management and response as per the Standard Operating Procedures (SOPs) with defined escalation procedures.
- The JICCC will manage and monitor entire the project and services. All the information and data collected through various components of the smart city project will be viewable through a centralized Application.
- JICCC will comprise of a centralized dashboard for entire smart city project for the reporting and viewing of all the project components and key performance indicators of systems such as CCTV Camera Surveillance System, Intelligent Signalling, Environmental Monitoring etc. through a single interface.
- JICCC will act as the centralized monitoring and decision making hub for managing Smart Applications and related Infrastructure project activities. Various smart elements will be able to use the data and intelligence gathered from operations of other elements so that civic services are delivered lot more efficiently and in an informed fashion.
- The benefits of the JICCC will be measured from two perspectives:
  - In times of disaster – This will improve the response time, coordination amongst various agencies and faster restoration of services post disaster.
  - In day-to-day non-emergency scenarios – This will improve the response time of Municipal Corporation towards citizen complaints, which in turn will lead to citizens using the system more frequently. This will also enable the various departments to offer better services to citizens including, utilities, security, traffic, etc.

### **7.1.1. Various Components of JICCC**

The Integrated Command and Control Centre shall comprise of:

- a. Video Wall & Controller system
- b. Data Centre
- c. City Operations Platform

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- d. Furniture, Fixtures, Operator Workstation and accessories
- e. Conference / Situation Room
- f. Integrated Dashboard
- g. Standard Operating Procedure Tool
- h. Helpdesk, Technical and Operations Staff

The Jalandhar Integrated Command Control Centre (JICCC) will be the nodal point of availability of all online data and information related to smart services. It will be a full-fledged system equipped with all the operational rights to its specified users. This will have integration with various components with data feed view and sharing. It will also have management console to perform all the operations.

### **The Component Modules**

The scope will entail design, development, installation, operation and maintenance of the following components JICCC:

- Centralized Command Control Room
- Data Center to cater to all Smart components of Smart City
- City Surveillance
- ITMS
- Environmental sensors
- GIS Integration
- Mobile Application for Smart Solutions
- Disaster Management
- Data Analytics Center
- Helpdesk

### **Viewing Centres**

Viewing centres shall have the following:

- LED screens for viewing and controlling video feeds
- Work station, Connectivity to Central Integrated Command Control Center
- Partition for Viewing center & Biometric access control with air conditioner as applicable

## Component Architecture

The component architecture of JICCC is mentioned below along with logical diagram.

1. Field IT Infrastructure Layer
2. Network Layer
3. Data Center Layer
4. Application Layer
5. Integration Layer
6. Command and Communication Center Layer
7. Security Layer

This component architecture is indicative in nature and bring clarity on the overall scope of project and its intended use. The MSI is expect to carry out the detail requirement analysis and finalize the technical architecture in consultation with JSCL and its consultants.

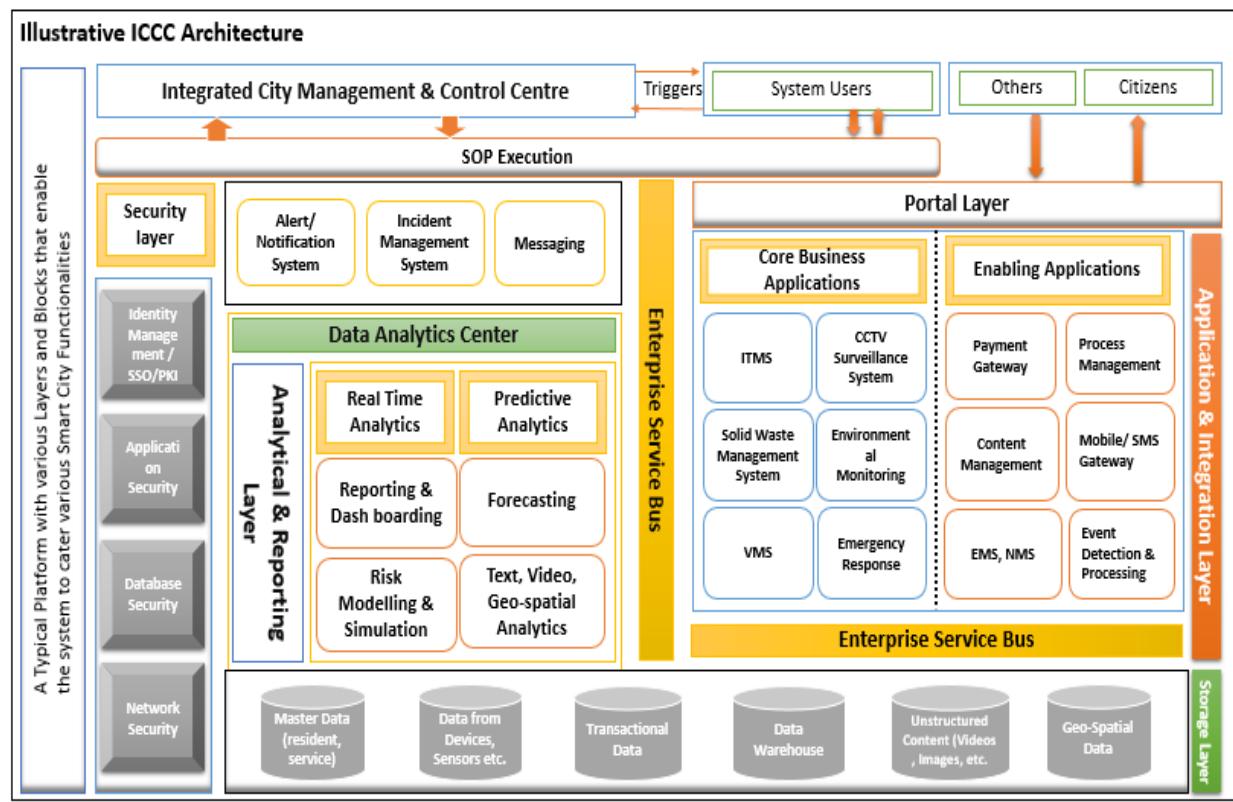


Figure: Logical diagram of JICCC

1. **Field IT Infrastructure Layer** –The sensor layer will help the city administration gather information about the ambient city conditions or capture information from the edge level devices like GPS devices, cameras, etc. MSI is expected to deploy multiple environmental sensors across the city, to measure ambient conditions such as light intensity, temperature, air pollution, noise pollution and humidity, etc. The output field devices layer will contain display devices or bi-directional (input & output) devices connected to the network, which will be used by citizens to consume - and for administrators to provide actionable information. Such field devices include digital messaging boards, environmental data displays, PA systems, surveillance cameras among others.
2. **Network Layer** – The secured network layer will serve as the backbone for the project and provide connectivity to gather data from sensors and communicate messages to display devices and actuators. The MSI will size the bandwidth required for the overall solution, and supply and install the edge devices to utilize the network.
3. **Data Center Layer** – The data center layer will house centralized computing power required to store, process and analyse the data to decipher actionable information. This layer includes servers, storage, ancillary network equipment elements, security devices and corresponding management tools. A disaster recovery site, which includes servers, storage, network equipment and security management systems, will be used in case of fall-back mechanism for the data center.
4. **Application Layer** – The applications layer will include applications that interface and control the street infrastructure, enterprise management system to monitor and manage all IT infrastructure and street infrastructure deployed in the city, and surveillance applications.
5. **Integration Layer** – While aspects of ambient conditions within the city will be gathered through various sensors deployed as a part of the solution, some city specific data will come from other government and non-government agencies. It is through the integration layer – that data will be exchanged to and from the under lying architecture components and other data from system developed by government (such as police department, meteorological

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department, street lights department, water department, irrigation department, transport organizations within Jalandhar, etc.) and non-government agencies.

6. **Command and Communication Center Layer** – The command center will enable citizens and administrators alike to get a holistic view of city conditions, and make informed decisions.
7. **Security Layer** – As ambient conditions, actuators and display devices are now connected through a network, security of the entire system becomes of paramount significance and the master system integrator (MSI) will have to provide Infrastructure security, Network security, Identity and Access Management, and Application security.

### 7.1.2. General Requirements

- MSI shall be responsible for compliance with all local standards and certifications, including building, electrical and occupational requirements
- MSI shall integrate JICCC with various other city systems and infrastructures. MSI shall coordinate with all the stakeholders of these city systems for integration purposes
- MSI shall be responsible for setting up the required software platform and interfacing JICCC with other city components as applicable
- Define SOPs with JSCL or its representative for the operations to ensure that JICCC systems are configured to support the operational procedures
- Creation of KPIs and dashboards as per the requirement
- Build and certify JICCC as per ISO 27001:2011 standards.

### 7.1.3. Key Performance Indicators

1. The vision of the Jalandhar Integrated Command Control Center (JICCC) is to have an integrated view of all the smart initiatives undertaken by JSCL with the focus to serve as a decision support engine for city administrators for day-to-day operations or during exigency situations. This dynamic response to situations, both pre-active and re-active will truly make the city operations “SMART”.

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2. JICCC involves leveraging the information provided by various departments and providing a comprehensive response mechanism for the day-to-day challenges across the city. JICCC shall be a fully integrated, Web-Based Server integrated with web based access/services, solution that provides seamless incident – response management, collaboration and geo-spatial display. Additional third party modules may be integrated as per solution requirements.
3. JICCC shall facilitate the viewing and controlling mechanism for the selected field locations in a fully automated environment for optimized monitoring, regulation and enforcement of services. The smart city operations center shall be accessible by operators and concerned authorized entities with necessary authentication credentials.
4. Various smart elements are able to use the data and intelligence gathered from operations of other elements so that civic services are delivered a lot more efficiently and in an informed fashion.
5. JICCC will provide 24\*7 City Surveillance System for effective management of the city.
6. JICCC shall leverage state of the art technology to effectively manage Road Traffic
7. JICCC should be able to integrate with various utility systems such as ITMS, Emergency Response System, Helpdesk etc.

### **The Technology Principles**

The following principles must be adopted during designing and development of the JICCC:

- Requirements-based Change – Changes to technology and applications are made only in response to changes in processes / service needs.
- Controlled Technological Diversity – Technological diversity is controlled to minimize the costs of maintaining expertise and connectivity between multiple processing environments.
- Adherence to Standards – Software and hardware should conform to all mandatory and necessary standards.

## **Processes**

The JICCC is the centralized component that holds all the smart city projects together and gives the decision makers a complete picture of the issues currently being faced by different stakeholders.

The supporting processes that are to be designed and executed within the JICCC are:

- a. Definition of role-based access mechanism
- b. Definition, logging and periodic review of standard operating procedures
- c. System health monitoring for each of the smart city components integrated with JICCC
- d. Periodic review of risks identified under monitoring and mitigation plan
- e. System backup and archival process
- f. Audits and (Re) certifications

## **Types of Operations**

### **A. Normal Operations**

Under normal operating conditions, various members of Operations team shall coordinate their activities and exchange information through voice and data communications systems about the equipment / facilities under their supervision to facilitate a safe and secure arrangement throughout the entire Jalandhar City. Under the normal conditions, the operations team shall continuously supervise the main assets and identify any fault, anywhere in system promptly. Operation team shall isolate faulty elements and operate the system in a manner to arrange alternatives wherever appropriate, alternative is possible (element redundancy, rerouting of services, alternate feeding path etc.). Faulty elements are further referred to appropriate team for respective corrective action. The JICCC Framework shall be able to enable faster isolation of faulty elements & identification & implementation of inbuilt alternatives in system.

### **B. Degraded Operation**

Degraded modes of operations occur when certain systems fail to meet the levels of service expectation. In such scenario, the applicable Standard Operating Procedure (SOP) will be followed.

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For ex: Various failures in power installation may affect the distribution of power in various sectors of the Jalandhar City. Load shedding need to be planned looking at many aspects, few of the incidents/situations may include Student Exams, Hospitals and Industries.

### **C. Emergency Operation**

In a Smart City, the emergencies need to be averted beforehand. Emergency operations are enforced in case of an unforeseen or abnormal situation, when it is not possible to carry on the services. An emergency or disaster is a sudden or calamity leading to deep distress affecting men and machinery. Many of the accidents / incidents like an act of vandalism, terrorist attack, an accidental fire, critical system failure, force majeure, etc. may lead to crisis / disaster. In cases of disasters, the main objective is to disperse the affected persons, as early as possible, from the affected site of occurrence and avoid loss of life and properties. Management of such situation requires sharing of clear and accurate information and necessary actions shall be initiate without any delay to ensure the restoration of normalcy.

- This requires seamless & timely sharing of information amongst multi-disciplines (viz. Traffic, Parking, Helplines, Smart Lights, Signal & Telecommunication, etc.) involved in Operations
  
- Necessitates that appropriate actions are initiated without any delay and the situation is tackled in the most appropriate and efficient manner, so that distress is relieved expeditiously.

Thus, for effective management of such scenarios, it is preferable to have visibility and ability to manage critical disciplines at one place. The JICCC framework shall support Automation of Disaster Management Procedure. The CCTV Cameras throughout the City and analytical tools would perform the emergency operations during such situations.

#### **7.1.4. Product Licenses**

All products and licenses procured shall be on Jalandhar Smart City Limited. Copy of the license terms and conditions has to be submitted to ASCL during trial run. All COTS software licenses shall be

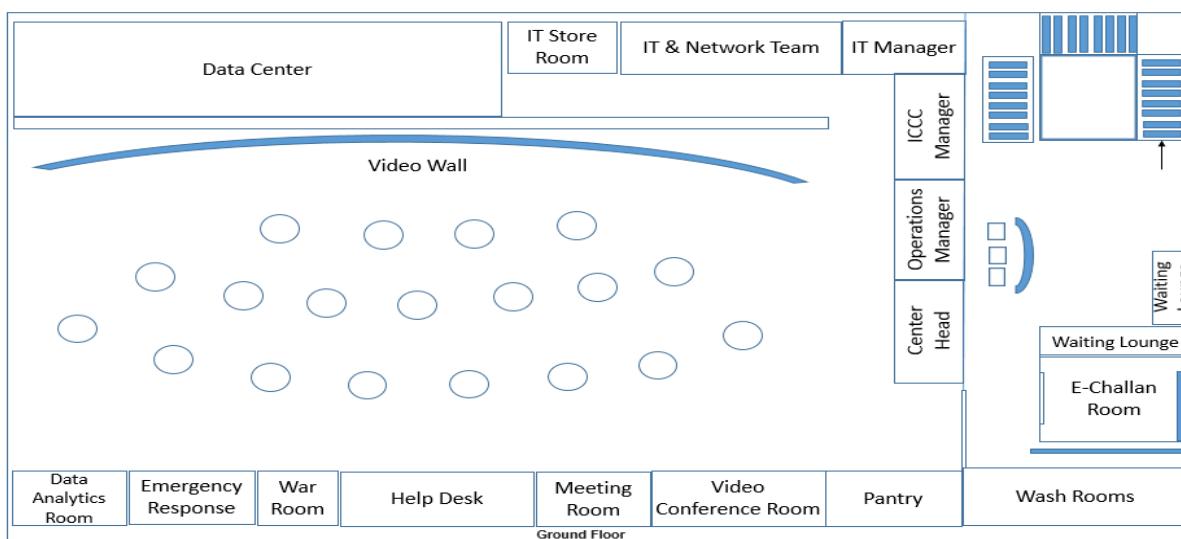
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perpetual along with Software Assurance (SA) during the project period. The MSI shall ensure that OEM's should be present during planning phase and also during fine tuning before Go-live.

### 7.1.5. Site Preparation for JICCC including Data Center

At Jalandhar Integrated Control and Command Centre basic civil structure shall be provided by Jalandhar Smart City. Interiors and Electrical Infrastructure along with the other infrastructure forms the basic pre-requisite for the setup of JICCC will be done by MSI.

An indicative layout is presented below:



The civil construction is not scope of the MSI. The MSI shall be responsible for minor site preparation works related to the equipment under its scope along with the installation and setup of facility management systems like Building Management System, Fire Alarm and Repellent System, CCTV System, Access Control System, etc. However, the MSI shall be required to coordinate extensively with the civil contractor for preparation of the JICCC site according to its requirements.

The following shall be the responsibility of the MSI with regard to JICCC Non-IT Infrastructure:

**A. UPS Requirements and Features:** UPS system shall provide a redundant power supply to the following needs:

- Servers and important network and storage equipment
- Access control, Fire Detection & suppression system and surveillance system

The system shall be automatic with power supply from the mains and automatic switchover to DG set as secondary source.

**B. Diesel Generator Set:** MSI has to specify the technical specifications based on the requirement. The MSI shall be responsible for regular operations and maintenance of the DG set. The MSI shall be responsible for but not limited to:

- Fuel
- Preventive maintenance
- Corrective maintenance
- AMC, if any
- Replacement of any parts etc.

**C. Fire Detection and Suppression System:** The facility shall be equipped with adequate and advanced Fire Detection and Suppression system. The system shall raise an alarm in the event of smoke detection. The system shall have proper signage, response indicators and hooters in case of an emergency. The system shall be based as per NFPA standards.

**D. Building Management System:** Building Management System shall be implemented for effective monitoring, management, control and integration of various building systems such as HVAC, lighting, electrical, fire detection and suppression system, CCTV system, Access Control System etc. over a single platform. BMS shall perform various functions such as data collection and archival, alarm and event management, trending, reports and MIS generation, preventive maintenance etc.

**E. Access Control System:** The Biometric/Access card based Access Control System shall be deployed with the objective of allowing entry and exit to and from the premises to authorized personnel only with appropriate door locks and controller assemble. The system deployed shall be based on proximity as well as biometric technology for critical areas and proximity technology for non-critical areas.

**F. CCTV System:** The MSI shall provide CCTV system within the Data center and JICCC on 24X7 bases. All-important areas of the Data center, JICCC along with the non-critical areas like locations for DG sets, entry exit of Jalandhar Integrated Command Control Center (JICCC), Entry and Exit of building premises need to be under constant video surveillance. Monitoring cameras shall be installed strategically to cover all the critical areas of all the respective locations.

**G. Water Leak Detection System:** The Water Leak Detection System shall be install to detect any seepage of water into the critical area and alert the security control room for such leakage. It shall consist of water leak detection cable and alarm module. The cable shall be installed in the ceiling and floor areas around the periphery.

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**H. Rodent Repellent:** The entry of rodents and other unwanted pests shall be controlled using non-chemical, non-toxic devices. Ultrasonic pest repellents shall be provided in the false flooring and ceiling to repel the pests without killing them. However, the MSI shall conduct periodic pest control using chemical spray once in a quarter as a contingency measure to effectively fight pests.

### 7.1.6. Functional requirements

#### Integrated Command Control Centre

The following are the indicative functional requirements of JICCC required for smart city operations. MSI is expect to use all the functionalities of IOT platform/City Operations Platform for holistic management of Smart city applications and integrate applications.

#### Jalandhar Integrated Command & Control Center (JICCC)

Sl. No	Minimum Specifications
1	JICCC shall provide a holistic and real time view of all city operations on a video wall along with individual views on operator workstations
2	JICCC shall enable monitoring, control and automation of various city operations in order to ease and organise city operations.
3	JICCC shall enable system and cross system analytics through smart city platform in order to make city operations intelligent
4	JICCC shall leverage information provided by multiple city systems in order to provide an integrated, seamless, proactive and comprehensive response mechanism for day-to-day city operations and challenges
5	JICCC shall provide real time dashboards, visualizations, KPIs, historical trending, analytics and other intelligent features to facilitate city operations analysis by city administrators.
6	JICCC shall provide alarm features for immediate notification to city administrators in case critical event occurs in the city
7	The Digital Content Management System (DCMS) provided as part of JICCC will manage and drive all visual content to the various display devices, including the video display wall. All city systems will display content through the DCMS
8	The operators will also manage and control various systems, and dispatch to system maintenance staff. They will be responsible for monitoring and managing all integrated city systems out of the JICCC.
9	All workstation units of the operator shall be installed at the central rack rooms so that space at the JICCC operator desks can be optimised as applicable.
10	Direct connections and data from devices / systems shall include real-time city systems data, KPIs and video feeds from CCTV cameras.

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Sl. No	Minimum Specifications
<b>Facilities Management and Building Management Systems (BMS)</b>	
11	Interface with the Building Management Systems (BMS) installed in JICCC for monitoring and control of all the building systems and parameters available through the BMS.
12	Interface with all the BMS or IP enabled fire alarm system for monitoring of essential parameters
13	Log calls / jobs on the helpdesk database utilizing helpdesk software (inquiries may be received by telephone, facsimile, email or in person).
14	Allocate and dispatch work orders to directly employ (or subcontracted) maintenance team
15	Take ownership of the Preventative Maintenance (PM) schedule and track reactive maintenance (RM) service requests.
16	Track progress of PM and RM service requests against pre-determined KPIs
17	Report back to JSCL and contract staff on progress of each PM and RM service request and close out service requests when completed
18	Maintain asset information
19	Update site specific facilities management files and other documentation for helpdesk compliance
20	Dispatch of emergency services
<b>City Security</b>	
21	Accurately and promptly observe, monitor and operate closed circuit television (CCTV) cameras and related equipment, and, where necessary direct Police Officers to real time incidents
22	To identify, report, and record anything suspicious, in line with JICCC procedures
23	To operate the cameras and equipment effectively ensuring that best possible evidential quality images are recorded
24	To ensure all equipment is functioning correctly, carry out equipment checks as required and report all faults to relevant personnel, carry out basic non-technical system maintenance as required
<b>Traffic Management</b>	
25	Recognize, identify and monitor the infracting vehicles in real-time / off-line mode for various violations at junctions and in streets
26	The system shall have the ANPR Non-intrusive modes of enforcement on traffic light violation and Speed
27	The system at the JICCC should be integrated with the E-Challan system to enable E-Challan generation, payment and billing process
28	Public Address (PA) System is disseminate the information to the citizen particularly emergency situation messages to reach quickly
29	The system should be able to integrate other network PA systems or third party application systems where the alerts are generated to broadcast messages at JICCC
30	The system should be able to generate various statistics, reports & MIS from time to time at JICCC.
31	Variable Message Sign (VaMS) board shall provide feedback to the JICCC on the VaMS status of Active / Inactive.

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Sl. No	Minimum Specifications
32	The system should maintain the history of messages archived for future reference and analysis
33	The ATCS & ATCC system shall provide multiple interfaces to share the data seamlessly to different sub systems e.g. Signalling system to configure and determine the traffic signal duration based on the traffic congestion, weather conditions, traffic pattern and other factors
34	The system at the JICCC shall feed the traffic density information to the associated junctions of critical junction subsystem to determine the expected traffic from its previous junction and traffic signal duration
Environmental Sensors	
35	Monitor key inputs from pollution sensors, noise sensors, particle sensors, etc.
36	Create awareness within the city based on dynamic inputs received from sensors and display output to various interfaces including city application, multi-services digital kiosks and Digital Display Screen (DDS).
37	Inputs to various regulations and permissions as needed in terms of carbon content, and content of other particles and gases in around Jalandhar
Smart Mobility & Vehicle Location Systems	
38	CAD/AVL System: Vehicle location monitoring for the following vehicles shall be done at JICCC: City Buses (Phase II) Municipal Vehicles Fire Engines Ambulances Police Vans Mobile Surveillance Vehicles (Phase II) Any other vehicle owned by JSCL (Phase II)
39	Complete operations management of the Municipal and Emergency Vehicles shall be provided from JICCC / Emergency Response Control Centre

## Common Operations Platform (COP)

Sl. No	Parameter	Minimum Specifications
1	Solution & Platform	The Command & Control solution should be implemented and complied to the industry open standards based Commercial-of-the-shelf (COTS) products.  The solution should be network and protocol agnostic and provide option to connect legacy system through APIs with either read, write or both options. It should

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Sl. No	Parameter	Minimum Specifications
		connect diverse on premise and/or cloud platforms and makes it easy to exchange data and services between them.
		The system shall allow seamless integration with all of the department's existing and future initiatives (e.g. open source intelligence, situation management, war room, etc.).
		System must provide a comprehensive API (Application Programming Interface) or SDK Software Development Kit) to allow interfacing and integration with existing systems.
		Software (Application, Database and any other) must not be restrict by the license terms of the OEM from scaling out on unlimited number of cores and servers for future expansion.
		The platform should be able to normalize the data coming from different devices of same type (i.e. different lighting sensors 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 be able to integrate with any type of sensor platform being use for the urban services irrespective of the technology used.
		Must have built-in fault tolerance, load balancing and high availability & must be certify by the OEM.
		The platform shall provide replay of all the events occurred based on user specified criteria.
		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.

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Sl. No	Parameter	Minimum Specifications
		Platform should support Cross collaboration APIs thereby enabling contextual information and correlation across domains and verticals.
		The software should be able to combine data from various sources and present it as different views tailored to different operator's needs. Common Operational Picture should comprise of a comprehensive view of the events as on a specific date and time which should include but not be limited to manual tasks assignment and their status, Agencies involved, Resources deployed, Timeline view of the situation.
		Should provide tools for users to collaborate in real-time using instant messaging features. Provide the ability to search/locate resources based on name, department, role, geography, skill etc. for rapidly assembling a team, across department, divisions and agency boundaries, during emergency. Provide the capability to Invite - Using information provided during the location of those individuals or roles, invite them to collaborate and to share valuable information. Provide a single web based dashboard to send notifications to target audiences using multiple communication methods including voice-based notification on PSTN/Cellular, SMS, Voice mail, and E-mail.
		The system should provide a facility to see alarms and KPI's filtered by day, week, month, year or any specific date range. The system should be able to filter the information based on at least the Event information Resources information, Agency type, Tasks and Criticality or priority

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Sl. No	Parameter	Minimum Specifications
2	Command and Control Center Components	<p>Web Server to manage client requests. Client/User should be provided with web-based, one-stop portals to event information, overall status, and details.</p> <p>The User Interface (UI) to present customized information in various preconfigured views in common formats. All information to be displayed through easy-to-use dashboards.</p> <p>Application Server to provide a set of services for accessing and visualizing data. Should be able to import data from disparate external sources, such as databases and files. It should provide the contacts and instant messaging service to enable effective, real-time communication. It should provide business-monitoring service to monitor incoming data records to generate key performance indicators. It should also provide the users to view key performance indicators, standard operating procedures, notifications, and reports, spatial-temporal data on a geospatial map, or view specific details that represent a city road, building or an area either on a location map, or in a list view. The application server should provide security services that ensure only authorized users and groups can access data. Analytics functionality can be part of application server or separate server</p>
3	Industry Standards for the Command and Control Center	<p>The solution should adhere to the industry standards for interoperability, data representation &amp; exchange, aggregation, virtualization and flexibility. IT Infrastructure Library (ITIL) V3 or above standards for Standard Operations Plan &amp; Resource Management</p> <p>Geo Spatial Standards like GML &amp; KML etc.</p> <p>Business Process Model and Notation (BPMN) or equivalent for KPI Monitoring.</p>

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Sl. No	Parameter	Minimum Specifications
4	Availability,	The solution system shall be highly available platform.
	Scalability,	The system shall be very tolerant to losses or reduction of communication such that the system shall recover gracefully from such incidents, with no human interaction required.
	Performance and	
	Usability	Should have a high performance and high availability architecture.
		Shall be flexible, modular and tolerant to failures/errors and able to exchange information with other systems
		The system must have an open architecture such that additional systems when added can be integrate with CCA without upgrades or disruption to other interfaces.
		The communications use standard components that are widely available.
		Should allow scalability and flexibility to include more applications / solutions in the future
		The server shall refresh system GUI within 1 second of an incident trigger requiring a change of state in the information in the database.
		The server hardware shall be based on high availability, fault tolerant design and capable of operating in mirrored server configuration.
5	Convergence of Multiple feeds/ services	The system shall have a resilient processing architecture such that failure of a single component does not affect entire common operations platform/ application.
		The system shall be able to operate at network bandwidth down to a minimum of 1 mbps.
		The system shall be able to operate at network latencies as long as 2 seconds.
5	Convergence of Multiple feeds/ services	System need to have provision that integrates various services and be able to monitor them and operate them.

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Sl. No	Parameter	Minimum Specifications
		<p>The solution should provide option to integrate existing deployed solution by City and need to provide scalability option to implement new use cases.</p> <p>System should have capability to source data from various systems implemented in the city (being implemented as part of this project or other projects) to create actionable intelligence</p>
6	Integrated User Specific & Customizable Dashboard	<p>Should provide integrated dashboard with an easy to navigate user interface for managing profiles, groups, message templates, communications, tracking receipts and compliance</p> <p>Collects major information from other integrated City sensors/platforms.</p> <p>Should allow different inputs beyond cameras, such as, User desktop screens, web page, and other external devices for rich screen layout</p> <p>Multi-displays configurations</p> <p>Support for GIS tool which allows easy map editing for wide area monitoring (Google map, Bing map, ESRI Arc GIS map, etc.).</p> <p>Should provide tools to assemble personalized dashboard views of information pertinent to incidents, emergencies &amp; operations of command centre</p> <p>Should provide dashboard filtering capabilities that enable end-users to dynamically filter the data in their dashboard based upon criteria, such as region, dates, product, brands, etc. and capability to drill down to the details</p> <p>Should provide historical reports, event data &amp; activity log. The reports can be export to PDF or HTML formats.</p>
7	Authentication & Encryption	<p>Use authentication information to authenticate individuals and/or assign roles.</p> <p>Support LDAP authentication mechanism</p>

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Sl. No	Parameter	Minimum Specifications
		Support for PKI implementation
8	Flexible Single Sign-On (SSO)	SSO to Web-based applications that can span multiple sites or domains with a range of SSO options.
9	Security & Access Control	Provide Role based security model with Single-Sign-On to allow only authorized users to access and administer the alert and notification system.
10	Internet Security	Provide comprehensive protection of web content and applications on back-end application servers, by performing authentication, credential creation and authorization.
11	API Integration	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
12	API Security	The access to data should be highly secure and efficient.
		Access to the platform API(s) should be secure 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 Software API(s) exposed to application eco system, API Management, API security features and API Key management functions are required.
13	Developer Tools	Common operations platform should provide online Developer tools that help City to produce new applications, and/or use solution APIs to enhance or manage existing solution free of cost. Platform should

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Sl. No	Parameter	Minimum Specifications
		have an online public facing web interface and support should be available 24X7.
14	Service management	Data brokerage, ID Management: Performs service management
15	Authorization	Comprehensive policy-based security administration to provide all users specific access based on user's responsibilities. Maintenance of authorization policy in a central repository for administration purposes.
16	User group	Should provide support to enable assignment of permissions to groups, and administration of access control across multiple applications and resources. Secure, web-based administration tools to manage users, groups, permissions and policies remotely
17	Provide multidimensional access control	Provide policies using separate dimensions of authorization criteria like Traditional static Access Control Lists that describe the principals (users and groups) access to resource and the permissions each of these principals possess.
18	Rule Engine & Optimization	Should have ability to respond to real-time data with intelligent & automated decisions
		Should provide an environment for designing, developing, and deploying business rule applications and event applications.
		The ability to deal with change in operational systems is directly relate to the decisions that operators are able to make.
		Should have at-least two complementary decision management strategies: business rules and event rules.
		Should provide an integrated development environment to develop the Object Model (OM) which defines the elements and relationships

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Sl. No	Parameter	Minimum Specifications
19	Remote Video Display	<p>The system should support dynamic reduction of bit rate and bandwidth for each stream based on the viewing resolution at the remote location. (Example: If the remote station is viewing with 352 x 240 (CIF), the stream to remote viewing location should not be using HD bandwidth, but dynamically should change to lower bandwidth. If the remote viewing station is viewing this camera in full screen 1080P, then it should dynamically increase the bandwidth to provide HD experience.)</p> <p>The system should use dynamic channel coverage specifically for video stream function for efficient bandwidth usage for multiple operation center and only transmits video stream required to display on monitor to maximize bandwidth efficiency and should support 20 to 30 camera feeds in single display.</p> <p>The solution should comprise of video processing server. This server must be able to cater to following functional requirements:</p> <ul style="list-style-type: none"> <li>a. To process and transmit video streams adaptive to each video requests to optimize network bandwidth usage.</li> <li>b. Shall be able to distribute real-time video streams without any loss in original video quality</li> </ul>
20	Device Engine	<p>Aggregation and abstraction of sensors: provides aggregation of sensors from diverse sensor cloud</p> <p>Normalization of sensor data organizes sensor data and assigns attributes based on relations; raw data removed and passed to data engine</p>
21	Location Engine	Map services and geospatial coordinates: provides the geographical coordinates of specific facilities, roads, and city infrastructure assets, as well as unmapped facilities

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Sl. No	Parameter	Minimum Specifications
		Geospatial calculation calculates distance between two, or more, locations on the map
		Location-based tracking locates and traces devices on the map
22	Enterprise Resource Planning (ERP) Integration capabilities	System should allow integration of business process in ERP workflows like property, water tax collection etc.
23	Data Engine	Data archive and logging: stores data feeds from the device engine and external data sources
24	Incident Management Requirements	<p>Should provide facility to capture critical information such as location, name, status, time of the incident and be modifiable in real time by multiple authors with role associated permissions (read, write).</p> <p>Incidents should be captured in standard formats to facilitate incident correlation and reporting.</p> <p>The system must provide Incident Management Services to facilitate the management of response and recovery operations</p> <p>Should support comprehensive reporting on event status in real time manually or automatically by a sensor/CCTV video feeds.</p> <p>Should support for multiple incidents with both segregated and/or overlapping management and response teams.</p> <p>Should support for sudden critical events and linkage to standard operating procedures automatically without human intervention.</p> <p>Allow operator to share/transfer the incident report to Mobile Device/another operator's console</p>

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Sl. No	Parameter	Minimum Specifications
		<p>The system must identify and track status of critical infrastructure / resources and provide a status overview of facilities and systems</p>
		<p>A Reference Section in the tool must be provide for posting, updating and disseminating plans, procedures, checklists and other related information.</p>
		<p>Should provide detailed reports and summary views to multiple users based on their roles.</p>
		<p>Should support incorporation of resource database for mobilizing the resources for response.</p>
		<p>Provide User-defined forms as well as Standard Incident Command Forms for incident management.</p>
25	Event Correlation	<p>Common operations platform should be able to correlate two or more events coming from different subsystems (incoming sensors) based on time, place, custom attribute and provide correlation notifications to the operators based on predefined business and operational rules in the configurable and customizable rule engine.</p>
26	Events and Directives control	<p>Should provide the capability for the events that are produce from a sub- system and are forward to the JICCC. Events could be a single system occurrence or complex events that are correlate from multiple systems. Events could be ad hoc, real-time, or predicted and could range in severity from informational to critical. At JICCC, the event should be display on an operations dashboard and analysed to determine a proper directive.</p> <p>Directives issued by the JICCC should depend on the severity of the monitored event. Directives will be design and modified based on standard operating procedures, as well as state legislation. A directive could be issue automatically via rules, or it could be create by the operations team manually.</p>

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No	Parameter	Minimum Specifications
27	Device Status, Obstruction	Should provide icon based user interface on the GIS map to report non-functional device.
	Detection and Availability	Should also provide a single tabular view to list all devices along with their availability status in real time.
	Notification	Shall view the environment through geospatial or fixed composite computer-generated (JPEG, BMP, AutoCAD, etc.) map
		Should allow user to view sensor or system data and related name from the displayed map
		Should visually display a camera sensor with related camera orientation, camera range and camera field of view angle.
		Should allow all resources, objects, sensors and elements on the map to be georeferenced such that they have a real world coordinate.
		Should allow user to choose camera and take live video image snapshot and save to file from any camera
		Should allow user to choose camera from map to move PTZ cameras
		Should allow map information “layers” to be displayed/hidden on items such as sensor names, Sensors, sensor range (e.g. camera – orientation, range, field of view angle), Locations and zones, Perimeter ranges
		Should provide User Interface to publish messages to multiple devices at the same time
28	Standard Operations Procedures (SOPs)	Solution should provide for authoring and invoking unlimited number of configurable and customizable standard operating procedures through graphical, easy to use tooling interface and support English and Hindi language and optionally Punjabi.

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No	Parameter	Minimum Specifications
		<p>Standard Operating Procedures should be establish, approved sets of actions considered the best practices for responding to a situation or carrying out an operation.</p> <p>The users should be able to edit the SOP, including adding, editing, or deleting the activities.</p> <p>It shall have facility to define more than one SOP for the selected alert category or location</p> <p>The users should be able to also add comments to or stop the SOP (prior to completion).</p> <p>Operations/Actions are automatically log in audit trail, changes, and commentary for the SOP and its activities, so that an electronic record is available for after-action review.</p> <p>The SOP Tool should have capability to define the following activity types:</p> <ul style="list-style-type: none"> <li>Manual Activity - An activity that is done manually by the owner and provide details in the description field.</li> <li>Automation Activity - An activity that initiates and tracks a particular work order and select a predefined work order from the list.</li> <li>If-Then-Else Activity - A conditional activity that allows branching based on specific criteria. Either enter or select values for Then and Else.</li> <li>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 and SMS notification.</li> <li>SOP Activity - An activity that launches another standard operating procedure.</li> </ul>
29	KPI Display	Solution should be able to facilitate measurement or criteria to assay the condition or performance of departmental processes & policies.

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No	Parameter	Minimum Specifications
		Solution should allow defining key performance indicators and provide visualization interface
30	What-if Analysis Tool	<p>The solution should provide the capability to manage the emergencies and in-turn reducing risks, salvaging resources to minimize damages and recovering the assets that can speed up recovery.</p> <p>To take proactive decisions that help minimize risks and damages, the solution should provide Analytical and Simulation systems as part of the Decision Support System.</p> <p>The solution should help simulate what if scenarios.</p> <p>It should help visualize assets/resources at risk due to the pending/ongoing incident, should render impacted region on a GIS/3D map.</p> <p>The solution should help build the list of assets, their properties, location and their interdependence through an easy to use Graphical User Interface.</p> <p>When in What-If Analysis mode the solution should highlight not only the primary asset impact but also highlight the linked asset that will be impact.</p> <p>The user should be able to run the What-if Analysis mode for multiple types of emergency events such as Bomb Blast, Weather events, Accidents etc.</p>
31	Reporting Requirements	<p>Solution should provide easy to use user interfaces for operators such as Click to Action, Charting, Hover and Pop Ups, KPIs, Event Filtering, Drill down capability, Event Capture and User Specific Setup</p> <p>The solution should generate Customized reports based on the area, sensor type or periodic or any other customer reports as per choice of the administrators</p>
32	Alarm Display	Should have an ability to display alarm condition through visual display and audible tone

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No	Parameter	Minimum Specifications
		Should have an ability to simultaneously handle multiple alarms from multiple workstations
		Should have an ability to automatically prioritize and display multiple alarms and status conditions according to pre-defined parameters such as alarm type, location, sensor, severity, etc.
		Should display the highest priority alarm and associated data / video in the queue as default, regardless of the arrival sequence.
33	Historical Alarm Handling	Should have an ability to view historical alarms details even after the alarm has been acknowledge or closed.
		Should have an ability to sort alarms according to date/time, severity, type, and sensor ID or location.
34	Alarm Reporting	Should have an ability to generate a full incident report of the alarm being generate.
		Should have an ability to display report on monitor and print report.
		Should have details of alarm including severity, time/date, description and location.
		Captured video image snapshots.
		Relevant sensor data such as SCADA sensors, Response instructions, Alarm activities, (audit trail).
		Should have an ability to export alarm report in various formats including pdf, jpeg, html, txt, and mht formats.
		Should have an ability to generate an alarm incident package including the full incident report and exported sensor data from the incident in a specific folder location.
35		The solution should have the following ability to handle the workflow alarms through graphical user interface.

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No	Parameter	Minimum Specifications
35	Alarm Policies and Business Logic Administration	Should have an ability to match keywords or text from the alarming subsystem's incident description to raise an alarm using criteria including exact match, exact not match, contains match, wildcard match and regular expression match (such as forced door alarm, denied access, door open too long, etc.)
		Should have an ability to optionally match alarming subsystem's incident status, incident severity, and sensor type
		Should have an ability to apply any alarm policy to one or more monitoring area(s) or zone(s) without having to reapplying the policy multiple times.
		Should have an ability to apply any alarm policy to one or more sensors without having to reapply the policy multiple times.
		Should have an ability to assign specific actions for each alarm
		Should have an ability to activate or deactivate alarms as required
		Should have an ability to create exceptions
		Should Create batch-wise rules and process them
		Should Check and rectify logical errors and contradictory rules
		Should have an ability to schedule execution of rules
36	Collaboration Framework/ Tools	Should Suspend or Terminate the application of rule
		Should archive unused or deactivated rules
		Shall establish a collaborative framework where input from different functional departments of city municipal corporation and other smart city stakeholders such as transport, water, police, e-governance, etc. can be assimilated and analyse on a single platform; consequently resulting in aggregated city level information.

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No	Parameter	Minimum Specifications
		This aggregated city level information can be convert to actionable intelligence, which would be propagate to relevant stakeholders and citizens.
		Cross collaboration APIs: Enabling contextual information and correlation across domains and verticals (Multiple vendor and Multi-sensor in future) and support security standards: OAuth 2.0, HTTPS over SSL, and key management
		The common operations platform` should have the capability to bring in multiple stake holders automatically into a common collaboration platform like persistent chat rooms and virtual meeting rooms in response to a SOP defined to handle a particular event.
		The stakeholders can be on various types of devices like computer, smart phones, tablets or normal phones.
		The operator should also have ability to create these collaboration spaces like virtual meeting rooms or chat groups manually.
		Shall offer the ability to create graphical displays that are representing real-time conditions in a useful, intuitive format.
		Shall enable the user to look at various operating areas and see, at a glance,
		<ul style="list-style-type: none"> <li>▪ What's going on?</li> <li>▪ What are the current problems?</li> <li>▪ What things are going well?</li> <li>▪ Do I need to dispatch maintenance/ emergency response?</li> </ul>
		Should provide tools for users to collaborate & communicate in real-time using instant messaging features.

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Sl. No	Parameter	Minimum Specifications
37	Communication Requirements	<p>The solution should adhere to the below mentioned communication requirements.</p> <p>Provide the ability to search/locate resources based on name, department, role, geography, skill etc. for rapidly assembling a team, across department, divisions and agency boundaries during emergency</p> <p>Provide the capability to invite using information provided during the location of those individuals or roles, invite them to collaborate and to share valuable information.</p> <p>Provide a single web based dashboard to send notifications to target audiences using multiple communication methods including voice-based notification on PSTN/Cellular, SMS, Voice mail, E-mail and Social Media</p> <p>The solution should provide Dispatch Console integration with various communication channels.</p> <p>It should provide rich media support for incidents, giving dispatchers the power to consolidate information relating to an incident and instantly share that information among responder teams.</p> <p>It should assess the common operating picture, identify &amp; dispatch mobile resources available nearby the incident location. Augment resources from multiple agencies for coordinated response.</p>
38	Instant Messaging	Provide ability to converse virtually through the exchange of text, audio, and/or video-based information in real time with one or more individuals within the emergency management community.

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Sl. No	Parameter	Minimum Specifications
39	Alert & Mass Notification Requirements	The system should provide the software component for the message broadcast and notification solution that allows authorized personal and/or business processes to send large number of messages to target audience (select-call or global or activation of pre-programmed list) using multiple communication methods including SMS, Voice (PSTN/Cellular), Email and Social Media.
		Provide a single web based dashboard to send notifications to target audiences using multiple communication methods including voice-based notification on PSTN/Cellular, SMS, Pager, Voice mail, E-mail and Social media
		Provide function for creating the alert content and disseminating to end users.
		Provision of alerting external broadcasting organizations like Radio, TV, Cellular, etc., as web-service.
40	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., CCTV Surveillance, Traffic etc.

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No	Parameter	Minimum Specifications
		<p>d) The solution should be able to predict and integrate with Smart City solutions helping in driving operational policies creation.</p> <p>e) The solution should be robust, secure and scalable.</p> <p>The solution should have a visualization platform to view historic analytics</p> <p>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:</p> <ul style="list-style-type: none"> <li>a) Connect to a variety of data sources</li> <li>b) Analyse the result set</li> <li>c) Visualize the results</li> <li>d) Predict outcomes</li> </ul> <p>Analytics Engine should support multiple Data Sources. Min below standard data sources should be supported from day one:</p> <p>CSV, TSV, MS Excel , NoSQL, RDBMS</p> <p>Analytics Engine should provide analysis of data from a selected data source(s).</p> <p>Analysis enables to define arithmetic and aggregation operations that result in the desired output.</p> <p>Analytics engine should provide capability to check analysis with multiple predictive algorithms</p>
41	Analytics	Analytics Engine should provide visualizations dashboard.
	Visualizations	In the visualization workspace, it should allow to change visual attributes of a graph.
		User should not be allow to alter the graph / visualization definition.

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No	Parameter	Minimum Specifications
		<p>In the visualizations workspace, user should able to do the following operations:</p> <ul style="list-style-type: none"> <li>a) Change the graph/visualization type</li> <li>b) Print the graph</li> <li>c) Export the graph</li> <li>d) Narrow down on the value ranges</li> <li>e) Toggle the axis labels</li> </ul> <p>Integrate with other 3rd party applications seamlessly</p>
42	Integration with Social Media & Open Source Intelligence	<p>Should provide integration of the Incident Management application with the social media.</p> <p>Should provide analytics based on the social media feed collected from the open source intelligence and collate with the surveillance inputs to alert the responders for immediate action on the ground.</p> <p>Should provide notifications to multiple agencies and departments (on mobile) that a new intelligence has been gather through open source/social media.</p> <p>Should be able to identify the critical information and should be able to link it to an existing SOP or a new SOP should be started.</p> <p>Should extract messages and display it in an operational dashboard.</p> <p>Should be able to correlate the extracted message from the social media with existing other events and then should be able to initiate an SOP.</p>
43	Field operator module	<p>Shall provide a mobile application for field operators bundled together with JICCC platform with at least 50 licenses</p> <p>Application shall provide incident management, SOPs and operations platform</p> <p>Operator shall be able to view the JICCC components based on set user permissions</p>

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No	Parameter	Minimum Specifications
44	Summary Dashboard	<p>Shall provide alarm summary of each monitoring zone or monitoring area in graphical chart format</p> <p>Shall display the following charts per global area, monitoring zone or monitoring area</p> <p>Shall Open Alert Count by Monitoring Zone/Monitoring Area</p> <p>Shall have the capability of New vs. Viewed (Opened Alerts)</p> <p>Shall Open Alert Count by Alert Severity</p> <p>Should have Highest Severity Alert</p> <p>Shall enable Monitoring Zone or Monitoring area default to Summary view dashboard or to a map when the zone or area is select.</p> <p>Shall provide a tabular list of sensors in each monitoring.</p>

## Integration Capabilities

List of Services	Minimum Specifications
Integration of Intelligent Traffic Management System (Police)	<ul style="list-style-type: none"> <li>▪ JICCC will be required to integrate with Command Center of Traffic Management System, to receive real-time feeds of the camera installed by them.</li> <li>▪ These video feeds will not be save, but will be utilize in Analytical layer to help administration monitor its assets and do a better urban planning.</li> </ul>
Integration with CCTV Surveillance (Police Dep't.)	<ul style="list-style-type: none"> <li>▪ JICCC will be required to integrate with CCTV Surveillance System to receive real-time feeds of the camera installed by them. These video feeds</li> </ul>

## Detailed Project Report for Jalandhar Integrated Smart Solutions

List of Services	Minimum Specifications
Integration of Call Centre Services	<p>will be saved and utilized in Analytical layer to create safe city</p> <ul style="list-style-type: none"> <li>▪ JICCC will be required to integrate its helpdesk and system with call center, in case if there is some information or notification is to be send to call center for doing some action in the field regarding Municipal Corporation work.</li> <li>▪ All the information received from the command center will also go into the Analytical layer, which will help city in better planning and running of operations.</li> <li>▪ JICCC will be required to integrate with the backend system of Jalandhar Municipal Corporation (MCJ).</li> <li>▪ JICCC should be able to integrate with the existing ICT systems and edge / end / mobile devices of various MC departments such as Garden, General Administration Department, Water Supply, Sewerage, Assessment and Collection (Property Tax, Shops and establishment), Fire (Fire Brigade Section), Transport of Heavy Vehicles and Maintenance (Workshop), Audit and License Issue to receive and send information.</li> <li>▪ JICCC should be able to map the data received from various MC departments on its GIS Platform.</li> <li>▪ JICCC will be required to send field agents, alerts and notifications for any emergency / incidents / disaster in the city for doing required action.</li> </ul>

## Detailed Project Report for Jalandhar Integrated Smart Solutions

List of Services	Minimum Specifications
Integration with Jalandhar GIS Maps	<ul style="list-style-type: none"> <li>▪ JICCC system should also be able to get acknowledgement from the receivers.</li> <li>▪ JICCC will be required to use the GIS platform developed by Jalandhar Municipal Corporation for the city.</li> <li>▪ There will be a requirement for enhancing the existing platform and using it in the JICCC for doing all the necessary actions.</li> <li>▪ All the information received from the application will also go into the Analytical layer, which will help city in better planning and running of operations.</li> </ul>
Integration with Environmental Sensors & Solid Waste Management	<ul style="list-style-type: none"> <li>▪ JICCC will be required to integrate with Environmental Sensors &amp; Solid waste management application to receive real-time information.</li> <li>▪ These information will be saved and utilized in Analytical layer to help administration monitor its assets and do a better urban planning</li> </ul>
Integration with Smart Parking & Smart Lights (As applicable)	<ul style="list-style-type: none"> <li>▪ JICCC will be required to integrate with Smart parking application on GIS Map.</li> <li>▪ JICCC will be required to integrate with Smart Lights Grid network with Jalandhar city on GIS Map</li> <li>▪ All functionalities of the LED lights (existing) should be Geo Tagged on Jalandhar GIS map that provides full functional and operational features in JICCC dashboard.</li> <li>▪ The Smart light project should be integrated into JICCC Dashboard which should be seamless integration as one component</li> </ul>

## Detailed Project Report for Jalandhar Integrated Smart Solutions

List of Services	Minimum Specifications
Integration with Project NERS 112	The proposed scheme NERS 112 of Govt. of India will also be integrated to the proposed system.

### Video Display Wall - 7 X 3 Cube 50 inch

Sl. No	Minimum Specifications
1	Video display wall content will not be switch frequently and shall be display real-time. It shall be rated for 24x7 operations
2	Functionality of centre zone for common viewing, for example map of the city can be enlarged and copied to the centre of the display wall for general reference
3	Option to create multiple layouts shall be present.
4	Ability for all CCTV video, web pages, IoT and all other display content to be routed to the board room
5	Ability to manage the content within the conference room or at the operators' consoles
6	Ability to add content from an JICCC workstation or conference room computer
7	The video display wall product selected shall be durable for optimal use in a 24/7 operational mode.
8	The focus of the design characteristics are ergonomics for the various viewers, quality and stability of the images, uniformity across the whole area, availability of the system, limited maintenance and low disruption of the control room operations
9	Video display wall shall be capable of displaying High Definition (HD) content
10	Gaps between screens shall be negligible to view HD graphics on multi screens
11	Auto calibration feature shall be provided to avoid periodic maintenance
12	There shall be a user interface for all settings and operational parameters

### Video Wall Management Software

Sl. No.	Parameter	Minimum Specifications
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## Detailed Project Report for Jalandhar Integrated Smart Solutions

1	Display & Scaling	Display multiple sources anywhere on display up to any size
2	Input Management	All input sources can be displayed on the video wall in freely resizable and movable windows
3	Scenarios management	Save and load desktop layouts from local or remote machines
4	Layout Management	Support all layout from input sources, Internet Explorer, desktop and remote desktop application
5	Multi View Option	Multiple view of portions or regions of Desktop, multiple application can view from single desktop
6	Other features	SMTP support
		Remote Control over LAN
		Alarm management
		Remote management
		Multiple concurrent client
		KVM support
7	Cube Management	Cube Health Monitoring
		Pop-Up Alert Service
		Graphical User Interface
8	Remote Viewing	The video wall content will be able to show live on any remote display .Mobile with IE
9	Integration	The video wall software should have tight integration with VMS and JICCC application

### Data Centre

The Jalandhar Smart City intends to establish a Data Center (DC) in the premises of the JICCC. It will be the obligation of the MSI to implement and commission the DC at the selected location as approved by the JSCL.

The MSI is required to implement all the hardware/software and related items for the data center as per the smart city solution including SLA monitoring & Help desk management, in a Tier III Data Center complying with standard guidelines as per Telecommunications Infrastructure UPTIME/TIA-942.

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

The Data center shall be available for 24x7x365 operation. 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. The MSI shall submit to JSCL adequate documentation/ evidences in support of the choice of the data center to meet the project requirements.

Any commercially available database (e.g., SQL or equivalent), shall be provided along with license and support and upgrade costs.

### **Server Infrastructure Zone**

This zone shall host servers, server racks, storage racks and networking components like routers, switches to passive components. All the Data center LAN connections shall be provided through switches placed in this area. MSI shall be required to undertake a detailed assessment of the space and size of the building proposed by JSCL for JICCC with co-hosted data center with respect to their system requirements and if required may propose a suitable solution. Access to this zone, where the surveillance project IT infrastructure is housed, shall be demarcated and physical access to the place shall be given only to the authorized personnel. Indoor CCTV Cameras shall be installed to monitor the physical access of the system from remote location.

### **UPS and Electrical Zone**

This zone shall house all the Un-Interrupted Power Supply units, Main Power Distribution Units (PDUs) to feed the components such as PAC, UPS, lighting, fixtures etc. This shall also house all the batteries accompanying the UPS components. As these generate good amount of radiation, it is advised to house these components in a room separate from server infrastructure zone.

Following are the benchmark requirements, which should act as guiding factors for the MSI:

- Access to the Data Center Space where the Smart City project infrastructure is proposed to be hosted should be demarcated and physical access to the place would be given only to the authorized personnel.
- Racks to be caged.
- Smart City Data Center should be at least a Tier III Data Center as per Telecommunications Infrastructure Standard for Data Center and should be 27001 Certified.
- It should have Access Control System implemented for secured access.

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

- Indoor CCTV Cameras would be required to be install to monitor the physical access of the system from remote location.
- 30-days Data Backup of the video feeds and the transaction data for min 3 months shall be stored within the Data Center infrastructure preferable in a cost effective and innovative manner.
- In case, the data center services are to go down due to any unforeseen circumstance, the Command Center should have access to the video feeds of previous 30 days and the transaction data for min 3 months from this data backup facility.
- Access logs to be stored for the entire duration of project period and handed over to JSCL upon termination/expiry of the MSI agreement.
- The availability of data must be guaranteeing to 99.982% availability.
- Receiving Power: Commercial power substation nearest to DC
- UPS system with N+1 redundancy, where N = 1
- Dual power feed, PDU sources to each rack, Power supply to a rack as per requirement
- Cooling Features:
  - System: Air-cooling system, Management of temperature and humidity.
  - Blow-out Type: Raised flooring air conditioning system, Down-blow below raised floor and drawn into ceiling.
- Fire Protection: High Sensitive Smoke Detectors, Fire Suppression System
- Security: CCTV surveillance cameras, 24\*7 on-site security presence, building Access (Photo Id Card must) along with biometric authentication.

## **Network Management System (Open Source)**

- The NMS should support an open database schema, configuration, administration, monitoring and troubleshooting of Switches, guided workflows based on best practices with built-in configuration templates, the capability to view the network topology, Layer 2 Services and Fault Management
- It should support rich visibility into end-user connectivity
- The NMS should automatically discover IP devices, SNMP compliant network devices on the network
- The NMS should support Inventory Management of Network devices, should support Monitoring and troubleshooting of Devices, should support configuration management & reporting.

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

- The NMS should support Inventory management of Network devices, should support Monitoring and troubleshooting of Devices, should support configuration management and
- The NMS should support flexible reporting for inventory, user tracking, compliance, switch port usage and end-of-sale
- Must show location information of clients, infrastructure Access Points, Rogue Access Points in a map format
- Must support virtualization
- The Network Management function must monitor performance across heterogeneous networks from one end of the enterprise to the other.
- It should proactively analyse problems to improve network performance.
- The Network Management function should create a graphical display of all discovered resources.
- The Network Management function should have extensive reporting facility, providing the ability to format and present data in a graphical and tabular display
- The Network Management function should collect and analyse the data. Once collected, it should automatically store data gathered by the NMS system in a database. This enterprise-wide data should be easily access from a central location and used to help with capacity planning, reporting and analysis.
- The Network Management function should also collect traffic statistics on client/server sessions, which cross the LAN on which it is running
- The Network Management function should also provide information on performance of Ethernet segments, including capacity utilization and error statistics for the segment and the top contributing hosts, WAN links and routers.
- It should be able to automatically generate a notification in the event of a link failure to ensure proper handling of link related issues.

## **Backup / Replication / Archival Solution**

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### Backup Solution

Sl. No.	Minimum specifications
1	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.
2	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.
3	Backup Solution should support various level of backups including full, incremental, and user driven backup along with various retention period.
4	Backup clients should be updated automatically using the client push feature
5	Backup should support agentless backup for virtualization platform with non-staged granular recovery.
6	Backup Software should support intelligent policy for virtualization.
7	Backup Software must provide Source (Client & Media Server) & Target base data Deduplication capabilities.
8	Backup Solution should Integrate with third party VTL, NAS, SAN which has data deduplication capabilities and Robotic/automated Tape library
9	Backup Solution must have Wizard-driven configuration and modifications for backup, restoration and devices.
10	The proposed backup solution shall have in-built frequency and calendar based scheduling system.
11	Backup Solution must have Optimized way for data movement from client to disk target.
12	Backup Solution should support (inflight & at rest) encryption.
13	The proposed backup solution shall support tape mirroring of the same job running concurrently with primary backup.
14	The proposed backup solution shall allow creating tape clone facility after the backup process.
15	Backup Solution should have Capability to do trend analysis for capacity planning of backup environment.
16	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.

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17	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.
18	The proposed backup solution license should be independent of hardware so replacing hardware should not incur new software license cost.
19	The proposed backup solution must include Agent/Modules for online backup of files, applications and databases.
20	The proposed backup solution should provide recovery from physical servers to Virtual and image level recovery.
21	The proposed backup solution should have Cloud plug-ins for backup data replication.
22	Backup Solution should have Inbuilt feature for extensive alerting and reporting with pre-configured and customizable formats.
23	Backup Replication at DR site, Cloud. Replication license should be included as part of solutions.
24	Backup software should support multiplexing and multi-streaming and shall support the capability to write up to Min 32 data streams.
25	Backup Solutions should have capabilities to tape/disk out backup catalog and deduplication catalog.
26	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 based replication of de-dupe data; without any extra charge.
27	The Proposed Backup solution must be capable of restoring files, emails and other granular items from different applications for e.g. File Exchange Server, Active Directory etc. and for hypervisors, virtualisation software etc. from a single-pass backup.
28	Backup solution must Support Backups/Restores for: <ul style="list-style-type: none"> <li>▪ Clustered servers (Industry popular clusters).</li> <li>▪ Virtual platform.</li> <li>▪ RAW SCSI volumes.</li> <li>▪ Block based backup &amp; restore simultaneously.</li> </ul>

### Replication Solution

Sl. No.	Minimum specifications
1	The proposed architecture should ensure that in event of Disaster at Primary Site, applications can be restarted at DR Site without any data loss.

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2	The proposed architecture should focus on not only the data replication, but ensuring application availability
3	The proposed solution must optimize additional infrastructure and storage resources in the architecture.
4	The proposed solution should be a storage agnostic solution. The solution should not only seamlessly integrate with current infrastructure, but also not impose any restriction on storage or platform technology that JSCL may deploy in future.
5	The proposed software must provide comprehensive hardware and platform support. Support for physical and virtual platforms.
6	The proposed software should provide application level availability by ensuring that it not only replicates data within database but also structural changes to databases, application and database binaries etc. without any manual intervention.
7	Application high availability at primary & DR site should not be dependent on Operating system event logs. Solution should be capable to integrate directly with application start, stop and monitor service to avoid outage remedy solution because of Operating system log.
8	The proposed software should support real time tracking of configuration changes being done to Operating system, application binaries, any tuneable added/modified etc. and alert administrators in case of configuration drift between primary and DR site.
9	Shall be able to handle long outages of network without affecting the consistency of data at secondary site. The replication solution should be provisioned for storing data for at least 4 days in case network is down for extended period.
10	The proposed software should provide for an automated fire-drill for testing of DR site. The testing mechanism should automatically validate the application start up at DR site at a pre-defined schedule defined.
11	The proposed software should provide availability across any distance—Builds local metropolitan and wide-area clusters for disaster recovery and local availability.
12	The proposed software should ensure no single point of failure. It has the ability to gracefully move an application to an available server in the event of a failure and coordinate the movement with storage ownership.
13	The proposed software should provide Multi-cluster management and reporting, including applications composed of multiple components running on different physical and virtual tiers, adding resilience to business services. Manages and reports on multiple local and remote clusters from a single unified web-based console.
14	The proposed software should provide seamless integration with all applications/databases used for increased application performance and availability.

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15	It should also have the integration capability with replication software/technologies.
16	The proposed software should provide advanced application failover logic to ensure that application uptime is maximized, server resources are efficiently utilized, and detect failures faster than traditional clustering solutions and requires almost no CPU overhead
17	The proposed software should provide advanced clustering support for virtual machine architectures.
18	The proposed software should be simple to install, configure, and maintain. It should provide powerful wizards that enable simple, quick, and error-free setup of advanced, high availability, disaster recovery, and Fire Drill configurations.
19	The proposed software must be able to provide comprehensive insight into the storage environment, enabling improved usage and efficiency across all major operating systems and storage hardware.
20	The proposed software should have deduplication and compression to reduce the primary storage footprint.
21	The proposed software should support automated storage tiering to seamlessly and transparently move data based on business value
22	The proposed software should have the ability to make data compatible between operating systems for simplified OS migration.
23	The proposed software should be able to support physical environment. It should support virtual disks in VMDK/VMFS format, and as well as RDM.
24	The proposed solution should have multi-pathing feature for I/O path availability and performance to efficiently spread I/Os across multiple paths for maximum performance, path failure protection, and fast failover.
25	Host Replication should be certified for performing replication to heterogeneous storage models from different.
26	The Host Replication technology should support different types of data whether structured or unstructured.
27	The proposed host base replication solution should be capable of maintaining data consistency at all times.

### Archival Solution

Sl. No.	Minimum specifications
1	The solution must be capable of archiving content from multiple sources like messaging including File Servers , VOIP etc.

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2	The proposed solution must have integration with Email solution through SMTP archiving without the need of any additional hardware.
3	The solution should have the capability to archive data from multiple electronic repository to single repository to achieve best single instance across multiple frontend source data.
4	The solution must support a Single unified console to manage archiving from different sources like File server, Mailing solution etc.
5	The solution should provision a web based discovery mechanism to search relevant data across archives from multiple sources like file server, messaging etc. The discovery mechanism should support a guided, hierachal review of searched data with capability to filter, marking and legal hold to prevent deletion/expiry.
6	The solution should facilitate a supervision mechanism for emails to ensure compliance of messaging content. The supervision mechanism should facilitate sampling of messages and subsequent review by authorized personnel
7	The solution should support tagging of messages by message security solutions like anti-spam/anti-virus for efficient retention
8	Proposed solution must support outlook on Windows & MAC machines.
9	Archival solution must have support with IMAP compliant devices to access the emails.
10	Proposed solution should support archiving both at premises and cloud.
11	Proposed solution must have monitoring integration with messaging solution vendor.
12	The solution should support Message Journaling as well as Envelope Journaling, capture data and expansion of distribution lists
13	The solution must support "Agentless" archiving of messages. There should be no need to deploy any agent on the messaging server.
14	The solution must support search for mails based on undisclosed recipients criteria
15	The solution should support seamless access using shortcuts from the native email client as well as browser based client. The solution should support all archiving actions like manually archive, search, restore, retrieve, delete from the native email client and browser based client
16	<p>The solution should support archiving based on either any or a combination of the following criteria:</p> <ul style="list-style-type: none"> <li>· Item Type (message, calendar etc.)</li> <li>· Date</li> <li>· Size</li> <li>· Email Attachment only</li> <li>· User</li> </ul>

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	<ul style="list-style-type: none"> <li>· Organizational Unit</li> </ul>
17	Proposed solution must have advance way of archive disk/partition data backup to avoid backup of old partitions which must be possible with or without WORM devices.
18	<p>The solution must allow the administrators to configure the following in shortcuts:</p> <ul style="list-style-type: none"> <li>• Include recipient information in the shortcuts.</li> <li>• Include nothing / original message body / custom message body in shortcuts.</li> <li>• Include "X" number of characters in the shortcut.</li> <li>• Include a custom body defined from a configuration file in the shortcut etc.</li> </ul>
19	The solution should leave a shortcut at either the time of archiving or later as well.
20	The solution should allow users to view archived items directly without having the need to restore them to the messaging server to avoid delays and impact on messaging solution. No network connections should be established between archiving server and messaging server at the time of retrieving archived items
21	The solution must support indexing and archiving of minimum 500+ commonly used file types.
22	The solution should support archiving of entire email folders and application of selective archiving policies based upon folders.
23	The solution must support dynamic retention period of archived items i.e. retention of archived items can be increased or decreased on fly.
24	The solution should facilitate "future proofing" of content by facilitating an HTML copy for long term retention and search
25	The solution should support "safety copies" of items to be kept on the mail server. The "safety copy" allows the archiving software to wait for the archived item to be backed up or replicated before the original item is removed from the mail server.
26	Archival solution must have option to set or configure disk property read and read-write access
27	Archival solution must have disk configurable option with High & Low watermark. In case, High watermark reaches, disk should automatically become Read only and other pre-configured disk should get read-write access to store fresh archived items.
28	The solution must have OWA integration in such a fashion that archived item can be browsed directly through archived browser tab instead of browsing through internet explorer (IE). IE can be additional feature.
29	The archival solution must have an integrated e-discovery solution which allows guided Discovery, review and analysis of data from the archives and non-archived data like desktop, file server, Documentum etc. It's required for future proofing.

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30	Proposed Archival solution must have seamless and consistent end user search experience across multiple interface like Desktop/Laptop, mobile, tablets etc.
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### **Application Delivery Controller with Web Application Firewall (WAF)**

Sl. No	Minimum Specifications
1	MSI has to design next generation data center in order to meet the modern networking requirements including software define networking, network function virtualization, agility, portability & programmability. MSI has to ensure multiple network functions to consolidated on purpose built hardware NFV to ensure
2	Multi-tenancy with Traffic isolation
3	Guaranteed performance – dedicated hardware resources including vCPU's, I/O, memory, SSL card, per virtual function , SR-IOV , open vSwitch
4	REST-API/Cloud API support for integration with centralized orchestration, cloud platform, and elasticity
5	Support for multiple network functions on single platform depending on throughput and capacity requirements per virtual functions
6	Support for multiple network functions including application firewall and reverse proxy with application load balancing on same platform
7	The appliance should have minimum 8 x10G SFP+ data interfaces from day one
8	The appliance should support Minimum 64GB RAM, 2*SSL ASICS/FGPA/cards with SSL I/O virtual function support for guaranteed SSL performance and 2TB HDD
Minimum Performance Specification	
1	Should be high performance purpose built next generation multi-tenant hardware with multicore CPU support. Platform should support multiple network functions including application load balancing, application firewall network functions with dedicated hardware resources for each virtual functions
2	Platform should support at least three network functions in order to cater current and future requirements and performance numbers including throughput, connections, SSL throughput and SSL transactions must be per virtual instance
For Reverse Proxy & Load Balancer – Network Functions	
1	15 Gbps of system throughput, 5 Gbps of SSL throughput
2	Minimum of 1.2 M concurrent connection

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3	Minimum of 8K SSL transaction Per Second per instance (2048 key)
4	Dedicated Management Interface
5	For Web Application Firewall – network function
6	There should be dedicated instance for Web Application Firewall with at least 2Gbps of layer7 throughput
7	Platform should have capacity to accommodate at least one additional instance of same capacity for all network functions mentioned above or 2 x numbers of instances with 50% capacity mentioned above

### Functional Specification

1	Meet all applicable PCI DSS requirements pertaining to system components and react appropriately (defined by active policy or rules) to threats against relevant vulnerabilities. WAF can be proposed as Network function on next generation platform or dedicated purpose built hardware. Platform should be scalable to accommodate more WAF function to meet the performance requirements
2	The Web application firewall should support positive security model with machine learning capabilities to detect and prevent vulnerabilities and anomalies in application traffic and unknown attacks. Machine learning should be based on true ML algorithms, and not just automation of dynamically learnt rules
3	New modules of applications should be learnt dynamically, and WAF should also provide the option of deploying the rules learnt dynamically for these new modules without manual intervention
4	WAF positive security model should be intelligent to adapt changes to existing modules of application or dynamically handle new modules without any manual learning and fine-tuning
5	The Web application firewall should address Open Web Application Security Project (OWASP) Top Ten security vulnerabilities such as SQL Injection, Cross-Site Scripting (XSS), nonstandard encoding and Session Management. Protection from CSRF attacks by Adding a CSRF token to application responses and blocking of POST requests with a missing or incorrect CSRF token
6	The Web application firewall should address unknown attacks based on user inputs and application responses using combination of dedicated protectors/signature engines and Machine Learning
7	WAF should support built-in correlation engine to detect atomic attacks and complex attack chains. Administrator should have option to define customized correlation rules
8	Administrator should have option to define customized correlation rules, edit and create new correlation rules

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9	WAF correlation should also identify complex attack chains, and not just aggregate events based on attacks or sources
10	Correlation should not be just an aggregation of multiple events, but detail the classification, prioritization and aggregation
11	Advanced bot detection mechanism based on smart combination of signature-based and heuristic analysis
12	WAF should be able to provide retrospective analysis of web application attacks either by consuming relevant log files or PCAP files
13	Should be able to take in virtual patching information from Static Analysers, not Dynamic scanners
Virtual Patching with Static Code Analysis	
1	This module can be proposed as integrated on WAF or dedicated solution to ensure better, improved and accurate working Virtual Patch
2	App firewall should have capability to scan source code using static analysers (not dynamic scanners) and deploy patches locally
3	The solution is required to provide SAST, DAST and IAST approaches to application testing Support PHP, C#, Java and other web based applications
Reverse Proxy and Application Load Balancing	
1	Should able to load balancer both TCP and UDP based applications with layer 2 to layer 7 load balancing support. Reverse proxy and WAF should be from different OEM to ensure reduced surface attack area and maximum security
2	The appliance should support server load balancing algorithms i.e. round robin, weighted round robin, least connection, Persistent IP, Hash IP, Hash Cookie, consistent hash IP, shortest response, proximity, SNMP, SIP session ID, hash header etc.
3	Support for policy nesting at layer7 and layer4, solution should able to combine layer4 and layer7 policies to address the complex application integration
4	Traffic load balancing using e-Policies should support algorithms including round robin, least connections, shortest response, persistence ip, hash ip and port, consistent hash ip and SNMP
5	Should provide application & server health checks for well-known protocols such as ARP, ICMP, TCP, DNS, RADIUS, HTTP/HTTPS, RTSP etc..
6	Appliance should provide real time Dynamic Web Content Compression to reduce server load and solution should provide selective compression for Text, HTML, XML, DOC, Java Scripts, CSS, PDF, PPT, and XLS Mime types
7	Should provide advanced high performance memory/packet based reverse proxy Web cache; fully compliant with HTTP1.1 to enhance the speed and performance of web servers

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8	Should provide support for cache rules/filters to define granular cache policies based on cache-control headers, host name, file type, max object size, TTL objects etc
9	Should provide secure online application delivery using hardware-based high performance integrated SSL acceleration hardware. SSL hardware should support both 2048 and 4096 bit keys for encrypted application access
10	Device level HA should support synchronization of network functions configuration from primary/master device to secondary/slave device
Management	
1	The appliance should have SSH CLI, Direct Console, SNMP, Single Console per Cluster with inbuilt reporting
2	The appliance should provide detailed logs and graphs for real time and time based statistics
3	Should capture, log and display traffic related data to analyze for security incidents.
4	Should support XML-RPC, REST-API, Centralized orchestration for integration with 3rd party management and monitoring of the devices
5	The appliance should have extensive report and logging with inbuilt tcp dump like tool and log collecting functionality
6	Should be able to send security incidents via syslog

## Advance Persistent Threat (APT)

Sl. No	Minimum Specifications
<b>Minimum Specifications of APT</b>	
1	End point Advanced Persistent Threat Solution
2	The solution shall support endpoint based solution to protect systems across all locations from targeted attacks and advanced persistent threats (APTs)
3	The proposed solution shall work independently without depending on any other endpoint or network systems for its functionality
4	The proposed solution shall support detection of all malware types. Necessary subsequent actions to fix malwares shall be supported
5	The proposed solution shall support root cause analysis for security incidents
6	Root cause analysis shall have capabilities of sequential and chronological trace of events with details and details on affected files/services
7	Proposed solution shall have capability to quarantine the malicious Application/program/ file automatically without quarantining the entire user machine

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8	Anti-Advanced Persistent Threat (APT)
9	Anti-APT shall be appliance based and support minimum throughput of 2 Gbps with required ports as per Bidder solution
10	Solution shall be capable of working in inline blocking mode without dependency on other network components
11	Proposed solution's detection rules shall be based on extensible, open language that enables users to create their own rules per requirements
12	Proposed solution shall be capable of gathering active directory user identity information, mapping IP address to username and making this information available for event management purposes and access control policy decisions
13	The proposed solution shall be able to whitelist trusted applications from being inspected

### AAA Specifications (AAA)

Sl. No	Parameter	Minimum Specifications
1	Server	Should support approach that combines AAA (Profiling of IoT sensors and ensures only authorized devices get connected to smart city network), NAC (For Employees) and Guest Access (Integrate with Wi-Fi hotspots and SMS gateway for OTP authentication)
		Must have ability to scale up to 5000 devices per appliance. Bidder should offer hardware appliance with redundancy
		Shell protected by CLI providing configuration for base appliance settings
		Appliance must provide disk or file encryption
		Ability to mix and match virtual and hardware appliances in one deployment.
		Platform must be deployable in out-of-band model and support for clustering with N+1 active redundancy model
2	Functionality	Flexibility to operate all features/functions on any appliance in the cluster
		Web-based, interface that includes several productivity tools such as a configuration wizard and preconfigured policy templates
		Support any type of networking equipment (wired, wireless, VPN) and a variety of authentication methods
3	Reporting	Must incorporate a complete set of tools for reporting, analysis, and troubleshooting
		Ability to generate reports in various formats (HTML, PDF, CSV, etc.) and export them to external systems

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		<p>AAA server should have device profiling functionality for 5000 concurrent devices from day 1 to enforce context aware policies</p> <p>AAA server must support both functionality RADIUS server for client device authentication and TACACS+ for network device authentication and logging from day 1. Overlay component can be added to achieve both functionality</p>
3	Management	<p>The solution Must be an easy-to-deploy hardware platform that utilizes identity based policies to secure network access and includes an integrated set of capabilities bundled under one policy platform:</p> <ul style="list-style-type: none"> <li>▪ Built-in guest management and device/user on boarding</li> <li>▪ Web based management interface with Dashboard</li> <li>▪ Reporting and analysis with custom data filters</li> <li>▪ Data repository for user, device, transaction information</li> <li>▪ Rich policies using identity, device, health, or conditional elements</li> <li>▪ Deployment and implementation tools.</li> </ul>
4	Licensing	<p>Must support flexible licensing model based on required functionality</p> <p>Correlation of user, device, and authentication information for easier troubleshooting, tracking etc.</p> <p>AAA framework must allow for the complete separation of Authentication and Authorization sources. For example, authentication against Active Directory but authorize against an external SQL database</p> <p>Should support multiple methods for device identification and profiling such as:</p> <ul style="list-style-type: none"> <li>• Network based, device profiler utilizing collection via SNMP, DHCP, HTTP, AD, ActiveSync/DNS</li> <li>• AAA solution should have an inbuilt Certificate server to generate unique certificates and this need to push to android phones and IOS devices</li> </ul>
5	Access	<p>Enforce security policies by blocking, isolating, and repairing noncompliant machines in a quarantine in future</p> <ul style="list-style-type: none"> <li>• Location Based Access</li> <li>• Time Based Access</li> </ul>

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6	Security	Must support complex PKI deployment where TLS authentication requires validating client certificate from multiple CA trust chain. Must also support AAA server certificate being signed by external CA whilst validating internal PKI signed client certificates
		AAA server should have licenses to support posture checking which includes antivirus check, firewall check , network connection , USB devices , Peer to Peer applications and auto remediation
7	Reliability / Performance	Appliances have ability to be clustered in any combination via local and remote network connections providing 1 million scale, redundancy, and access load balancing
		Failure of master node should not impact the ability for backup appliances to continue servicing authentication traffic
		Must support several deployment modes including centralized, distributed, or mixed
8	Guest Access	Must allow Self registration of Guest with Sponsor approval
		Should support customizable guest pages to allow the web-developers to create a page for the desired look and feel Access can be restricted based on <ul style="list-style-type: none"> <li>- Time of Day</li> <li>- Number of Devices</li> <li>- Number of Sessions</li> <li>- Amount of Data consumed - Device Type</li> </ul>
		Unique delivery of method of 'guest user credentials' <ul style="list-style-type: none"> <li>- SMS</li> <li>- SMS over SMTP</li> </ul>
		Solution should support 1000 guest user on boarding - Workflow can be OTP, Sponsor based, receptionist based or social login
		Sponsor approval based on boarding to ensure that no-one can provision a device without an approval

### Distributed Denial of Service (DDos)

Sl. No	Minimum Specifications
<b>System Stability and Reliability</b>	
1	The Vendor should guarantee the stability and the reliability of hardware system such as CPU, memory, interface, and software like OS

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2	The proposed Equipment must make sure the DDOS mitigation devices can work independently when there is any problem happened in the DDOS detector
3	The proposed Equipment shall be appliance based with fully hardened and secured Operating System (OS)
System Functions and Requirement	
4	The proposed Equipment shall support 10GE SFP+ port and 1 x Console port
5	Mitigation capacity of System should be at least 20Gbps
6	System should support service availability through functions of service monitoring and protection from DDoS traffic
7	System should be stable and not affect service availability even upon any system fault
8	System should support 'Troubleshooting function' for each system function
9	System should provide in-line mode and Diversion(off ramping)/Reinjection(on ramping) mode for detecting and protecting DDoS traffic
10	System should detect any DDoS traffic and mitigate any DDoS attack without interrupt legitimate traffic and customer services
11	The Proposed system must be able to detect volumetric DDOS traffic and start mitigate volumetric DDOS traffic within 3 min
12	System should provide IP reputation list protection to filter blacklisted IP.
13	Systems should consists of Detector, Mitigator and Management device
14	System should provide user defined signatures
15	System should support detection and protection of DDoS traffic as below: IP Spoofed/Non-spoofed TCP Syn Flooding IP Spoofed/Non-spoofed TCP Syn-ACK Flooding IP Spoofed/Non-spoofed TCP FIN Flooding IP Spoofed/Non-spoofed UDP Flooding IP Spoofed/Non-spoofed ICMP Flooding HTTP GET Flooding HTTP POST Flooding HTTPS Flooding DNS Query Flooding SIP Flooding DNS amplification NTP amplification SSDP amplification

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	Charge amplification SNMP amplification
16	System should support protection policy for L3 protocol (IP), L4 protocol (TCP, UDP, ICMP) and should support a function of exclusion for specific network.
17	System should support a function ‘protection of Payload pattern’ after analysis of Payload of Web, DNS, HTTP, etc.
18	System should support a DDoS protection function for VoIP(SIP) protocol
19	System should support to protection as a group for several IP addresses
20	System should support IPv4 and IPv6 dual-stack without deteriorating performance
21	In IPv4 and IPv6 dual-stack environment, the application and change operation of individual function should not affect each other
22	The proposed Equipment shall be able to support VLAN traffic reinjection
23	The proposed Equipment shall be able to support MPLS Label traffic reinjection
24	The proposed DDoS device shall be able to support high-availability with: <ul style="list-style-type: none"> <li>• Device (Anti-DDOS) failure detection</li> <li>• Traffic Reinjection Dead Link, gateway and interface detection</li> </ul>
25	The proposed Equipment shall have built-in high availability (HA) features in the following mode: Active-Passive Active-Active
26	The proposed Equipment Ethernet interfaces shall support link aggregation (IEEE 802.3ad) standard
27	The proposed Equipment shall be able to immediately support both IPv4 and IPv6, and implements dual stack architecture
28	The proposed Equipment shall be able to sync with NTP server
29	The proposed Equipment shall be able to support IPv4 & IPv6 routing protocols for traffic mitigation: Static , OSPF & BGPv4
30	The proposed system should be able to be extended it performance using additional modules
31	The proposed system should be able to extend the Anti-DDOS performance and capacity automatically without additionally manual traffic distribution when new modules are added. The proposed system should be able to load share the traffic when new modules are added
32	The propose Equipment shall support policy based routing (PBR) features
33	Time to apply the Anti-DDOS policy should be within 5 minute without any service interruption

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34	The proposed Equipment must able to support real-time configuration changes without impact to service
35	The proposed Equipment must be able to integrate with existing management system via SNMP version 3 and SNMP version 2
36	The Vendor must provide the latest Management Information Base (MIB) file for SNMP operation
37	<p>The proposed Equipment log shall contain the following information:</p> <ul style="list-style-type: none"> <li>Attack logging</li> <li>User Login logging</li> <li>Operation Activity</li> <li>logging Link Status</li> <li>logging Diversion</li> <li>logging System</li> <li>Performance logging</li> <li>HA logging</li> <li>Traffic Alerts</li> <li>logging DDoS Attack</li> <li>logging Syslog</li> </ul>
38	The Security System provided shall be able to do remote inventory management capability and software download
39	The NMS shall provide the flexibility of performing configuration via GUI and command base remotely
40	The Vendor must state clearly on the features which are currently supported, to be supported under the road map, and feature that does not support by the equipment
41	Security Equipment proposed by Vendor must be fully compatible with the existing Data Centre network which may have third party equipment's
42	The Vendor shall state the maximum number of devices supported
43	The proposed System shall support secure devices management
44	Able to access managed devices through GUI
45	Able to deploy system OS / firmware patching to managed devices
46	Able to deploy scripts to automate devices system administration
47	The proposed System shall support encrypted communication between management system and device
48	The Vendor shall state the encryption level & algorithm used

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49	The proposed System shall be able to execute real-time configuration changes without device service interruption
50	The proposed System shall be able to push global configuration to all or selected devices
51	The proposed System shall support secure web-based access
52	The proposed System shall be able to limit administrator network access
53	The proposed system shall support devices security configuration management
54	Able to deploy single configuration element to all or selected devices
55	Able to store back-up configuration for selected devices
56	The proposed System shall support active monitoring: <ul style="list-style-type: none"> <li>▪ Able to display devices status</li> <li>▪ Able to display system alerts</li> <li>▪ Able to display various traffic data</li> <li>▪ Able to display security component status &amp; alerts</li> </ul>
57	The proposed Equipment shall be able to support authentication schemes but not limited to: Local Password & RADIUS
58	The proposed system should support the HTTP GET FLOOD detection and mitigation. The mitigation devices should support at least 6 algorithms for http attack protection
59	The proposed system should support the extension based on growth of the network and at least support expansion of mitigation devices up to 25 devices
60	The proposed system should support the behaviour based and algorithm based DDOS mitigation
61	The proposed system must provide multi-level Anti-DDOS mitigation infrastructure. The system must support integration of upstream and downstream Anti-DDoS device to mitigate DDoS Attack effectively
62	The proposed system must provide multi-level DDOS + Web application mitigation infrastructure. The upstream Anti-DDoS and downstream WAF can integrate and mitigate layer 1 to layer 7 attack effectively
63	The proposed mitigation device should provide auto packet capture function during DDOS mitigation
64	The proposed system should provide the traffic AUTO learning function for the DDOS traffic monitoring. The auto learning threshold baseline should captured hourly
65	The traffic Auto learning threshold can be apply automatically after auto learning completed
66	The proposed system should provide the multi-level DDOS mitigation policy and different mitigation action based on DDOS traffic type

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67	The proposed system should provide the function to monitor the outbound DDOS attack and cooperate with the mitigation platform to block the outbound DDOS attack
68	The proposed system must be able to support netflow v5, netflow v9, sflow v4, sflow v5, netstream v5, ipfix
69	The proposed system must support double diversion feature that can advertise two BGP diversion prefix under single attack to different devices for mitigation
70	The proposed system must support multiple BGP community tagging for different diversion configuration
71	The proposed system must support BGP traffic diversion based on attack size in terms of pps/bps
72	The proposed system must support auto null route based on attack size in terms of pps/bps
<b>Anti – DDoS Reporting System</b>	
73	The proposed System shall support the provisioning of the following reports in detail or in summary
74	Attack reports -top sources, targets, attack type etc
75	System reports -security events triggered
76	User reports -user access activity
77	The proposed system must be able to generate summary attack report of daily/weekly/monthly
78	The proposed system must be able to send schedule summary attack report of daily/weekly/monthly
79	The Vendor shall provide full details regarding the proposed staff required to fulfil the site design and installation service, including an organization chart, job descriptions and staff competency levels.
80	The proposed System shall support report format customization
81	The proposed System shall support remote report view in web HTML
82	The proposed System shall be able to export reports as documents or images
83	The proposed System shall support the export format.
84	The proposed System shall support secure web-based access
85	The proposed system must be able to limit administrator access by IP address

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### **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.
2. Ability to scan HTML, VBScript Viruses, malicious applets and ActiveX controls.
3. Must update itself over internet for virus definitions, program updates etc. (periodically as well as in push-updates in case of outbreaks)
4. Able to perform different scan Actions based on the virus type (Trojan/ Worm, Joke, Hoax, Virus, other)
5. Shall provide Real-time Product Performance Monitor and Built-in Debug and Diagnostic tools, and context-sensitive help.
6. The solution must provide protection to multiple remote clients
7. Shall provide for virus notification options for Virus Outbreak Alert and other configurable Conditional Notification.
8. Should be capable of providing multiple layers of defence.
9. Shall have facility to clean, delete and quarantine the virus affect files.
10. Should support online update, where by most product updates and patches can be performed without bringing messaging server off-line.

### **Enterprise Management System (EMS)**

Sl. No.	Parameter	Minimum specifications
1	SLA & Contract Management System	<ul style="list-style-type: none"><li>▪ It must be a centralized monitoring solution for all IT assets (including servers, network equipment etc.).</li><li>▪ The solution must have integrated dashboard providing view of non performing components/issues with related to service on any active components. The solution must follow governance, compliance and content validations to improve standardization of service level contracts.</li></ul>

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	<ul style="list-style-type: none"><li>▪ Application should be pre-configured so as to allow the users to generate timely reports on the SLAs on various parameters.</li><li>▪ The solution must support Service Level Agreements &amp; Lifecycle Management including Version Control, Status Control, Effectively and audit Trail to ensure accountability for the project.</li><li>▪ The solution must have the ability to define and calculate key performance indicators from an End to End Business Service delivery perspective related to JICCC Project under discussion.</li><li>▪ The solution should support requirements of the auditors requiring technical audit of the whole system which MSI should allow the auditors to access the system.</li><li>▪ The solution must have an integrated dashboard, view of Contract Parties &amp; current SLA delivery levels and view of Services &amp; current SLA performance.</li><li>▪ The solution should support SLA Alerts escalation and approval process. Solution should support effective root-cause analysis, support capabilities for investigating the root causes of failed service levels and must make it possible to find the underlying events that cause the service level contract to fail.</li><li>▪ Accept Data from a variety of formats. Support for Defining and Calculating Service Credit and Penalty based on clauses in SLAs.</li><li>▪ Reporting:<ul style="list-style-type: none"><li>• Ability to generate reports on penalty and credit due, to check on non-compliance of SLAs for the JICCC project</li><li>• Monetary penalties to be levied for non-compliance of SLA, thus the system must provide Service Level Performance Report over time, contract, service and more.</li><li>• The solution should provide historical and concurrent service level reports for the surveillance project in order to ensure accountability of the service provider's performance</li><li>• Automatic Report creation, execution and Scheduling, must support variety of export formats including Microsoft Word, Adobe, PDF etc.</li><li>• The solution must support Templates for report generation,</li></ul></li></ul>
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		<p>Report Filtering and Consolidation and Context sensitive Drill-down on specific report data to drive standardization and governance of the JICCC project</p> <ul style="list-style-type: none"> <li>• The solution must support security for drill-down capabilities in dashboard reports ensuring visibility for only relevant personnel of the JICCC project</li> <li>• Support real-time reports (like at-a-glance status) as well as historical analysis reports (like Trend, TopN, Capacity planning reports etc.)</li> </ul>
2	Network Monitoring System	<ul style="list-style-type: none"> <li>▪ The Solution should provide capability to monitor any device based on SNMP v1, v2c &amp; 3</li> <li>▪ The Solution should monitor bandwidth utilization.</li> <li>▪ The solution should monitor utilization based on bandwidth</li> <li>▪ The Solution must be capable of monitoring the availability, health, and performance of core networking devices including but not limited to CPU, memory, temperature.</li> <li>▪ The Solution should have the ability to issues pings to check on availability of ports, devices.</li> <li>▪ The Ping Monitoring should also support collection of packet loss, Latency and Jitters during ICMP Ping Checks</li> <li>▪ The Port Check for IP Services monitoring should also provide mechanism to define new services and ability to send custom commands during port check mechanism.</li> <li>▪ The Solution should have the ability to receive SNMP traps and syslog.</li> <li>▪ The Solution should automatically collect and store historical data so users can view and understand network performance trends. The solution should be capable of monitoring network delay/latency.</li> <li>▪ The solution should be capable of monitoring delay variation</li> <li>▪ The solution should be capable of monitoring packet loss, Packet QOS, Packet Errors on one or more ports</li> <li>▪ The solution should allow users to access network availability and performance reports via the web or have those delivered via e-mail.</li> </ul>

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		<ul style="list-style-type: none"> <li>▪ The solution should support auto-discovery of network devices</li> <li>▪ The solution should have the ability to schedule regular rediscovery of subnets.</li> <li>▪ The solution should provide the ability to visually represent LAN/WAN links) with displays of related real-time performance data including utilizations.</li> <li>▪ The system should provide discovery of heterogeneous physical network devices like Layer-2 &amp; Layer-3 switches, Routers and other IP devices and do mapping of LAN &amp; WAN connectivity.</li> <li>▪ The System shall support monitoring of Syslog</li> <li>▪ The solution should provide capability to add an IP device or IP Range or IP subnet with functionality supporting multiple SNMP strings.</li> <li>▪ The solutions should have real time, detect configuration and asset information changes made across a multi-vendor device network, regardless of how each change is made and also support configuration deployment/rollback and configuration templates.</li> </ul>
3	Server Performance Monitoring System	<ul style="list-style-type: none"> <li>▪ The proposed tool should integrate with network performance management system and support operating system monitoring for various platforms supplied as part of the Surveillance Project. The proposed tool must provide information about availability and performance for target server nodes. The proposed tool should be able to monitor various operating system parameters such as processors, memory, files, processes, file systems, etc where applicable.</li> <li>▪ The solution should provide a unified web based console, which consolidates all aspects of role based access under a single console. Proposed Network Management shall integrate with SLA &amp; Contract Management system in order to supply KPI metrics like availability, utilization, and performance in order to measure central SLA's and calculate penalties</li> </ul>

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4	<p><b>Application Performance Management</b></p> <ul style="list-style-type: none"> <li>▪ The solution should measure the end users' experiences based on transactions without the need to install agents on user desktops.</li> <li>▪ The solution must be able to provide user usage analysis and show how user's success rate, average time and transaction count has changed over a specific period of time such as current week versus previous week.</li> <li>▪ The solution must be able to provide the ability to detect and alert when users experience HTTP error codes such as 404 errors or errors coming from the web application.</li> <li>▪ Solution shall be able to monitor customer transaction by end-user name, and thus able to understand exactly which customers were impacted, their location, type of browser used etc.</li> <li>▪ The solution must simplify complex app topologies through task-relevant views based on attributes such as location, business unit, application component etc.</li> <li>▪ The solution must speed up the process of triage by showing the impact of change, thus enabling to easily locate where performance problems originate. The solution should provide the flexibility of collecting deep-dive diagnostics data for the transactions that matter for triage as opposed to collecting deep-dive data for every transaction.</li> <li>▪ The solution must proactively monitor 100% of real user transactions; detect failed transactions; gather evidence necessary for triage and diagnosis of problems that affect user experiences and prevent completion of critical business processes.</li> <li>▪ The solution must determine if the root cause of performance issues is inside the monitored application, in connected back-end systems or at the network layer from a single console view.</li> <li>▪ The solution must provide proactive real-time insights into real user behaviour, trends, log analytics and performance to enhance customer experience across various channels</li> </ul>
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		<ul style="list-style-type: none"> <li>▪ The solution must provide operational efficiency capabilities that provide insight of app performance by version, geo, OS, network, real-time alerts on threshold violations impacting SLAs and prioritize alerts based on impact to business, revenue and gain end- to-end visibility into the mobile infrastructure.</li> <li>▪ The solution must provide complete Insights into Application Flows, Heat Maps to enable improving the UI design, understand user interactions, build functionality based on real user data and create product &amp; services differentiation.</li> </ul>
<b>6</b>	Asset Management System	<ul style="list-style-type: none"> <li>▪ Ability to provide inventory of hardware and software applications on end-user desktops, including information on processor, memory, OS, mouse, keyboard, etc. through agents installed on them.</li> <li>▪ Ability to have reporting capabilities; provide predefined reports and ability to create customized reports on data in the inventory database. Report results could be displayed as lists or graphs.</li> <li>▪ Ability to provide the facility to collect custom information from desktops.</li> <li>▪ Ability to provide facility to recognize custom applications on desktops.</li> <li>▪ Facility for the administrator to register a new application to the detectable application list using certain identification criteria. Shall enable the new application to be detected automatically next time the inventory is scanned.</li> <li>▪ Ability to support configuration management functionality using which standardization of configuration can be achieved of all the desktops.</li> <li>▪ Software metering shall be supported to audit and control software usage. Shall support offline and online metering.</li> <li>▪ Ability to support dynamic grouping of enabling assets to be grouped dynamically based on some pre-defined criteria e.g. a group shall be able to display how many and which computers has a specific application installed. As and when a new</li> </ul>

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		<p>computer gets the new application installed it shall dynamically add to the group.</p> <ul style="list-style-type: none"><li>▪ Ability to use the query tool to identify specific instances of concern like policy violation (presence of prohibited programs / games and old versions, etc.), inventory changes (memory change, etc.) and accordingly it could perform several actions as reply. These actions may be (a) sending a mail, (b) writing to file (c) message to scroll on monitor screen, etc.</li><li>▪ Facility to track changes by maintaining history of an asset.</li><li>▪ The proposed EMS solution shall provide comprehensive and end -to-end management of all the components for each service including all the hardware devices, Network, Systems and Application infrastructure.</li></ul> <p>Note: It is mandatory that all the modules for the proposed EMS Solution shall provide out-of-the-box and seamless integration capabilities. SI shall provide the specifications and numbers for all necessary Hardware, OS &amp; DB (if any) which is required for an EMS to operate effectively.</p>
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### Network Management System (Open Source)

- The NMS should support an open database schema, configuration, administration, monitoring and troubleshooting of Switches, guided workflows based on best practices with built-in configuration templates, the capability to view the network topology, Layer 2 Services and Fault Management
- It should support rich visibility into end-user connectivity
- The NMS should automatically discover IP devices, SNMP compliant network devices on the network
- The NMS should support Inventory management of Network devices, should support Monitoring and troubleshooting of Devices, should support configuration management and reporting.
- The NMS should support Inventory management of Network devices, should support Monitoring and troubleshooting of Devices, should support configuration management and
- The NMS should support flexible reporting for inventory, user tracking, compliance, switch port usage and end-of-sale
- Must show location information of clients, infrastructure Access Points, Rogue Access Points in a map format

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- Must support virtualization
- The Network Management function must monitor performance across heterogeneous networks from one end of the enterprise to the other.
- It should proactively analyse problems to improve network performance.
- The Network Management function should create a graphical display of all discovered resources.
- The Network Management function should have extensive reporting facility, providing the ability to format and present data in a graphical and tabular display
- The Network Management function should collect and analyse the data. Once collected, it should automatically store data gathered by the NMS system in a database. This enterprise-wide data should be easily accessed from a central location and used to help with capacity planning, reporting and analysis.
- The Network Management function should also collect traffic statistics on client/server sessions, which cross the LAN on which it is running
- The Network Management function should also provide information on performance of Ethernet segments, including capacity utilization and error statistics for the segment and the top contributing hosts, WAN links and routers.
- Alerts should be shown on the Event Management map when thresholds are exceeded and should subsequently be able to inform network operators and notify concerned authority using different methods such as emails etc.
- It should be able to automatically generate a notification in the event of a link failure to ensure proper handling of link related issues.

### Virtualization software

Sl. No.	Parameter	Minimum specifications
1	Guest OS Support	Windows client, Windows Server, Linux (at least Red Hat, SUSE, Ubuntu and CentOS, Solaris x86) etc.
2	VM Capability	Create Virtual machines with up to 128 virtual processors, 6 TB virtual RAM and 2 GB Video memory in virtual machines for all the guest operating system supported by the hypervisor.
3	VM Live Migration	Virtual Machine migration between different generations of CPUs in the same cluster and without Virtualization 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.

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4	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
5	High Availability	Proactive High availability capability that utilizes server health information and migrates VMs from degraded hosts before problem occurs.
6	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.
7	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.
8	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.
9	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.
10	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.

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		<p>Virtual Volumes which enables abstraction for external storage (SAN and NAS) devices making them Virtualization aware.</p> <p>Integration with Storage API's providing integration with supported third-party data protection, multi-pathing and disk array solutions.</p>
11	Virtual Switch	<p>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.</p>
		<p>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.</p>
		<p>“Latency Sensitivity” setting in a VM that can be tuned to help reduce virtual machine latency.</p>
		<p>Link aggregation feature in the virtual switch which will provide choice in hashing algorithms on which link aggregation is decided and this should also provide multiple link aggregation groups to be provided in a single host.</p>
12	VM Based Replication	<p>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.</p>
13	VM Backup	<p>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.</p>
14	I/O Control	<p>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.</p>
		<p>Prioritize network access by continuously monitoring I/O load over network and dynamically allocate available I/O resources to virtual machines according to needs.</p>

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15	OEM Support	Direct OEM 24x7x365 days with unlimited incident support and 30mins or less response time including the unlimited upgrades and updates.
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### Databases

Any commercially available database (e.g., SQL or equivalent), shall be provided along with license and support and upgrade costs

Sl. No.	Minimum specifications
<b>General</b>	
1	Database License should be un-restricted, to prevent any non-compliance in an event of customization & integration.
2	Database should provide Unicode (Latest version) capability with Indian language support
3	Databases shall support multi hardware and Operating System platform.
4	Database shall provide standard access Tool for administering the database. The tool should be able to monitor, maintain and manage the database instance, objects, and packages.
5	Database shall have built-in backup and recovery tool, which can support the online backup.
6	Database shall be able to provide database level storage management mechanism, which should enable the availability by means of creating redundancy, automatically balance the data files across the available disks, i/o balancing across the available disks for the database for performance, availability and management.
8	Should be an enterprise class database with the ability to support connection pooling, load sharing and load balancing when the load on the application increases.
9	Database shall provide native functionality to store XML, within the database and support search, query functionalities.
10	Database shall have built-in DR solution to replicate the changes happening in the database across DR site with an option to run real-time reports from the DR site without stopping the recovery mechanism
11	Database shall have Active-Passive failover clustering with objectives of scalability and high availability.
12	Database shall provide mechanism to recover rows, tables when accidentally deleted. The mechanism should provide ways and means of recovering the database.
13	Database shall provide functionality to replicate / propagate the data across different databases.
14	The RDBMS should support partitioning feature in table level object.

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15	Database shall provide native functionality to store XML, Images, Text, Medical Images, CAD images within the database and support search, query functionalities.
16	Database shall include tools for enterprise class high availability solution like monitoring performance, diagnose and alert for problems, tuning bottlenecks, resource monitoring and automatic resource allocation capabilities.
17	RDBMS must support the SQL queries.
18	Database shall provide security mechanism at foundation level of the database, so that the options and additions to the database confirm the security policy of the organization without changing the application code. Shall confirm to security evaluations and conformance to common criteria.
19	Database shall provide control data access down to the row-level so that multiple users with varying access privileges can share the data within the same physical database.
20	Database shall support for enhanced authentication by integrating tokens and biometric technologies.
21	Database shall provide functionality for classifying data and mediating access to data based on its classification for multi-level security and mandatory access control, manage access to data on a "need to know" basis.
22	Database shall be having native auditing capabilities for the database. Should support optional Audit Capability to store the audit records in separate audit store with monitoring & reporting for multiple databases to detect any security breaches.
23	Database shall be having built-in provision to Administer database / database clusters, Monitor performance, Maintain database, Backup and recovery, Recovery management, Disaster recovery management.
24	The Management tool should provide advisory-based performance tuning tool which help to tune the queries or objects, SQL analysis, SQL access.
25	The enterprise database should provide single web-based console for management of the database.
<b>Restart and Recovery</b>	
26	Availability of recovery/restart facilities of the DBMS.
27	Automated recovery/restart features provided that do not require programmer involvement or system reruns.
30	Program restart should be provided from the point of failure.
31	Ability to manage recovery/restart facilities to reduce system overhead.
32	Provides extra utilities to back up the databases by faster means than record by record retrieval.

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33	Provides clear error reporting, recovery and logging.
34	Describe recovery strategies that needs to be in place.
35	System should support mirroring for DRP.
Backup Procedures	
36	Describe Backup Procedures you plan to deploy.
37	Describe backup application(s) your proposed solution use.
38	Provide details of data backup and restore processes and procedures for all data elements.
39	Provide details of automated archiving procedures to copy active data to storage media when archive 'age' is reached.
Error Handling	
40	<p>Ability to trap a transaction failure through:</p> <ul style="list-style-type: none"> <li>• Application Software</li> <li>• DBMS</li> <li>• Availability of manual containing all system error messages and correction procedures</li> </ul>
System Control	
41	Provide details of the 'Audit trail' facility for your proposed solution.
42	Should provide adequate auditing trail facility.
43	System should record the date and time stamp for all records.
44	Ability to track terminals from where the system is accessed.

## Video Conferencing System

Video Conferencing System – General Requirements		
Sl. No.	Parameter	Minimum Specifications
1	System Features	Conferencing System should have minimum 20 ports at HD/ 1080p, 25fps or better on IP in continuous presence mode with H.265 resolution or better and encryption
		Multi-point video Conferencing Solution should be capable of offering a High Definition/1080p, 25fps or better in real-time for at least 15 number of concurrent ports/systems in single call or multiple multi-party sessions in continuous presence and voice activation mode with minimum bandwidth utilisation
		It should as well provide network flexibility for a reliable distributed architecture and cost-effective scalability for future requirements.

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		Conferencing System should be deployed in High Availability and should be redundant (1:1)
		It should provide flexibility to the users, where users can join the video conference call using PC, laptop, Smart phones, PSTN but not limited to. Video conferencing system shall support various browsers installed in PC, Laptop, Smartphones etc. This facility should be available from day one.
		The systems should support document sharing (PC images, etc.).
2	Video Standards and Resolutions	It should support WebRTC and latest industry standards for video compression.
3	Content Standards and Resolutions	Content sharing should be possible at 1080p 25fps It should support H.239 and encryption in SIP & H.323 modes
4	Audio Standards and Features	It should support G.711, G.722, G.722.1 It shall support aspect ratio of 16:9 and 4:3. It shall support a mix of resolutions in both Voice-activated mode and Continuous Presence. Each endpoint shall receive at the maximum of its capacity without reducing the capacity of another. Dynamic CP layout adjustment (it will choose the best video layout according to the number of participants in the conference). It should support distributed architecture with intelligent and automatic call routing. It must support load balancing such that in case there are two instances, conference participants can get distributed across these two instances based on their locations and still join into the same conference.
5	Network and security features	It shall support encryption of 128 bit for every participant without affecting any other feature, functionality or port count.
6	Interoperability	Apart from Integrated video systems, video IP phones, normal IP phones also should be able to join the conference seamlessly
7	General Standards	Should be based on ITU's (International Telecommunication Union) standards and guidelines.

### Management & Scheduling

Sl. No.	Component	Minimum Specifications
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<b>8</b>	System	The central management solution should be able to schedule the meeting quickly and easily manage conference infrastructure device configuration and provision of the endpoints.
<b>9</b>	System Capacity	The Central management server must support 10 devices capacity from day one and must be scalable.
<b>10</b>	Provisioning	The administration should be able to configure individual end points or group of endpoints using user policy from single management console.
		It should be possible for the endpoint to automatically pull the device and site provisioning information from the system while start up
<b>11</b>	Software Update	It should support automatic and scheduled mechanism to upgrade the software on one or more endpoints with a standard software.
<b>12</b>	Scheduling	The system should support schedule video conference meetings.
<b>13</b>	Directory Services	Should support integration with the corporate Active Directory for scheduling the video conference calls.
		The system should store video dialling information.
<b>Voice and Video Call Control</b>		
<b>Sl. No.</b>	<b>Parameter</b>	<b>Minimum Specifications</b>
<b>14</b>	System	The Call control solution should be able to register Integrated VC room system, Video IP phones, normal IP phones natively.
		The system should be a converged communication System with ability to run TDM and IP on the same platform.
		It should be possible to deploy Servers / Call Servers in an active-active/active hot-standby configuration over the distributed IP infrastructure (LAN/WAN).
		The communication feature server and gateway should support IP V6 from day one so as to be future proof
		The offered solution must provide a standard based mechanism for QoS implementation
		Should support AD & LDAP integration for directory synchronization & user authentication
<b>15</b>	Support for call-processing and call-control	Should support signalling standards/Protocols – SIP, MGCP, H.323, Q.Sig
		Voice Codec support - G.711, G.729, G.729ab, g.722, ILBC. Video codecs: H.261, H.263, H.264, H.265 and Wideband Video Codec
		Video telephony support
		System should be supplied with 50 endpoint license

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16	Security	The protection of signalling connections over IP by means of authentication, Integrity and encryption should be carried out using TLS
		System should support MLPP feature
		Proposed system should support SRTP for media encryption and signalling encryption by TLS
		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
Fully Integrated Single Room System		
Sl. No.	Parameter	Minimum Specifications
18	Protocols	Should support H.320 (ISDN Video conferencing) as well as H.323 (LAN Video Conferencing) standards. The system should be able to call any H.323 and SIP endpoint directly or indirectly.
		It should be possible to share content via BFCP and H.239
		Endpoint should support the latest video coding standard either H.263, H.264, H.265
		It should support Audio coding G.722, G.722.1, G.711
19	Network	Endpoint should support bit rate up to 8 Mbps or more on IP (H.323 and SIP)
		Minimum 2 X Gigabit Ethernet: Should support 10/100/1000 BASET
20	Main Video Resolution	Shall support high definition video resolution/1080p, 25fps or better for live video for both Transmit and receive
21	Camera	Inbuilt in the Integrated system with 2 cameras
		Both cameras should be capable of automatic voice tracking capability so as to automatically zoom and focus on to the person speaking in the room.
		Zoom: Minimum 10x (optical) or better
22	Video Inputs	Minimum 2 HDMI inputs and 1 input for connecting PC / laptop
23	Video Outputs	Minimum 2 x HDMI or similar or better to connect two displays. Additional Outputs are desirable.
24	Audio Inputs	Omnidirectional / Directional Microphones. 3 microphones to be supplied from day one with the system.
25	Encryption	AES 128 bit or more, TLS, SRTP, HTTPS or similar or better

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26	User Interface	Intuitive touch panel to operate the entire system
Video device		
Sl. No.	Parameter	Minimum Specifications
27	System	Should be an integrated system with at least 50-inch LCD/TFT screen, 1080P resolution (16:9), HD camera and speakers for wideband audio output. The Codec should be a part of the unit.
		The LCD/TFT screen should be remote control operable.
		Video Standards:
		<ul style="list-style-type: none"> <li>• Minimum H.264 and above</li> <li>• The system should support SIP protocol</li> <li>• Must support desktop sharing SIP calls</li> </ul>
		Video Frame Rate: Must support 1080p 25 fps
		Video Input: Should have HDMI or DVI (Digital Video Interface) input to connect PC/Laptop directly to the Video conferencing system and display a resolution of XGA/SXGA. The user must be able to toggle between the Laptop/PC mode and the Video conferencing mode at a push of button/icon.
		Video Output: Must have an HD output via an HDMI/DVI output port to display the VC screen onto an external display
		Should have inbuilt microphone & speaker system.
28	Security	Security - Password protected system menu
29	Camera	Should be HD at least 6-megapixel camera, with privacy shutter
		Must support 1080p resolution. Should support Wide formats. Must support 1920 X 1080 resolution
		The VC unit must allow the camera to be used as a document camera to capture hard copies and transmit it to the far end site

## EPABX

### Operational Requirements

1. The control room shall be equipped with **EPABX comprising** of at least 1 PRI line hunting - single telephone number to a group of at least 30 lines.
2. The Control room shall have seating capacity of minimum of 30 operators. Citizen can dial the telephone no. for any complaints related with police/ambulance/fire/Municipal

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Corporation. The system shall have capability to display name, address and find the geographical position of the caller at the time of receiving call in call center.

3. All phone calls shall be recorded for future references. The phone calls of at least the last 6 months shall be stored.
4. The operators shall be able to receive call, dispatch calls, use GIS maps and can send the alerts to the nearby free patrolling vehicles / fire engines / ambulances and inform the nearest Police Station about the event.
5. The operator shall be able to view the nearest Fire Station, Hospital, Blood Bank for providing additional assistance at the site of incident.
6. A web-based incident analytic software shall be made available that will help the Police / Ambulance / Fire / Municipal Corporation to do detailed analysis and analytics so that the response can be made proactive and the effectiveness of the service improved.
7. After the Call has been logged in by the call taker, the system shall send a SMS to the Caller stating the CFS/Tracking Number along with a password as acknowledgement to the call made to the control room. The caller can use this number on department website to access the event progress details such as Action Taken Reports (ATR), file attachments, remarks, or other information's as per the prevailing departmental policy for data sharing.
8. Security and Audit - The platform needs to be audited with STQC certification by CERT-IN empanelled agency.
9. Multi-Language & Differently abled person Support - Should have support for local Indian languages to be able to reach masses. Shall provide support for English and Hindi, standard local languages (Punjabi) across various channels (SMS, IVR, Smart Client, Mobile Web etc.) for services across service categories as required by individual integrating departments.
  - a. Policies for retention of records including voice recording screen recording, case details etc.
  - b. Records would be deleted in consultation with the department.

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### Video Wall

Sl. No.	Parameter	Minimum Specifications
1	Size	JICCC Screen unit size- 50" in 7 * 3 array arrangement DLP screen Viewing Centre – 50" single DLP screen
2	Resolution	Full high definition (1920 x 1080); 16:9 Widescreen
3	Dynamic Contrast ratio	1000000:01 or more
4	Brightness	Minimum 250 nits and should be adjustable for lower or even higher brightness requirements Uniformity: >=95%
5	Viewing angle	178 degree/178 degree (H/V)
6	Screen to screen gap	< 1 mm or better
7	Light Source Type	Best in class LED light source with redundancies for DLP LEDs
8	Dust Prevention	Should be designed to avoid dust / Dust tight and resistant / Follow standards as prescribed by Government
9	Response time	8ms
10	Input	HDMI
11	Control	· On Screen Display (OSD) · IR remote control or IP based control or any other medium
12	Operations	24 x 7 basis
13	Power Consumption	Less than 250 watts per cube or more
14	Colour and Brightness	All cubes should have uniform brightness and colour. The colour calibration should be automatic and continuous operations.

### Video Wall Controller

Sl. No.	Parameter	Minimum Specifications
1	Controller	Controller to control Video wall in a matrix arrangement as per requirement along with software
2	Chassis	19" Rack mount

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3	Processor	Latest Generation 64 bit x86 Quad Core processor (3.4 Ghz) or better
4	Operating System	Pre-loaded 64-bit Operating System Windows / Linux / Equivalent, with recovery disc
5	RAM	32 GB or more
6	HDD	500 GB (7200 RPM) or more
7	Networking	Dual-port Gigabit Ethernet Controller with RJ-45 ports
8	RAID	RAID 0, 1 or better
9	Power Supply	Redundant
11	Input/ Output support	DVI/HDMI/USB/ LAN/ VGA/SATA port
12	Accessories	104 key Keyboard and Optical USB mouse
13	USB Ports	Minimum 4 USB Ports
14	Redundancy support	Power Supply, HDD, LAN port & Controller
15	Scalability	Display multiple source windows in any size, anywhere on the wall
16	Control functions	Brightness/ Contrast/ Saturation/ Hue/ Filtering/ Crop/ Rotate
17	Inputs	To connect to minimum 2 sources through HDMI
18	Output	To connect to minimum 16 Displays through HDMI
19	Operating Temperature	10°C to 35°C, 80 % humidity
20	Cable & Connections	Successful bidder should provide all the necessary cables and connectors, so as to connect Controller with LED Display units
21	Architecture	The controller should be based on distributed architecture. The controller should be used to decode the IP camera on the video wall

### Workstation

The workstations to be provided for Emergency Response System shall have three monitors. For details please refer Emergency Response system. CCTV surveillance desktops shall have two monitors.

Sl. No.	Parameter	Minimum Specifications
1	Processor	Latest generation 64bit X86 Quad core processor(3Ghz) or better
2	Chipset	Latest series 64bit Chipset
3	Motherboard	OEM Motherboard

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4	RAM	Minimum 8 GB DDR3 ECC Memory @ 1600 Mhz. Slots should be free for future upgrade. Minimum 4 DIMM slots, supporting up to 32GB ECC
5	Graphics card	Minimum Graphics card with 2 GB video memory (non- shared)
6	HDD	2 TB SATA-3 Hard drive @7200 rpm with Flash Cache of 64GB SSD. Provision for installing 4 more drives.
7	Media Drive	No CD / DVD Drive
8	Network interface	10/100/1000 Mbps autosensing on board integrated RJ-45 Ethernet port.
9	Audio	Line/Mic IN, Line-out/Spr Out (3.5 mm)
10	Ports	Minimum 6 USB ports (out of that 2 in front)
11	Keyboard	104 keys minimum OEM keyboard
12	Mouse	2 button optical scroll mouse (USB)
13	PTZ joystick controller (with 2 of the workstations in JICCC)	<ul style="list-style-type: none"> <li>• PTZ speed dome control for IP cameras</li> <li>• Minimum 10 programmable buttons</li> <li>• Multi-camera operations</li> <li>• Compatible with all the camera models offered in the solution</li> <li>• Compatible with VMS /Monitoring software offered</li> </ul>
14	Monitor	22" TFT LED monitor, Minimum 1920 x1080 resolution, 5 ms or better response time, TCO 05 (or higher) certified
15	Certification	Energy star 5.0/BEE star certified
16	Operating System	64 bit pre-loaded OS with recovery disc
17	Security	BIOS controlled electro-mechanical internal chassis lock for the system.
18	Antivirus feature	Advanced antivirus, antispyware, desktop firewall, intrusion prevention (comprising of a single, deployable agent) which can be managed by a central server. (Support, updates, patches and errata for the entire contract/ project period)
19	Power supply	SMPS; Minimum 400-watt Continuous Power Supply with Full ranging input and APFC. Power supply should be 90% efficient with EPEAT Gold certification for the system.
20	USB Ports	Minimum 4 USB ports (out of that 2 must be in front)
21	Certification for Desktop	Energy Star 5.0 or above / BEE star certified

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### Laptops

Sl. No.	Parameter	Minimum Specifications
1	Processor	Latest generation Intel Core i7 (2 Ghz) or higher OR AMD (2 Ghz) Processor or higher OR Equivalent 64 bit x86 processor
2	Display	Minimum 14" Diagonal TFT Widescreen with Minimum 1366 x 768 resolution (16:9 ratio)
3	Memory	8 GB DDR3 RAM @ must be free for future upgrade
4	Hard Disk Drive	Minimum 500 GB SATA HDD @ 5400 rpm
5	Ports	3 USB Ports; 1- Gigabit LAN (RJ 45); 1- HDMI/Display port; 1- VGA; 1- headphone/Microphone
6	Web Camera	Built in web cam
7	Wireless Connectivity	Wireless LAN - 802.11b/g/n/ Bluetooth 3.0
8	Audio	Built-in Speakers
9	Battery backup	Minimum 4 lithium ion or lithium polymer battery with a backup of minimum 4 hours
10	Keyboard and Mouse	84 Keys Windows Compatible keyboard, Integrated Touch Pad.
11	Operating System	Pre-loaded Windows 10 (or latest) Professional 64 bit or equivalent and Office suite or equivalent, licensed copy with certificate of authenticity (or equivalent authenticity information) and all necessary and latest patches and updates. All Utilities and driver software, bundled in CD/DVD/Pen-drive media.
12	Certification	Energy Star 5.0 or above / BEE star certified
13	Weight	Laptop with battery (without DVD) should not weigh more than 2 Kg
14	Accessories	Laptop carrying Back-pack. It must be from same OEM as laptop
15	Other pre-loaded software (open source/ free)	Latest version of Liber-office, Latest version of Adobe Acrobat Reader, Scanning Software (as per scanner offered). These software shall be preloaded (at the facility of OEM or any other location) before shipment to Authority offices/locations.

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### IP Phone

Sl. No.	Parameter	Minimum Specifications
1	Display	2 line or more, Monochrome display for viewing features like messages, directory
2	Integral switch	10/100 mbps for a direct connection to a 10/100 BASE-T network or better.
3	Speaker Phone	Yes
4	Headset	Wired, Cushion Padded Dual Ear- Speaker, Noise Cancelling headset with mouthpiece microphone, port compatibility with IP Phone
5	VoIP Protocol	SIP V2
6	POE/POE+	IEEE 802.3af or better and AC Power Adapter (Option)
7	Supported Protocols	SNMP, DHCP, DNS
8	Codecs	G.711, G.722, G.729 including handset and speakerphone
9	Speaker Phone	Full duplex speaker phone with echo cancellation Speaker on/off button, microphone mute
10	Volume control	Easy decibel level adjustment for speaker phone, handset and ringer
11	Phonebook/Address book	Minimum 100 contacts
12	Call Logs	Access to missed, received, and placed calls. (Minimum 20 overall)
13	Clock	Time and Date on display
14	Ringer	Selectable Ringer tone
15	Directory Access	LDAP standard directory

### IP PBX

Sl. No.	Minimum specifications
1	The IP telephony system should be a converged communication System with ability to run analog and IP on the same platform using same software load based on server and Gateway architecture
2	The single IP PBX system should be scalable to support up to 500 stations (any mix/percentage of Analog/IP) to achieve the future capacity

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<b>3</b>	The system should be based on server gateway architecture with external server running on Linux OS. No. of card based processor systems should be quoted.
<b>4</b>	The voice network architecture and call control functionality should be based on SIP
<b>5</b>	The call control system should be fully redundant solution with no single point of failure & should provide 1:1 redundancy.
<b>6</b>	The communication server and gateway should support IP V6 from day one so as to be future proof
<b>7</b>	The entire solution (IP PBX, its hardware, IP Phones, Voice Gateway) should be from a single OEM
<b>Support for call-processing and call-control</b>	
8	Should support signalling standards/Protocols – SIP, MGCP, H.323, Q.Sig
9	Voice Codec support - G.711, G.729, G.729ab, g.722, ILBC
10	The System should have GUI support web based management console
<b>Security</b>	
11	The protection of signalling connections over IP by means of authentication, Integrity and encryption should be carried out using TLS
12	System should support MLPP feature
13	Proposed system should support SRTP for media encryption and signalling encryption by TLS
14	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
15	The administrator logging on to the call control server needs to authenticate by suitable mechanism such as User Login Information and Passwords/ Radius Server
16	Voice gateway to be provided with 1 PRI card scalable to 3 PRI in future for PSTN (PRI) line termination.

## Multi-Function Laser Printer

Sl. No.	Parameter	Minimum Specifications
1	Technology	Laser
2	Monthly duty cycle/RMPV (pages)	200,000/5K-20K
3	Print speed – simplex (A4)	Up to 41 ppm
4	Scan speed – Black/Colour simplex	Up to 50/30 ipm
5	Scan speed – Black/Colour duplex	Up to 19/14 ipm
6	Scan-to destinations	Email, Network folder, USB

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7	Processor (MHz)	600
8	Memory (MB)	1024
9	Hard disk drive (HDD)/Capacity (GB)	Yes/240
10	Connectivity	2 Hi-Speed USB 2.0; 1 Gigabit Ethernet 10/100/1000T network
11	Print resolution – Max/Best print quality (dpi)	Up to 1200x1200
12	Input capacity – Std/Max (sheets)	600/4,600
13	Output size – Min/ Max (mm)	76.2 x127/312x469.9
14	Automatic duplex	Yes
15	Energy Efficiency	BEE or Energy Star certified
16	Control panel display	20 m touchscreen

### Laser Printer

Sl. No.	Parameter	Minimum Specifications
1	Print speed black (normal, A4)	Up to 25 ppm
2	Print quality black (best)	Up to 1200 x 1200 dpi
3	Print technology	Monochrome Laser
4	Duty cycle (monthly, A4)	Up to 15,000 pages
5	Recommended monthly page	volume 250 to 2000
6	Standard memory	Minimum 128 MB
7	Processor speed	Minimum 700 MHz
8	Paper handling standard/input	Up to 250-sheet input tray
9	Paper handling standard/output	Up to 150-sheet output bin
10	Media sizes supported	A4, A5, A6, B5, postcard
11	Media types supported	Paper, transparencies, postcards, envelopes, labels
12	Standard connectivity	Hi-Speed USB 2.0 port with USB data cable, Ethernet with RJ45 connectivity

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13	Duplex printing	Automatic (standard)
14	Compatible operating systems	Microsoft Windows 7 Professional(64bit), Windows 8 Pro(64 bit), Windows 8.1, Windows 10, Server 2008 R2, Server 2012 R2, MAC OS 9.0, MAC OS X, Linux
15	Power requirements:	Input voltage 220 to 240 VAC (+/- 10%), 50 Hz (+/- 2 Hz);
16	Power consumption during printing	Less than 500W
17	Energy Efficiency	BEE or Energy Star certified
18	Front operating Panel	Graphical LCD display

### Projector

Sl. No.	Item	Minimum Specifications
1	Display Technology	Poly-silicon TFT LCD
2	Resolution	HD 1080p
3	Colours	16.7 million Colours
4	Brightness	2500 or more ANSI lumens (in Normal Mode)
5	Contrast Ratio	2000:1 or more
6	Video Input	One computer (D-Sub, Standard 15 pin VGA connector), One S-Video, One HDMI
7	Audio	Internal speaker
8	Output ports	External Computer Monitor port, audio ports
9	Remote Operations	Full function Infrared Remote Control
10	Other features	Auto source detect, Auto-synchronization, Keystone Correction

## **7.2. Data Center (DC) & Disaster Recovery (DR)**

### **Data Center**

- MSI is required to co-locate all the hardware/software and related items for the smart city infrastructure including SLA monitoring and Help Desk Management, in a Tier III or above data Center complying to standard guidelines as per Telecommunications Infrastructure UPTIME/TIA-942.
- The Data center shall be available for 24x7x365 operation.
- 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.
- The MSI shall submit to JSCL adequate documentation/ evidences in support of the choice of the data center to meet the project requirements.
- Access to the Data Center Space where the Smart City Project Infrastructure is proposed to be hosted should be demarcated and physical access to the place would be given only to the authorized personnel
- It should have access control system implemented for secured access.
- Indoor CCTV Cameras would be required to be installed to monitor the physical access of the system from remote location
- Physical Access to the building hosting Data Center should be arm and it must be possible to even depute police personnel for physical security of the premises.
- MSI should optimize the overall system within intranet and internet communications during maintenance phases based on utilization of applications and submit reports accordingly
- Enterprise Management System and Network and Security Management Solution.
- Centralized System for Security Solution.

## **Disaster Recovery (DR)**

1. The MSI is required to provision for a Disaster Recovery (DR) Site on cloud
2. The DR site should not be in the same seismic zone and should be at least 250 km from Main DC site.
3. DR site shall provision to cater to 100% load of the smart city system for only mission critical applications and 5% of video feeds.
4. MSI shall propose to host Applications and storage on cloud for complete Data Recovery (DR) operations.
5. MSI should select the Cloud Service Provider who adheres to the guidelines of MeITY or preferred to be empanelled vendors of MeITY.
6. The MSI shall establish dedicated connectivity between the DC and DR Site for replication & failover.
7. For CCTV surveillance, selected video feeds from police shall only be replicated to DR site
8. The SI shall design the CCC & Near DR Site solution with the necessary load balancing, replication and recovery solution that provide zero RPO (Recovery Point Objective) and RTO (Recovery Time Objective) of 10 minutes.

### **7.2.1. Functional Requirements – Data Center & Disaster Recovery**

#### **Data Center:**

- Design Standard: Tier-III or above
- The availability of data must be guaranteeing to 99.982% availability.
- Receiving Power: Commercial power substation next to DC
- UPS: UPS system with N+N redundancy
- Generator: Gen-set with N+1 redundancy
- Power Provision: Dual power feed, PDU sources to each rack, Power supply to a rack as per requirement

#### **Disaster Recovery**

Below are the key factors and functional requirements, which need to be considered for cloud hosting of DR:

- i. The MSI is required to submit the details of methodologies and computations for sizing and capacity of storage, compute, backup, network and security.
- ii. There should be physical and logical separation (of space, servers, storage, network infrastructure and networks) to protect data, applications and servers.
- iii. The system will be hosted in the site identified by the MSI and as agreed by the JSCL for DR.
- iv. There should be sufficient capacity (compute, network and storage capacity offered) available for near real time provisioning (as per the SLA requirement of the JSCL) during any unanticipated spikes in the user load.
- v. DR site will be located in India only.
- vi. Ensure redundancy at each level for applications that are identified as mission critical.
- vii. MSI shall provide interoperability support concerning available APIs, data portability etc. for the JSCL to utilize in case of Change of cloud service provider, migration back to in-house infrastructure, burst to a different cloud service provider for a short duration or availing backup or DR services from a different service provider.
- viii. The MSI is fully responsible for tech refreshes, patch management and other operations of infrastructure that is in the scope of the MSI.
- ix. JSCL retains ownership of all virtual machines, templates, clones, and scripts/applications created for the JSCL's application. JSCL retains the right to request (or should be able to retrieve) full copies of these virtual machines at any time.
- x. Provide a robust, fault tolerant infrastructure with enterprise grade SLAs with an assured uptime of 99.5%, SLA measured at the VM Level & SLA measured at the Storage Levels
- xi. Cloud services should be accessible via internet and MPLS.
- xii. Required Support to be provided to the JSCL in migration of the VMs, data, content and any other assets to the new environment created by the JSCL or any Agency (on behalf of the JSCL) on alternate cloud service provider's offerings to enable successful deployment and running of the Smart city solution on the new infrastructure.
- xiii. The MSI should configure, schedule and manage backups of all the data including but not limited to files, folders, images, system state, databases and enterprise applications

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- Perform and store data and file backups consisting of an initial full back up with daily incremental backups for files
  - For the files, perform weekly backups
  - For the databases, perform a twice weekly full database backup, with a three times daily backup of database log files
  - Encryption of all backup files and data and management of encryption keys as a service that can be enable for Government Departments that require such a service.
  - Retain database backups for thirty (30) days
  - Videos selected by police shall never be deleted
- xiv. The MSI should offer dashboard to provide visibility into service via dashboard.
- xv. MSI shall not delete any data at the end of the agreement (for a maximum of 45 days beyond the expiry of the Agreement) without the express approval of the JSCL.

**Preparation of Disaster Recovery Operational Plan:** The MSI should provide detailed operating procedures for each application.

### Technical Specifications:

#### WAN Router

Sl. No.	Parameter	Minimum Specifications
1	Architecture	Router should have redundant controller cards and should support state full switchover, non-stop forwarding, Non-stop routing and Graceful restart.
		Router shall support sync any configurations from previous modules to new modules with hot-swap event occurred The router shall support following type of interfaces – 10GE, 1GE interfaces, 10G, Ch STM1 Field replacement of port or card should not require to bring down the chassis.
2	Performance	Router shall support non-blocking capacity of 64 Gbps full duplex Router shall support 60 Mbps forwarding performance for IPv4 & IPv6 performance

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		The router should support 20Gbps per slot throughput.
		Router shall support 16000 Mac addresses
		Router shall support 18000 IPv4/IPv6 routes
		Router shall support 4000 queues and 128 MPLS VPN's
		Router shall support aggregation of links. Minimum 8 links should be supported as part of single aggregation
		Router shall support IPSLA or equivalent and Y.1731 for performance monitoring
3	High Availability	<p>Router should support Redundant Power Supply and should also support Online insertion and removal of same.</p> <p>Fan tray should be a Field Replaceable Unit (FRU). The node can run indefinitely with a single fan failure.</p> <p>Router shall support MPLS-TE with FRR for sub 50 msec protection.</p> <p>Router must support Traffic Engineering for node and link protection.</p>
4	Protocol Support	<p>Router should support following routing protocols: IPV4 and IPV6, IGMP V2/V3, MLD, IGMP V1,V2,V3 and PIM, 6PE, BGP, Policy Routing, OSPF V2 and V3</p> <p>Router should support high availability for all BFD,BGP ,OSPF and IS-IS and no packet loss during controller switch over.</p> <p>Router should support RFC 3107 of Carrying Label Information in BGP-4</p> <p>The Router should support Point to Point and Point to Multipoint LSP for Unicast and Multicast traffic.</p> <p>Router shall support layer3 and layer2 MPLS VPN.</p>
5	QoS Features	<p>Router shall support HQOS on all kind of interface in both ingress and egress direction. Similar QOS shall be supported for all type of interface including Bundled interfaces.</p> <p>Shall support Ingress classification, marking and policing on physical interfaces and logical interfaces using source/destination IP subnet, protocol types (IP/TCP/UDP),source/destination ports, IP Precedence, MPLS EXP, DSCP,802.1p</p>

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		Shall support Strict Priority Queuing or Low Latency Queuing to support real-time application like Voice and Video with minimum delay and jitter.
		Congestion Management: WRED, Priority queuing, Class-based weighted fair queuing
6	Security & Management	Support Access Control List to filter traffic based on Source & Destination IP Subnet, Source & Destination Port, Protocol Type (IP, UDP, TCP, ICMP etc.) and Port Range etc. Should Support per-user Authentication, Authorization, and Accounting through RADIUS or TACACS and SNMPv1/v2/V3
7	Operating Environmental Requirements	0°C to 40°C operating temperature and 10 to 90%, non-condensing
8	Interface	The proposed router should support the following from day1: - 2x10G SFP+ ports supplied with 1x10G single mode transceiver, 1x10G multi-mode transceiver, 8x1G SFP ports supplied with 4x1G single mode transceiver, 4x1G multi-mode transceiver & 32 no's of 10/100/1000 Base-T ports.
9	Certifications/ OEM	The router should be IPv6 ready from day-1.

## Internet and Aggregation Router

Sl. No.	Minimum Specifications
1	Router should be chassis based device with minimum 10 Gbps of throughput scalable up to 20 Gbps. It should have minimum 4 GB of RAM/ DRAM
2	Router supports management protocol: SNMP v1/v2/v3, CLI (Telnet/Console), TFTP update and configured file management
3	Router must have inbuilt state full firewall, zone-based firewall and 3 DES capability technologies to support the access controller strategy based source and destination IP protocol port and time parameters
4	Router should have tunnelling protocols like IPsec VPN, GET VPN or equivalent, Multi Point VPN and encryption mechanisms like DES, 3DES, AES (128 and 256Bit).It should support minimum 300 IPsec tunnels from day one.
5	Router has support for the following routing /WAN protocols

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6	PPP/MLPPP, HDLC
7	Router should be modular chassis based device and should accommodate a combination of high-density 10G, Gigabit Ethernet, Fast Ethernet
8	Router should support protocols like RIP, OSPF, BGP, VRRP/HSRP, 802.1q, GRE, ACL's and NAT MPLS, traffic engineering, EoMPLS or VPLS
9	or equivalent, L2 VPN from day one
10	Shall support the RIPng & BGP for IPv6, OSPFv3, MPLS, BGP from day one.
11	The router supports state full packet inspection supporting H.323, SIP and other application level gateway support
12	The state full firewall supports IPsec pass through
13	System shall support to provide the ability to filter and gather application information in a flexible manner from day one
14	Router should support QoS Classification and marking policy based routing, IP precedence, DSCP
15	QoS -congestion management WRED/RED, Priority queuing, class-based weighted for fair queuing
16	IP Access list to limit Telnet SNMP access to router
17	Multiple privilege level authentication for console and telnet access
18	Time-based ACL for controlled forwarding based on time of day for offices
19	Should have extensive support for SLA monitoring for metrics like delay latency, jitter, packet loss and MoS
20	Provides QoS features like traffic prioritization, differentiated services, and committed, and committed access rate, QoS Support, RSVP/WFQ/MRED. Router should be able to take pre-configured action on these events like changing routes, changing routing metric
21	Router supports for QoS Features for defining the QoS policies. Support for low latency queuing, Layer 2 and Layer 3 CoS/DSCP
22	Router should have multicast routing protocols support: IGMPv1, v2 (RFC2236) PIM-SM (RFC2362) and PIM-DM/ Multicast VLAN Registration
23	The following interface required from Day-1: 2x 10G SFP+ based ports loaded with single mode transceiver, 3*1GE & 3*1G SFP-based transceiver.
24	The router should be IPv6 ready

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### Layer 3 Switch

Sl. No.	Parameter	Minimum Specifications
1	Switch type	Layer 3
2	Ports	24 or 48 (as per requirements) 10/100/1000 Base-T/TX/FX ports All ports can auto-negotiate between 10Mbps/ 100Mbps/ 1000Mbps, half-duplex or full duplex and flow control for half duplex ports 100Mbps/1000Mbps, half duplex or full duplex and flow control for half duplex ports
3	MAC	Support 60 K MAC address
4	Backplane	Properly sized Switching fabric capacity (as per network configuration to meet performance requirements of wire speed switching for the connected devices)
5	Forwarding rate	100 Mbps or higher for both IPv4 and IPv6
6	Port Features	Must support Port Mirroring, Port Trunking and 802.3ad LACP Link Aggregation port trunks
7	Flow Control	Support IEEE 802.3x flow control for full-duplex mode ports
8	Protocols	<ul style="list-style-type: none"> <li>▪ Should Support IP routing, RIP, OSPF, PIM</li> <li>▪ Should support IGMP snooping v1,v2 &amp; v3</li> <li>▪ Should support Secure Shell (SSH) Protocol and Simple Network Management Protocol</li> </ul>
9	Access Control	<ul style="list-style-type: none"> <li>▪ Support 802.1x (Port based network access control).</li> <li>▪ Support for MAC filtering.</li> <li>▪ Should support RADIUS authentication</li> </ul>
10	VLAN	<ul style="list-style-type: none"> <li>▪ Support 802.1 Q Tagged VLAN and port based VLANs and Private VLAN</li> <li>▪ The switch must support dynamic VLAN Registration or equivalent Dynamic Trunking protocol or equivalent</li> </ul>
11	Traffic	<ul style="list-style-type: none"> <li>▪ Switch should support traffic segmentation</li> <li>▪ Traffic classification should be based on user-definable application types: TOS, DSCP, Port based, TCP/UDP port number</li> </ul>
12	Management	<ul style="list-style-type: none"> <li>▪ Switch needs to have RS-232 or any other console port for management via a console terminal or PC</li> <li>▪ Must have support SNMP v1, v2 and v3</li> </ul>

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		<ul style="list-style-type: none"> <li>▪ Should support 4 groups of RMON</li> <li>▪ Should have accessibility using Telnet, SSH, Console access, easier software upgrade through network using TFTP etc.</li> <li>▪ Configuration management through CLI, GUI based software utility and using web interface</li> <li>▪ Switch should be manageable through both IPv4 &amp; IPv6</li> <li>▪ Should have modular OS and should support configuration roll back to recover mis-configured switch to last known good configuration</li> </ul>
13	Power Supplies	Redundant power supply

### Layer 2 Switch

Sl. No.	Parameter	Minimum Specifications
1	Switch type	Layer 2
2	Ports	24 or 48 (as per requirements) 10/100/1000 Base-T Ethernet Port
3	MAC	Support 8K or more MAC address
4	Backplane	Properly sized Switching fabric capacity (as per network configuration to meet performance requirements of wire speed switching for the connected devices)
5	Forwarding rate	Packet Forwarding Rate should be 70.0 Mbps or better
6	Port Features	Must support Port Mirroring, Port Trunking and 802.3ad LACP Link Aggregation port trunks
7	Transfer Rate	Non-Blocking, Wire speed Architecture
8	Flow Control	Support IEEE 802.3x flow control for full-duplex mode ports
9	Protocols	<ul style="list-style-type: none"> <li>• IPV4, IPv6</li> <li>• Support 802.1D, 802.1S, 802.1w, Rate limiting</li> <li>• Support 802.1Q VLAN encapsulation, IGMP v1, v2 and v3 snooping</li> <li>• 802.1p Priority Queues, port mirroring, DiffServ</li> <li>• DHCP support</li> <li>• Support up to 1024 VLAN</li> </ul>

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10	Access Control	<ul style="list-style-type: none"> <li>• Support port security</li> <li>• Support 802.1x (Port based network access control).</li> <li>• Support for MAC filtering.</li> <li>• Should support TACACS+ and RADIUS authentication</li> </ul>
11	VLAN	Support 802.1Q Tagged VLAN and port based VLANs and Private VLAN. The switch must support dynamic VLAN Registration or equivalent Dynamic Trunking protocol or equivalent
12	Protocol and Traffic	Network Time Protocol or equivalent Simple Network Time Protocol support switch should support traffic segmentation. Traffic classification should be based on user-definable application types: TOS, DSCP, Port based, TCP/UDP port number
13	Management	Switch needs to have RS-232 or any other console port for management via a console terminal or PC. Must have support SNMP v1, v2 and v3. Should support 4 groups of RMON. Should have accessibility using Telnet, SSH, Console access, easier software upgrade through network using TFTP etc. Configuration management through CLI, GUI based software utility and using web interface

## SAN Storage

Sl. No.	Parameter	Minimum Specifications
1	RAID Level	RAID Array supporting Raid Levels 0, 1, 5, 0+1 / 10 or equivalent
2	Availability and Required Cache	Cache should be mirrored between Active-Active controllers on dedicated, redundant paths / links between the controllers. In case of power failure, the SAN array must be provided with cache protection mechanism to ensure no loss of data in cache by de-staging to disks, irrespective of duration of power outage. The Proposed SAN Array should be configured with at least 16 GB usable data cache or higher or as per proposed solution for storage
3	Reliability	The proposed SAN Array should be configured with No Single Point of Failure Architecture with Dual Controllers for redundancy and should support hot plug and hot swap of components online (including controllers, disks, power supplies, cooling fans etc.). Should have continuous system monitoring and shall support remote diagnostics / error reporting feature. It should also allow the recovery of data in transit in the event of failure

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<b>4</b>	Drive interface	The array proposed should be an end-to-end 12 Gbps architecture. 2X12 Gbps drive/SAS port or 4 SAS lane per controller
<b>5</b>	Other Features	<ul style="list-style-type: none"> <li>▪ Box should be compatible of SAN environment</li> <li>▪ The SAN Array should support intermixing of SAS / FC &amp; NL-SAS / FATA/SATA-II Disks of various capacities and speeds</li> <li>▪ Storage subsystem shall support 300GB/ 400 GB/ 600 GB or higher with 10K / 15 K RPM Fiber channel/ SAS drives or as per proposed backup solution &amp; 750GB /1TB or higher SATA/FATA or equivalent disk drives in the same device array</li> <li>▪ The storage array proposed should have an upgrade path</li> <li>▪ All the necessary software to configure and manage the storage space, RAID configuration, logical drives allocation, virtualization, snapshots (including snap clones and snap mirrors) for entire capacity etc. should be included.</li> <li>▪ Must have redundant power supplies, batteries, cooling fans and data path and storage controller.</li> <li>▪ Should support Non-disruptive component replacement of controllers, disk drives, cache, power supply, fan subsystem etc.</li> <li>▪ Load balancing shall be able to be controlled by system management software tools.</li> <li>▪ Should support the supplied storage and operating systems</li> <li>▪ The storage system should be scalable from 150 TB.</li> <li>▪ The storage array should support block level replication across storage arrays</li> <li>▪ The storage array should support all the Operating System Platforms &amp; Clustering</li> <li>▪ Any software or license required to enable connectivity to these OS should be included</li> <li>▪ Storage should support non-disruptive online firmware upgrade for both Controllers and disk drives.</li> <li>▪ The storage array should support hardware based data replication at the Block level across all models of the offered family.</li> <li>▪ The storage should provide automatic rerouting of I/O traffic from the host in case of primary path failure.</li> <li>▪ Should provide for LUN masking, fiber zoning and SAN security</li> </ul>

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		<ul style="list-style-type: none"> <li>▪ Should support storage virtualization, i.e. Easy logical drive expansion.</li> <li>▪ Storage should be supplied with virtualization license as per solution requirement</li> <li>▪ Should support hot-swappable physical drive raid array expansion with the addition of extra hard disks</li> <li>▪ Should be able to support clustered and individual servers at the same time.</li> <li>▪ Should be able to take "snapshots" of the stored data to another logical drive on a different Disk/RAID Group for backup purposes</li> <li>▪ Should be configured with "snapshots and clone"</li> <li>▪ The vendor must provide the functionality of proactive monitoring of Disk drive and Storage system for all possible hard or soft disk failure. Vendor should also offer storage performance monitoring and management software.</li> <li>▪ The storage system shall be configured with GUI based management software as below:           <ul style="list-style-type: none"> <li>▪ Monitor and manage the storage array Configuration</li> <li>▪ Remote Storage base replication</li> <li>▪ Storage front end port monitoring</li> <li>▪ Disk Monitoring</li> <li>▪ LUN management.</li> <li>▪ Storage Component replacement, etc.</li> </ul> </li> </ul>
6	Note	All specifications stated are minimum required. Proposed system may have features over and above the minimum specification stated. Bidder should ensure that the performance of storage is not negatively affected

### SAN Switch

Sl. No.	Minimum Specifications
1	The fibre channel switch must be rack-mountable. Thereafter, all reference to the 'switch' shall pertain to the 'fibre channel switch'
2	The switch to be configured with minimum of 96 ports 16 Gbps FC configuration backward compatible to 4/8
3	All 96 x FC ports for device connectivity should be 4/8/16 Gbps auto-sensing Fibre Channel ports

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4	The switch must have redundant power supply & fan module without resetting the switch, or affecting the operations of the switch
5	The switch must be able to support non-disruptive software upgrade.
6	The switch must be able to support state full process restart
7	The switch must be capable of creating multiple hardware-based isolated Virtual Fabric (ANSI T11) instances. Each Virtual Fabric instance within the switch should be capable of being zoned like a typical SAN and maintains its own fabric services, zoning database, Name Servers and FSPF processes etc. for added scalability and resilience
8	The switch must support up to 32 Virtual Fabric Instances
9	The switch must be capable of supporting hardware-based routing between Virtual Fabric instances
10	The switch must support graceful process restart and shutdown of a Virtual Fabric instance without impacting the operations of other Virtual Fabric instances
11	The switch shall support Small Form Factor Pluggable (SFP) LC typed transceivers
12	The switch must support hardware ACL-based Port Security, Virtual SANs (VSANs), and Port Zoning
13	The switch must support Smart Zoning such that the entries in the TCAM is significantly reduced and therefore increasing the overall scalability of the SAN Fabric
14	The switch must support Power On Auto Provisioning (POAP) and Quick Configuration Wizard for simplified operations
15	Inter-switch links must support the transport of multiple Virtual Fabrics between switches, whilst preserving the security between Virtual Fabrics
16	The switch must support routing between Virtual Fabric instance in hardware
17	The switch shall support FC-SP for host-to-switch and switch-to-switch authentication.
18	The switch must be able to load balance traffic through an aggregated link with Source ID and Destination ID. The support for load balancing utilizing the Exchange ID must also be supported
19	The switch must be equipped with congestion control mechanisms such that it is able to throttle back traffic away from a congested link
20	The switch must be capable of discovering neighbouring switches and identify the neighbouring Fibre Channel or Ethernet switches
21	The switch should support IPv6. It should support native switch based REST APIs
22	The bidder must provide at least 2 of these switches

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23	The interface requirement mentioned here is the minimum. If the solution requires more number of interfaces (considering 100% redundancy) then the same should be quoted by the bidder
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### Rack

Sl. No.	Parameter	Minimum Specifications
1	Type	<ul style="list-style-type: none"> <li>▪ 19" 42U racks mounted on the floor</li> <li>▪ Floor Standing Server Rack - 42U with Heavy Duty Extruded Aluminium Frame for rigidity.</li> <li>▪ Two pairs of 19" mounting angles with 'U' marking</li> <li>▪ Heavy Duty Top and Bottom frame of MS.</li> <li>▪ Should be capable of carrying maximum load of 500 Kg.</li> <li>▪ All racks must be lockable on all sides with unique key for each rack</li> <li>▪ Shelf, Stationery 4 Sets per Rack</li> </ul>
2	Power Distribution Units	<ul style="list-style-type: none"> <li>▪ 2 per rack</li> <li>▪ Vertically Mounted, 32AMPs with 25 Power Outputs. (20 Power outs of IEC 320 C13 Sockets &amp; 5 Power outs of 5/13Amp Sockets), Electronically controlled circuits for Surge &amp; Spike protection, LED readout for the total current being drawn from the channel, 32AMPS MCB, 3KVAC isolated input to Ground &amp; Output to Ground (2 No per Rack). Each power distribution unit should be with built in mechanism of trip in case of short circuit</li> </ul>
3	Doors	Fully perforated front & rear mesh doors
4	Fans and Fan Tray	<ul style="list-style-type: none"> <li>▪ Fan 4 Nos. per Rack</li> <li>▪ The Fans should switch on based on the Temperature within the rack. This unit should also include - Humidity &amp; temperature sensor</li> </ul>

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### Rack Server

Sl. No.	Parameter	Minimum Specifications
1	Chipset	Lewisburg PCH Intel C621 or equivalent or higher
2	Form Factor	Max. 2U rack mounted with sliding rails
3	CPU	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. Scalable up to up to 28 cores per processor
4	Memory Slots	24 DDR4 DIMM slots RDIMMS& LR DIMMS supporting speeds up to 2666MT/s. Optionally support up to 12 DIMM & 12 NVDIMM
5	Memory configured	Minimum 128 GB RAM, scalable to 1.5TB
6	RAID Controller	12Gbps PCIe 3.0 with RAID 1, 5, 6,10, 50
7	Disks configured	Minimum 8 x 2.5" SAS/SATA/SSD or 4 x 3.5" SAS/SATA
8	I/O slots	Up to 8x PCIe Gen3 Slots
9	GPU Support	Up to 3 DW and 6 SW GPU cards
10	Ethernet ports	4 x 1G RJ45 LOM
11	Certification and compliances	Microsoft Windows Server, Hyper-V, VMWare, Red Hat Enterprise Linux (RHEL), SUSE Linux Enterprise Server (SLES)
12	Power Supply	Platinum rated redundant Power Supply
13	SD Modules slots	Dual SD Module slots supporting redundant configuration
14	Management integration	Support for integration with systems such as Microsoft System Center, VMware vCenter, BMC Software et
15	Pre-failure alert	Should provide predictive failure monitoring & proactive alerts of actual or impending component failure

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16	Configuration & management	Real-time out-of-band hardware performance monitoring & alerting, Agent-free monitoring, driver updates & configuration, power monitoring & capping, RAID management, external storage management, monitoring of FC, HBA & CNA & system health Out-of-band hardware & firmware inventory Zero-touch auto configuration to auto deploy a baseline server configuration profile. Automated hardware configuration and Operating System deployment to multiple servers Zero-touch repository manager and self-updating firmware system, Virtual IO management / stateless computing, Support for Redfish API for simple and secure management of scalable platform hardware
17	HTML5 support	To Support HTML/ Java based KVM
18	Server security	<p>Should have a cyber-resilient architecture for a hardened server design for protection, detection &amp; recovery from cyber attacks</p> <p>Should protect against firmware which executes before the OS boots</p> <ul style="list-style-type: none"> <li>▪ Should provide effective protection, reliable detection &amp; rapid recovery using:</li> <li>▪ Silicon-based Hardware Root of Trust</li> <li>▪ Signed firmware updates</li> <li>▪ Secure default passwords</li> <li>▪ Configuration and firmware drift detection</li> <li>▪ Persistent event logging including user activity</li> <li>▪ Secure alerting § Automatic BIOS recovery</li> <li>▪ Rapid OS recovery § System erase</li> </ul>
19	Upgrades	Configuration upgrades should be only with cryptographically signed firmware and software
20	System lockdown	Should provide system lockdown feature to prevent change (or “drift”) in system firmware image(s) & prevent malicious modification of server firmware
21	Intrusion alert	Intrusion alert in case chassis cover being opened
23	Warranty	3 years On-site comprehensive warranty with 24x7x365 remote hardware support. Post installation, 3-year product warranty should reflect in the support web site of the OEM

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### KVM Switch

Sl. No.	Parameter	Minimum Specifications
1	KVM Requirement	Keyboard, Video Display Unit and Mouse Unit (KVM) for the IT Infrastructure Management at Data Center
2	Form Factor	19" rack mountable
3	Ports	Minimum 8 ports
4	Server Connections	USB or KVM over IP
5	Auto-Scan	It should be capable to auto scan servers
6	Rack Access	It should support local user port for rack access
7	SNMP	The KVM switch should be SNMP enabled. It should be operable from remote locations
8	OS Support	It should support multiple operating system
9	Power Supply	It should have dual power with failover and built-in surge protection
10	Multi-User support	It should support multi-user access and collaboration
11	Power Specification	200-240V, 50-60 Hz
12	Operating temperature range	0° to 45° C
13	Operating Relative Humidity range (non-condensing)	10 to 90% relative humidity
14	Total no. of ports on the proposed switch	24
15	Throughput of each FC port	8/16Gbps
16	Support for 4/8/16 Gb/s HBAs	YES
17	Interface	Support for 4/8/16 Gb/s HBAs
18	Security	RADIUS, SSH, SNMP
19	Availability	No single point of failure Redundant Power supply

### Backup Appliance

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Sl. No.	Minimum Specifications
1	Appliance should support Inline deduplication and compression with up to 20:1 of data reduction ratio or higher
2	System should be configured with minimum 20TB of physical usable capacity (non-dedupe) or higher
3	Should have minimum 3 TB/hr of transfer rate (data ingest speed) or higher
4	Should support CIFS & NFS protocol
5	Should have minimum 4 x 1 GbE ports, 2x 10GbE ports
6	System should be able to support loss of up to 3 disks at the same time
7	Should be compatible with all industry standard backup applications and must be supplied with required software
8	System should have inbuilt capability and configured with data replication to central location
9	System should support one to one, many to one, bidirectional replication topologies
10	Should support WORM feature for data protection & regulatory compliance
11	System should be configured with GUI for remote management & monitoring purpose
12	Should have a remote management port to manage the system in case system is down
13	System should support SNMP v1, v2c or higher and IPMI v2.0 Support
14	Should be able to generate Email alerts in case of any information, Warning & Error
15	Should be able to send system reports and logs via emails
16	Should have redundant fans and redundant power supplies
17	Form Factor : 2U rack mountable or better

### Switching Fabric Architecture

Sl. No.	Parameter	Minimum Specifications
1	Fabric Definition	<ul style="list-style-type: none"> <li>▪ Fabric is the Clos Architecture defined using Spine, Leaf and VXLAN + ISIS or VXLAN + EVPN Protocol.</li> <li>▪ Fabric should have following functionalities to be achieved:           <ul style="list-style-type: none"> <li>▪ Flexibility: allows workload mobility anywhere in the DC.</li> </ul> </li> </ul>

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		<ul style="list-style-type: none"> <li>▪ Robustness: while dynamic mobility is allowed on any authorized location of the DC, the failure domain is contained to its smallest zone.</li> <li>▪ Performance: full cross sectional bandwidth (any-to-any) – all possible equal paths between two endpoints are active.</li> <li>▪ Deterministic Latency: fix and predictable latency between two endpoints with same hop count between any two endpoints, independently of scale.</li> <li>▪ Scalability: add as many Leaf as needed to achieve desired scale in terms of number of servers while maintaining the same oversubscription ratio everywhere inside the fabric.</li> </ul>
2	Optics	Fabric should have Switch and Optics from same OEM.
3	Fabric Features	<ul style="list-style-type: none"> <li>▪ Fabric must support various Hypervisor encapsulation without any additional hardware/software or design change.</li> <li>▪ Fabric must auto discover all the hardware and auto provision the fabric based on the policy.</li> <li>▪ The fabric architecture must be based on hardware VXLAN overlays to provide logical topologies that are abstracted from the physical infrastructure with no performance degradation. Fabric must support VXLAN Switching/Bridging and VXLAN Routing.</li> <li>▪ Fabric must provide open programmable interface using python SDK, Jason SDK, XMLS or COBRA etc. from the Central Management appliance / SDN Controller for programming/configuring the entire fabric.</li> <li>▪ Fabric must provide open scripting interface using Bash, PowerShell, NetConf, YANG from the central management appliance / SDN Controller for configuring the entire fabric.</li> <li>▪ Fabric must support Role Based Access Control in order to support Multi - Tenant environment.</li> </ul>

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		<ul style="list-style-type: none"> <li>▪ Fabric must integrate with different virtual machine manager and manage virtualise networking from the single pane of Glass - Fabric Controller/SDN Controller.</li> <li>▪ Fabric must integrate with best of breed L4 - L7 Physical and virtual appliances and manage using single pane of glass - Fabric Controller / SDN Controller.</li> <li>▪ Fabric must provide deeper visibility into the fabric in terms of latency and packet drop between VM to VM, VM to Physical server and vice versa, Leaf to another leaf etc.</li> <li>▪ Fabric must act as single distributed layer 2 switch, Layer 3 router and Stateless distributed firewall etc.</li> <li>▪ Fabric must provide REST APIs from the Central management appliance/SDN Controller in order to integrate with best of breed Management, Monitoring, Hypervisor and Cloud automation &amp; Orchestration software.</li> </ul>
4	Fabric Layer 2, Layer 3 and Misc. Features	<ul style="list-style-type: none"> <li>▪ Fabric must support Layer 2 features like LACP, STP /RSTP /MSTP, VLAN Trunking, LLDP etc.</li> <li>▪ Fabric must support multi chassis ether channel/MLAG i.e. Host connects to two different Leaf switches and form ether channel using LACP/NIC Teaming on Host.</li> <li>▪ Fabric must support Jumbo Frame up to 9K Bytes on 1G/10G/25G/40G/100G ports.</li> <li>▪ Fabric must support Layer 2 Multicast i.e. IGMP v1, v2 and v3.</li> <li>▪ Fabric must support IP v4 and IP v6 FHRP using HSRP or VRRP.</li> <li>▪ Fabric must support IP v4 and IP v6 Layer 3 routing protocol OSPF and BGP.</li> <li>▪ Fabric must support IP v6 dual stack.</li> <li>▪ Fabric must support traffic redistribution between different routing protocols.</li> <li>▪ Fabric must support IP v4 and IP v6 management tools like - Ping, Traceroute, VTY, SSH, TFTP and DNS Lookup.</li> <li>▪ Fabric must support IP v4 and IP v6 SNMP V1 / V2 / V3.</li> </ul>

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		<ul style="list-style-type: none"> <li>▪ Fabric must support RMON/RMON-II for monitoring.</li> <li>▪ Fabric must support integration with the centralised Syslog server for monitoring and audit trail.</li> <li>▪ Fabric must support NTP.</li> </ul>
5	Fabric Security Features	<ul style="list-style-type: none"> <li>▪ Fabric must have zero trust policy model for connected systems or hosts to help in protecting against any kind of attacks like Unauthorized Access, Man - in - the - middle - attack, Replay Attack, Data Disclosure, Denial of Service.</li> <li>▪ Fabric must provide RBAC policies and support AAA using Local User authentication, External RADIUS, External TACACS+, External LDAP, External AD.</li> <li>▪ Fabric must support VM attribute based zoning and policy.</li> <li>▪ Fabric must support Micro Segmentation for the Virtualize and Non - Virtualize environment.</li> <li>▪ Fabric must support true multi tenancy.</li> <li>▪ Fabric must be accessible using CLI over SSH and GUI using HTTP/HTTPS</li> <li>▪ Fabric must support SNMP v2/3 with HMAC-MD5 or HMAC-SHA authentication and DES encryption.</li> <li>▪ Fabric must act as a State-less distributed firewall with the logging capability.</li> </ul>
6	Fabric Service Features	<ul style="list-style-type: none"> <li>▪ Fabric must be capable to provide services of L 4 - L7 services using physical or virtual appliances i.e. Firewall, ADC, IPS etc.</li> <li>▪ Fabric must have zero trust policy model for connected systems or hosts to help in protecting against any kind of attacks like Unauthorized Access, Man - in - the - middle - attack, Replay Attack, Data Disclosure, Denial of Service.</li> </ul>
7	Fabric Scale and Performance	<ul style="list-style-type: none"> <li>▪ Fabric should support scale up and scale out without any service disruption.</li> <li>▪ Fabric must support for 500 VRF/Private network without any additional component or upgrade or design change.</li> <li>▪ Fabric must scale from 100 Tenant to 500 Tenant without any additional component or upgrade or design change.</li> </ul>

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		<ul style="list-style-type: none"> <li>▪ Fabric must integrate with minimum 3 Virtual Machine Manager (i.e. vCenter, SCVMM, OpenStack etc.) of different Hypervisors simultaneously and scalable to 5 in future with or without common orchestrator.</li> <li>▪ Fabric must be capable of connecting 2500 physical servers and scale to 5000 physical servers.</li> <li>▪ Fabric must be capable of integrating minimum of 8 nos. of L 4 - L7 services physical or virtual appliances (i.e. Firewall, ADC, IPS etc.) and scale up to 16 no's of L4 - L7 Services appliances.</li> <li>▪ Fabric must support minimum of 4 Leaf switches and scale up to 250 Leaf switches without any design change.</li> <li>▪ Fabric must support minimum of 2 Spine Switches and scale up to 6 Spine switches without any design change.</li> <li>▪ Spine Switches must have adequate number of line rate 40/100G ports to support desired Leaf Scale.</li> <li>▪ Each Leaf connects to Each Spine using minimum 1 x 40/100 G ports connectivity i.e. Each Spine must have 128 nos. of line rate 40G/100G ports with consideration of leaf to SPINE over subscription ration of 4:1.</li> <li>▪ Fabric must support 20K IPv4 and 10K IPv6 routes scalable to 30K IPv4 and 15K IPv6 routes.</li> <li>▪ Fabric must support 4K multicast groups scalable to 8K multicast groups.</li> <li>▪ Fabric must support 256 nos. of MLAG/VPC scalable to 384 nos. Each MLAG/VPC must support maximum 8-member links.</li> <li>▪ Fabric must support 256 nos. of Port Channel scalable to 384 nos. Each Port Channel must support maximum of 8 member links.</li> </ul>
8	Fabric Management	<ul style="list-style-type: none"> <li>▪ Fabric must provide Centralised Management Appliance or SDN Controller - Single pane of Glass for managing, monitoring and provisioning the entire Fabric.</li> </ul>

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	<ul style="list-style-type: none"><li>▪ Fabric must Auto discover all the Spine and Leaf switches and auto provision them based on the Fabric policy using Centralised Management appliance or SDN Controller.</li><li>▪ Centralised management appliance or SDN Controller must manage and provision L4 - L7 Services physical or virtual appliance as well as integrate with Virtual Machine manager.</li><li>▪ Centralised management appliance or SDN Controller should not participate in Data plane and control plane path of the fabric.</li><li>▪ Centralised management appliance or SDN Controller must provide necessary report for compliance and audit.</li><li>▪ Centralised management appliance or SDN Controller must communicate to south bound devices using open standard protocol i.e. OPFLEX, OPENFLOW, OVSDB etc. or using Device APIs.</li><li>▪ Centralised management appliance or SDN Controller communication with the south bound devices must be encrypted</li><li>▪ Centralised management appliance or SDN Controller must communicate with the south bound devices using more than one path i.e. in-path connectivity and out of band management connectivity</li><li>▪ Centralised management appliance or SDN Controller provide dynamic device inventory of the Fabric as well as current network topology of the fabric. It must also validate the cabling connectivity and generate alarms in case of wrong or faulty connectivity.</li><li>▪ Centralised management appliance or SDN Controller must run in "N + 1 or N + 2" redundancy to provide availability as well as function during the split brain scenario.</li></ul>
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### Spine Switch

Sl. No.	Parameter	Minimum Specifications
1	Solution Requirement	Minimum 2 number of Spine switches should be provided. If the solution requires more number of spine switches, the same shall be provided by the bidder.
2	General Requirement	The core/spine layer switches should have hardware level redundancy (1+1) in terms of data plane and control plane. Issues with any of the plane should not impact the functioning of the switch. All the switches should be from same OEM.
		The switch should have redundant CPUs working in active-active or active-standby mode. CPU fail over/change over should not disrupt/impact/degrade the functioning the switch.
		The Switch should support non-blocking Layer 2 switching and Layer 3 routing
		The switch should not have any single point of failure like CPU, supervisor, switching fabric power supplies and fans etc. should have 1:1/N+1 level of redundancy
		Switch should support in line hot insertion and removal of different parts like modules/power supplies/fan tray etc. This should not require rebooting of the switch or create disruption in the working/functionality of the switch
		Switch should support the complete STACK of IP V4 and IP V6 services.
		Switch with different modules should function line rate and should not have any port with oversubscription ratio applied
		Switch should support in service software upgrade of the switch without disturbing the traffic flow. There should not be any impact on the performance in the event of the software upgrade/downgrade. It should support in service patching of selected process/processes only without impacting other running processes
		Switch should support non-blocking, wire speed performance per line card
3		Switch should have the following interfaces:

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	Hardware and Interface Requirement	<p>36 nos. of line rate and Non - Blocking 40/100G ports</p> <p>Switch should have min 80MB buffer</p> <p>Switch should have EAL2/NDPP certified</p> <p>Switch should have console port for local management</p> <p>Switch should have management interface for Out of Band Management</p> <p>Switch should be rack mountable and support side rails, if required</p> <p>Switch should have adequate power supplies for the complete system usage with all slots populated and used, providing N+1 redundancy</p> <p>Switch should have hardware health monitoring capabilities and should provide different parameters through SNMP</p> <p>Switch should support VLAN tagging (IEEE 802.1q)</p> <p>Switch should support IEEE Link Aggregation and Ethernet Bonding functionality to group multiple ports for redundancy</p> <p>Switch should have the capability of holding multiple OS images to support resilience &amp; easy rollbacks during the version upgrades etc and should support in service software upgrade including:</p> <ul style="list-style-type: none"> <li>• Multiple System image</li> <li>• Multiple system configuration</li> <li>• Option of Configuration roll-back</li> </ul> <p>Switch should support for different logical interface types like loopback, VLAN, SVI, Port Channel, multi chassis port channel/Link Aggregation Group (LAG) etc.</p>
4	Performance Requirement	<p>The switch should support 1,20,000 IPv4 and IPv6 routes entries in the routing table with multicast routes</p> <p>Switch should support Graceful Restart for OSPF, BGP etc.</p> <p>Switch should support minimum 1000 VRF instances</p> <p>The switch should support uninterrupted forwarding operation for OSPF, BGP etc. routing protocol to ensure high-availability during primary controller failure</p> <p>The switch should support hardware based load-balancing at wire speed using LACP and multi chassis ether channel/LAG</p>

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		<p>Switch should support total aggregate minimum 32 Tbps minimum of switching capacity including the services:</p> <ul style="list-style-type: none"> <li>• Switching</li> <li>• IP Routing (Static/Dynamic)</li> <li>• IP Forwarding</li> <li>• Policy Based Routing</li> <li>• QoS</li> <li>• ACL and Other IP Services</li> <li>• IP V.6 host and IP V.6 routing</li> </ul>
5	Virtualization Features	<p>Switch should support Network Virtualisation using Virtual Over Lay Network using VXLAN (RFC 7348)/NVGRE as per RFC 2890</p> <p>Switch should support VXLAN (RFC7348) and EVPN or equivalent for supporting Spine - Leaf architecture to optimise the east - west traffic flow inside the data center</p> <p>Switch should support Open Flow/Open Day light/Open Stack controller</p> <p>Switch should support Data Center Bridging</p> <p>Switch should support multi OEM hypervisor environment and should be able to sense movement of VM and configure network automatically</p>
6	Layer2 Features	<p>Spanning Tree Protocol (IEEE 802.1D, 802.1W, 802.1S)</p> <p>Switch should support VLAN Trunking (802.1q) and should support 4096 VLAN</p> <p>Switch should support basic Multicast IGMP v1, v2, v3</p> <p>Switch should support minimum 160,000 no. of MAC addresses</p> <p>Switch should support 16 Nos. of link or more per Port channel (using LACP) and support 48 port channels or more per switch</p> <p>Switch should support Industry Standard Port/Link Aggregation for All Ports across any module or any port.</p> <p>Switch should support multi chassis Link Aggregation for All Ports across any module or any port of the switch and Link aggregation should support 802.3ad LACP protocol for communication with downlink/uplink any third party switch or server. Spine to spine -</p>

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		<p>minimum 16 port Multi Chassis ether channel/LAG should be provided.</p> <p>Switch should support Jumbo Frames up to 9K Bytes on 1G/10G Ports</p> <p>Support for broadcast, multicast and unknown unicast storm control to prevent degradation of switch performance from storm due to network attacks and vulnerabilities</p> <p>Switch should support Link Layer Discovery Protocol as per IEEE 802.1AB for finding media level failures</p>
7	Layer3 Features	<p>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</p>
		<p>Switch should support basic routing feature i.e. IP Classless, default routing and Inter VLAN routing</p>
		<p>Switch should support static and dynamic routing using:</p> <ul style="list-style-type: none"> <li>• Static routing</li> <li>• OSPF V.2 using MD5 Authentication</li> <li>• ISIS using MD5 Authentication</li> <li>• BGP V.4 using MD5 Authentication</li> <li>• Should support route redistribution between these protocols</li> <li>• Should be compliant to RFC 4760 Multiprotocol</li> <li>• Extensions for BGP-4 (Desirable)</li> </ul>
		<p>Switch should re-converge all dynamic routing protocol at the time of routing update changes i.e. Non-Stop forwarding for fast re-convergence of routing protocols</p>
		<p>Switch should support multi instance MPLS routing using VRF, VRF Edge routing and should support VRF Route leaking functionality</p>
		<p>Switch should be capable to work as DHCP server and relay</p>
		<p>Switch should provide multicast traffic reachable using:</p> <ul style="list-style-type: none"> <li>• PIM-SM</li> <li>• PIM-SSM</li> <li>• Bi-Directional PIM</li> </ul>

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		<ul style="list-style-type: none"> <li>• Support RFC 3618 Multicast Source Discovery Protocol (MSDP)</li> <li>• IGMP V.1, V.2 and V.3</li> </ul> <p>Switch should support Multicast routing ECMP</p>
8	Availability	Switch should have provisioning for connecting to 1:1/N+1 power supply for usage and redundancy
		Switch should provide gateway level of redundancy in IP V.4 and IP V.6 using HSRP/VRRP
		Switch should support for BFD For Fast Failure Detection as per RFC 5880 and RFC-7419, 3618, 7296, 7427, 7296.
9	Quality of Service	Switch system should support 802.1P classification and marking of packet using: <ul style="list-style-type: none"> <li>• CoS (Class of Service)</li> <li>• DSCP (Differentiated Services Code Point)</li> <li>• Source physical interfaces</li> <li>• Source/destination IP subnet</li> <li>• Protocol types (IP/TCP/UDP)</li> <li>• Source/destination TCP/UDP ports</li> </ul>
		Switch should support methods for identifying different types of traffic for better management and resilience
		Switch should support for different type of QoS features for real time traffic differential treatment using: <ul style="list-style-type: none"> <li>• Weighted Random Early Detection</li> <li>• Strict Priority Queuing</li> </ul>
		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
10	Security	Switch should support for deploying different security for each logical and physical interface using Port Based access control lists

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		<p>of Layer-2 to Layer-4 in IP V.4 and IP V.6 and logging for fault finding and audit trail</p> <p>Switch should support control plane i.e. processor and memory Protection from unnecessary or DoS traffic by control plane protection policy</p> <p>Time based ACL</p> <p>Switch should support for external database for AAA using:</p> <ul style="list-style-type: none"> <li>• TACACS+</li> <li>• RADIUS</li> </ul> <p>Switch should support MAC Address Notification on host join into the network for Audit trails and logging</p> <p>Switch should support to restrict end hosts in the network. Secures the access to an access or trunk port based on MAC address. It limits the number of learned MAC addresses to deny MAC address flooding</p> <p>Switch should support for Role Based access control (RBAC) for restricting host level network access as per policy defined</p> <p>Switch should support to prevent edge devices in the network not administrator's controlled from becoming Spanning Tree Protocol root nodes</p> <p>Switch should support unicast and/or multicast blocking on a switch port to suppress the flooding of frames destined for an unknown unicast or multicast MAC address out of that port</p> <p>Switch should support Spanning tree BPDU protection</p> <p>Switch should support for MOTD banner displayed on all connected terminals at login and security discrimination messages can be flashed</p>
11	Manageability	<p>Switch should support for embedded RMON/RMON-II for central NMS management and monitoring</p> <p>Switch should support for sending logs to multiple centralised syslog server for monitoring and audit trail</p> <p>Switch should provide remote login for administration using:</p> <ul style="list-style-type: none"> <li>▪ Telnet</li> <li>▪ SSH V.2</li> </ul>

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		<p>Switch should support for capturing packets for identifying application performance using local and remote port mirroring for packet captures</p>
		<p>Switch should support for management and monitoring status using different type of Industry standard NMS using:</p> <ul style="list-style-type: none"> <li>▪ SNMP V1 and V.2</li> <li>▪ SNMP V.3 with encryption</li> <li>▪ Filtration of SNMP using Access list</li> <li>▪ SNMP MIB support for QoS</li> </ul>
		<p>Switch should support for basic administrative tools like:</p> <ul style="list-style-type: none"> <li>▪ Ping</li> <li>▪ Traceroute</li> </ul>
		<p>Switch should support central time server synchronisation using Network Time Protocol NTP V.4</p>
		<p>Switch should support for providing granular MIB support for different statistics of the physical and logical interfaces</p>
		<p>Switch should support for predefined and customized execution of script for device mange for automatic and scheduled system status update for monitoring and management</p>
		<p>Switch should provide different privilege for login in to the system for monitoring and management</p>
		<p>Switch should support Real time Packet Capture using Wireshark in real time for traffic analysis and fault finding</p>
12	IPv6 features	<p>Switch should support for IP V.6 connectivity and routing required for network reachability using different routing protocols such as:</p> <ul style="list-style-type: none"> <li>• OSPF V.3</li> <li>• BGP with IP V.6</li> <li>• IP V.6 Policy based routing</li> <li>• IP V.6 Dual Stack etc</li> <li>• IP V.6 Static Route</li> <li>• IP V.6 Default route</li> <li>• Should support route redistribution between these protocols</li> </ul>
		<p>Switch should support multicast routing in IP V.6 network using PIMv2 Sparse Mode</p>

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	<p>Switch should support for QoS in IP V.6 network connectivity</p> <p>Switch should support for monitoring and management using different versions of SNMP in IP V.6 environment such as:</p> <ul style="list-style-type: none"> <li>• SNMPv1, SNMPv2c, SNMPv3</li> <li>• SNMP over IP V.6 with encryption support for SNMP Version 3</li> </ul> <p>Switch should support syslog for sending system log messages to centralised log server in IP V.6 environment</p> <p>Switch should support NTP to provide an accurate and consistent timestamp over IPv6 to synchronize log collection and events</p>
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### Leaf (Fiber) Switch:

Sl. No.	Parameter	Minimum Specifications
1	Solution Requirement	Minimum 4 number of switches should be provided. If the solution requires more number of spine switches, the same shall be provided by the bidder as per requirement.
2	General Requirement	<p>The Switch should support non-blocking Layer 2 switching and Layer 3 routing.</p> <p>There switch should not have any single point of failure like power supplies and fans etc should have 1:1/N+1 level of redundancy</p> <p>Switch support in-line hot insertion and removal of different parts without disrupting the functionality of the system.</p> <p>Switch should support the complete STACK of IP V4 and IP V6 services. Switch must have IPv6 phase 2 ready logo certification.</p> <p>The Switch and different modules used should function in line rate and should not have any port with oversubscription ratio applied.</p>
3	Hardware and Interface Requirement	<p>Switch should have the following interfaces:</p> <p>a. 48 x 1G/10G/25G Multi Mode Fiber Interface</p> <p>b. 6 x 40/100GbE QSFP ports</p> <p>Switch should have minimum 15MB buffer</p> <p>Switch should have console port</p> <p>Switch should have management interface for Out of Band Management</p>

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		<p>Switch should be rack mountable and support side rails if required</p> <p>Switch should have hardware health monitoring capabilities and should provide different parameters through SNMP</p> <p>Switch should support VLAN tagging (IEEE 802.1q)</p> <p>Switch should support IEEE Link Aggregation and Ethernet Bonding functionality to group multiple ports for redundancy</p> <p>Switch should support Configuration roll-back and check point</p> <p>Switch should support for different logical interface types like loopback, VLAN, SVI, Port Channel, multi chassis port channel/LAG etc.</p>
4	Performance Requirement	<p>The switch should support 1,20,000 IPv4 and IPv6 routes entries in the routing table with multicast routes</p> <p>Switch should support Graceful Restart for OSPF, BGP etc.</p> <p>The switch should support uninterrupted forwarding operation for OSPF, BGP etc. routing protocol to ensure high-availability during primary controller failure</p> <p>The switch should support hardware based load balancing at wire speed using LACP and multi chassis ether channel/LAG</p> <p>Switch should support total aggregate minimum 32 Tbps minimum of switching capacity including the services:</p> <ul style="list-style-type: none"> <li>a. Switching</li> <li>b. IP Routing (Static/Dynamic)</li> <li>c. IP Forwarding</li> <li>d. Policy Based Routing</li> <li>e. QoS</li> <li>f. ACL and Other IP Services</li> <li>g. IP V.6 host and IP V.6 routing</li> </ul> <p>Each leaf should have connectivity to all spine switches and the over subscription should not be less than 4:1</p>
5	Advance Features	<p>Switch should support Network Virtualisation using Virtual Over Lay Network using VXLAN (RFC 7348)/NVGRE as per RFC 2890</p> <p>Switch should support VXLAN (RFC7348) and EVPN or equivalent for supporting Spine - Leaf architecture to optimise the east - west traffic flow inside the data center</p>

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		Switch should support Open Flow/Open Day light/Open Stack controller
		Switch should support Data Center Bridging
		Switch should support multi OEM hypervisor environment and should be able to sense movement of VM and configure network automatically
6	Layer2 Features	Spanning Tree Protocol (IEEE 802.1D, 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 minimum 80,000 no. of MAC addresses
		Switch should support 16 Nos. of link or more per Port channel (using LACP) and support 200 port channels or more per switch
		Switch should support Industry Standard Port/Link Aggregation for All Ports across any module or any port.
		Switch should support multi chassis Link Aggregation for All Ports across any module or any port of the switch and Link aggregation should support 802.3ad LACP protocol for communication with downlink/uplink any third party switch or server. Spine to spine - minimum 16 port Multi Chassis ether channel/LAG should be provided.
		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
7	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 basic routing feature i.e. IP Classless, default routing and Inter VLAN routing

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		<p>Switch should support static and dynamic routing using:</p> <ul style="list-style-type: none"> <li>a. Static routing</li> <li>b. OSPF V.2 using MD5 Authentication</li> <li>c. ISIS using MD5 Authentication</li> <li>d. BGP V.4 using MD5 Authentication</li> <li>e. Should support route redistribution between these protocols</li> <li>f. Should be compliant to RFC 4760 Multiprotocol Extensions for BGP-4 (Desirable)</li> </ul>
		<p>Switch should re-converge all dynamic routing protocol at the time of routing update changes i.e. Non-Stop forwarding for fast re-convergence of routing protocols</p>
		<p>Switch should support multi instance MPLS routing</p>
		<p>Switch should be capable to work as DHCP server and relay</p>
		<p>Switch should provide multicast traffic reachable using:</p> <ul style="list-style-type: none"> <li>a. PIM-SM</li> <li>b. PIM-SSM</li> <li>c. Bi-Directional PIM</li> <li>d. Support RFC 3618 Multicast Source Discovery Protocol (MSDP)</li> <li>e. IGMP V.1, V.2 and V.3</li> </ul>
		<p>Switch should support Multicast routing ECMP</p>
8	Availability	<p>Switch should have provisioning for connecting to 1:1/N+1 power supply for usage and redundancy</p>
		<p>Switch should provide gateway level of redundancy in IP V.4 and IP V.6 using HSRP/VRRP</p>
		<p>Switch should support for BFD For Fast Failure Detection.</p>

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9	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)
		c. Source physical interfaces d. Source/destination IP subnet e. Protocol types (IP/TCP/UDP) f. Source/destination TCP/UDP ports
10	Security	Switch should support methods for identifying different types of traffic for better management and resilience
		Switch should support for different type of QoS features for real time traffic differential treatment using
		a. 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
10	Security	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
		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
		Time based ACL
		Switch should support for external database for AAA using: a. TACACS+ b. RADIUS
		Switch should support MAC Address Notification on host join into the network for Audit trails and logging

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		Switch should support to restrict end hosts in the network. Secures the access to an access or trunk port based on MAC address. It limits the number of learned MAC addresses to deny MAC address flooding
		Switch should support to prevent edge devices in the network not administrator's controlled from becoming Spanning Tree Protocol root nodes
		Switch should support unicast and multicast blocking on a switch port to suppress the flooding of frames destined for an unknown unicast or multicast MAC address out of that port
		Switch should support Spanning tree BPDU protection
11	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 login for administration using: a. Telnet b. SSH V.2
		Switch should support for capturing packets for identifying application performance using local and remote port mirroring for packet captures
		Switch should support for management and monitoring status using different type of Industry standard NMS using: a. SNMP V1 and V.2 b. SNMP V.3 with encryption c. Filtration of SNMP using Access list d. SNMP MIB support for QoS
		Switch should support for basic administrative tools like: a. Ping b. Traceroute
		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

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		Switch should support for predefined and customized execution of script for device management 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
		Switch should support Real time Packet Capture using Wireshark in real time for traffic analysis and fault finding
12	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
		c. IP V.6 Policy based routing
		d. IP V.6 Dual Stack etc.
		e. IP V.6 Static Route
		f. IP V.6 Default route
		g. Should support route redistribution between these protocols
		Switch should support multicast routing in IP V.6 network using PIMv2 Sparse Mode
		Switch should support for QoS in IP V.6 network connectivity
		Switch should support for 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
		Switch should support syslog for sending system log messages to centralised log server in IP V.6 environment
		Switch should support NTP to provide an accurate and consistent timestamp over IPv6 to synchronize log collection and events
		Switch should support for IP V.6 different types of tools for administration and management such as:
		a. Ping
		b. Trace route
		c. VTY
		d. SSH
		e. DNS lookup

**Web Security Appliance:**

Sl. No.	Parameter	Minimum Specifications
1	Appliance Requirement and Functionality	The solution should be a hardened Web Proxy, Caching, Web based Reputation filtering, URL filtering, Antivirus and Anti-malware appliance. All the functionalities should be in a single appliance only.
2	Hardware	Minimum of 1 * 6-core CPUs, 2.4 TB storage, RAID 10, 32 GB or more DRAM, hot-swappable hard drive
3	Operating System	The appliance based Solution shall provide hardened Operating System.
4	Operating System Performance	The underlying operating system and hardware should be capable of supporting at least 2000 users from day with licenses & scalable up to 5000 users.
5	Operating System Security	The operating system should be secure from vulnerabilities and hardened for web proxy and caching functionality.
6	IP V6 Support	Should have the ability to proxy, monitor, and manage IPv6 traffic.
7	Forward proxy mode	The solution should support explicit forward proxy mode deployment in which client applications like browsers are pointed towards the proxy for web traffic.
8	Proxy support	The proposed solution should be a Fast Web Proxy and should support HTTP, FTP and HTTPS proxy.
9	HTTPS Decryption	The solution should support HTTPS decryption
10	HTTPS decrypted traffic scanning	The solution should support scanning of the https decrypted traffic by the on-board anti-malware and/or anti-virus engines.
11	HTTPS decryption policy	HTTPS decryption should provide flexibility to have multiple decryption policies and should not be just a Global action

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12	Proxy Chaining	The solution should support proxy configuration in a Chain. The Lower end proxies at spoke locations should be able to forward the request to an Higher end proxies at Hub Location forming a Chain of Proxies
13	DNS Splitting	The solution should support configuration to use Split DNS. It should be able to refer to different DNS for Different Domains e.g. (root dns for all external domains and internal DNS for organization domain
14	IP Spoofing support in transparent mode deployments	The solution should have facility to do IP spoofing. When enabled, requests originating from a client should retain the client's source address and appear to originate from the client instead of the appliance. This is useful in scenarios where policies are based on original IP and logging/reporting is required to track activity of individual IP basis.
15	Transparent mode	The solution should also support transparent mode deployment using WCCP v2 and L4 switches/PBR (Policy-based Routing)
16	Pac File support	The appliance should support hosting proxy auto-config files that defines how web browsers can automatically choose the appropriate web proxy for fetching a URL.
17	Support multiple deployment options	The solution should allow to deploy the appliance in explicit proxy as well as transparent mode together.
18	Remote support	The remote support from principal company should be available via India Toll Free and Email. The Support Portal access should be provided for Case management, knowledgebase, new version information, tools etc.
19	Secure Remote Access	The Support Engineers should be able to login to appliance using secure tunnelling methods such as SSH for troubleshooting purposes
20	High Availability	Provision of active/active High Availability is required
21	Application and Protocol Control	The solution should support granular application control over web eg. Facebook controls like block file upload, block posting text, enforcing bandwidth limits on application types.

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22	File download and size restrictions	The solution should be capable of blocking specific files downloads and based on size and per user group basis. It should also provide option to block object using MIME File types.
23	IP based Access Control	The solution should allow administrator to define access to internet based on IP addresses, range of IP addresses, subnet and CIDR basis. It should also support to be forced for Authentication from Specific IP addresses, Subnet or CIDR's
24	User based Access Control	The solution should support integration with active directory and/or LDAP. This should allow administrator to define user or group based access policies to Internet
25	Multiple Authentication Server Support	The solution should support Multiple Auth Servers / Auth Failover using Multi Scheme Auth (NTLM and LDAP). It should also support authentication exemption.
26	Layer 4 Traffic Monitoring	Should detect Phone Home attempts occurring from the entire Network. It should support actions to allow traffic to & from known malware addresses & should support from known allowed & unlisted addresses & block traffic to & monitoring suspected malware addresses.
27	Bandwidth restrictions	The solution should support providing bandwidth limit/cap for streaming media application traffic. This should be possible at the Global level as well as at a per policy level.
28	Anti-Malware	The appliance should support at least 2 industry known Anti Malware/Anti-Virus engine that can scan HTTP, HTTPS and adware, browser hijackers, phishing and pharming attacks to FTP traffic for web based threats, that can range from more malicious threats such as rootkits, Trojans, worms, system monitors and Key loggers and as defined by the organizations policy. Please mention the antimalware engine.
29	Malware Protection	With dual AV/Anti-Malware engine scanning when a URL causes different verdicts from the scanning engine the appliance should perform the most restrictive action.

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30	Web Reputation	The solution should provide Web Reputation Filters that examine every request made by the browser (from the initial HTML request to all subsequent data requests) – including live data, which may be fed from different domains to assign a web based score to determine the likelihood that it contains url-based malware.
31	Customizable Web Reputation	The Appliance should have customizable setting in the Web Based Reputation Services, like Allow, Scan and Block based on the scoring settings by the Administrator.
32	Incoming/Outgoing Traffic scanning	The solution should scan for Incoming and outgoing traffic.
33	Outbound connection control on all ports and protocols	The solution shall provide option to scan all ports at wire speed, detecting and blocking spyware activity trying to connect to the outside Internet. By tracking all 65,535 network ports and all protocols, the solution shall effectively mitigate malware that attempts to bypass Port 80
34	Custom URL filtering	The solution should support creation of custom URL categories for allowing/blocking specific destinations as required by the Organisation.
35	URL Filtering Options	The web Proxy should support following actions like allow, monitor, block, time-based access. Should also support displaying a warning page but allows the user to continue clicking a hypertext link in the warning page.
36	URL check & submission	Support portal should give facility to end user to check URL category and submit new URL for categorization
37	Dynamic Categorization	Provision should be available to enable Real Time Dynamic categorization that shall classify in real time in case the URL the user is visiting is not already under the pre-defined or custom categories database.
38	Reporting MIS-categorization	The solution should have facility for End User to report Mis-categorisation in URL Category.
39	Filtering Content	Solution should support filtering adult content from web searches & websites on search engines like Google.

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40	Signature based application control	The solution should support signature based application control.
41	End User Notification	<p>Solution should support following end user notification functionalities. The proxy should support the functionality to display a custom message to the end user to specify the reason the web request is blocked.</p> <p>When the website is blocked due to suspected malware or URL-Filters it should allow the end user to report that the webpage has been wrongly misclassified.</p> <p>The solution should support the functionality of redirecting all notification pages to a custom URL to display a different block page for different reasons.</p> <p>Should support the functionality to force users to explicitly agree to the terms and conditions for browsing the World Wide Web from the organization's network to let the user know that the Organisation is monitoring their web activity.</p>
42	Diagnostic Tools	The appliance should have diagnostic network utilities like telnet, traceroute, nslookup and tcpdump/packet capture.
43	Updates and Upgrades	The appliance should provide seamless version upgrades and updates.
44	Secure Web Based management	The appliance should be manageable via HTTP or HTTPS
45	CLI based management	The appliance should be manageable via command line using SSH
46	Serial Console access	For emergency, the appliance should have serial console access
47	Ethernet Management	Should have provision for separate Ethernet for managing the appliance
48	Web Logs	The Proxy Log should be scalable. The log formats shall include Apache, Squid and W3C.
49	Retention Period	The retention period should be customizable. Options should be provided to transfer the logs to an FTP using FTP or SCP.

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50	User Reports	Informative and exhaustive set of reports on User Activity and URL filtering activities (GUI to report past activity, top usage users and top malware threat)
51	Bandwidth Reports	Reports on Bandwidth Consumed / Bandwidth Saved
52	Detailed logging	Product to maintain detailed proxy access logs that can be searched via filters, for easy location of any desired access of the user and to see how the product dealt with it
53	Blocked by reputation & malware reports	It should support reporting web requests blocked due to web reputation & blocked by malware
54	Report Formats	Solution should support generating a printer-friendly formatted pdf version of any of the report pages. Should also support exporting reports as CSV files.
55	Scheduling of Reports	Solution should support to schedule reports to run on a daily, weekly, or monthly basis.
56	System Reports	Should support system reports to show CPU usage, RAM usage, percentage of disk space used for reporting & logging.
57	Updates and Upgrades	Support should cover all upgrades for the time period the licenses and support purchased from principal vendor

## Anti-APT

Sl. No.	Minimum Specifications
1	Anti-APT solution should be appliance based and should offer a minimum throughput of 2 Gbps
2	Appliance should support at least 8*1Gbps ports
3	Appliance shall provide a separate management port and should also provide a web-based GUI management
4	Appliance should provide at least 1 Million concurrent sessions or 1000 concurrent users
5	Appliance should be capable of working in Inline Blocking mode without depending on other network components like a separate FW, IPS or Web Security Appliance
6	Appliance should have fail-open capabilities for all ports
7	Appliance should have redundant power supplies
8	Solution should be capable of blocking call backs to CnC Servers

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9	Solution should be capable of blocking threats based on both signatures and behaviour
10	Proposed solution's detection rules should be based on an extensible, open language that enables users to create their own rules, as well as to customize any vendor-provided rules.
11	Proposed solution should be capable of blocking threats on the following protocols: HTTP, HTTPS
12	The solution should be capable of executing MS Office Documents, Portable Documents, Archive Files, Multimedia Files and executable binaries in a virtual sandbox environment
13	The solution should be capable of exempting specific hosts from specific compliance rules and suppressing corresponding compliance events and alerts.
14	<p>The solution should be capable of gathering Active Directory user identity information, mapping IP addresses to username and passively gathering information about network devices including but not limited to:</p> <ul style="list-style-type: none"> <li>• Network protocols used, e.g. IPv6, IPv4</li> <li>• Network services provided, e.g. HTTPS, SSH</li> <li>• Open ports, e.g. TCP:80</li> <li>• Client applications installed and type, e.g. Chrome - web browser</li> <li>• Web applications access, e.g. Facebook, Gmail</li> <li>• Risk and relevance ratings should be available for all applications</li> <li>• Potential vulnerabilities</li> <li>• Current User</li> <li>• Device type, e.g. Bridge, Mobile device</li> <li>• Files transferred by this device/user</li> </ul>
15	The solution should be capable of whitelisting trusted applications from being inspected to avoid business applications from being affected & in turn productivity
16	The solution should be capable of blocking traffic based on geo locations to reduce the attack landscape and to protect communication to unwanted destinations based on geography
17	The sandbox should be appliance based with the ability to run multiple versions of 32 and 64-bit client and Server Windows within the same environment
18	<p>All the devices shall be managed centrally and should be capable of</p> <ul style="list-style-type: none"> <li>▪ Centralized, life cycle management for all sensors</li> <li>▪ Aggregating all events and centralized, real-time monitoring and forensic analysis of detected events</li> <li>▪ Must provide a highly customizable dashboard</li> </ul>
19	The sandbox should be appliance based with the ability to run multiple versions of Windows within the same environment

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20	The Sandbox should be a proprietary custom-built malware analysis solution and not open source or generic sandbox
21	<p>The Sandbox should be a proprietary custom-built malware analysis solution and not open source or generic sandbox and should provide:</p> <ul style="list-style-type: none"> <li>- analysis reports</li> <li>- threat score of the sample</li> <li>- ability to queue samples,</li> <li>- impact analysis</li> <li>- Global Threat Intelligence</li> <li>- Sandbox shall be able to detect memory residing malware</li> </ul>
22	The proposed solution shall have the capability to continuously track a file's disposition based on global intelligence and do a retrospective block and alert if the file has exhibited malicious traits globally even if the file hasn't started behaving maliciously locally
23	The solution should include protection against desktop and server & should support minimum Windows 7 desktop, Windows server 2003 & 2008. Bidder should provide license for 1000 window based PC/Servers.

### Firewall with IPS & URL Filtering

Sl. No.	Minimum Specifications
1	<p><b>Hardware Architecture</b></p> <p>The appliance-based security platform should be capable of providing firewall, application visibility, and IPS functionality in a single appliance</p> <p>The appliance should support at least 2 * 10G ports scalable up to 8x10G, the firewall should be modular in nature so that it can be scalable</p> <p>The appliance hardware should be a multicore CPU architecture with a hardened 64-bit operating system to support higher memory</p> <p>Proposed Firewall should not be proprietary ASIC-based in nature &amp; should be open architecture based on multi-core CPU's to protect &amp; scale against dynamic latest security threats.</p>
2	<p><b>Performance &amp; Scalability</b></p> <p>Should support at least 10 Gbps of production performance / multiprotocol combined firewall &amp; IPS throughput</p>

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	<p>Firewall should support at least 8,000,000 concurrent sessions</p> <p>Firewall should support at least 60,000 connections per second</p> <p>Firewall should support at least 1000 VLANs</p>
<b>3</b>	<p><b>Firewall Features</b></p> <p>Firewall should provide application detection for DNS, FTP, HTTP, SMTP,ESMTP, LDAP, MGCP, RTSP, SIP, SCCP, SQLNET, TFTP, H.323, SNMP</p> <p>Firewall should support creating access rules with IPv4 &amp; IPv6 objects simultaneously</p> <p>Firewall should support operating in routed &amp; transparent mode</p> <p>Should support Static, RIP, OSPF, OSPFv3 and BGP</p> <p>Firewall should support manual NAT and Auto-NAT, static nat, dynamic nat, dynamic pat</p> <p>Firewall should support Nat66 (IPv6-to-IPv6), Nat 64 (IPv6-to-IPv4) &amp; Nat46 (IPv4-to-IPv6) functionality</p> <p>Firewall should support Multicast protocols like IGMP, PIM, etc.</p> <p>Should support security policies based on security group names in source or destination fields or both</p> <p>Should support capability to limit bandwidth on basis of apps/groups, Networks / Geo, Ports, etc.</p>
<b>4</b>	<p><b>High-Availability Features</b></p> <p>Firewall should support Active/Standby failover</p> <p>Firewall should support ether channel or equivalent functionality for the failover control &amp; date interfaces for providing additional level of redundancy</p> <p>Firewall should support redundant interfaces to provide interface level redundancy before device failover</p> <p>Firewall should support 802.3ad Ether channel or equivalent functionality to increase the bandwidth for a segment.</p> <p>Firewall should have integrated redundant power supply</p> <p>Firewall should have redundant FANs.</p>
<b>5</b>	<p><b>Next Generation IPS</b></p> <p>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 as intrusion event data correlation, elimination of false positives, and policy compliance.</p> <p>Should be capable of dynamically tuning IDS/IPS sensors (e.g., selecting rules, configuring policies, updating policies, etc.) with minimal human intervention.</p>

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	Should be capable of automatically providing the appropriate inspections and protections for traffic sent over non-standard communications ports.
	Should be able to link Active Directory and/or LDAP usernames to IP addresses related to suspected security events.
	Should be capable of detecting and blocking IPv6 attacks.
	Should support the capability to quarantine end point
	The solution should support full-featured NBA capability to detect threats emerging from inside the network. This includes the ability to establish “normal” traffic baselines through flow analysis techniques (e.g., NetFlow) and the ability to detect deviations from normal baselines.
	The solution must provide IP reputation feed that comprised of several regularly updated collections of poor reputation of IP addresses determined by the proposed security vendor
	The solution must support IP reputation intelligence feeds from third party and custom lists of IP addresses including a global blacklist.
	Should must support URL and DNS threat feeds to protect against threats
	Should support reputation and category based URL filtering offering comprehensive alerting and control over suspect web traffic and enforces policies in more than 80 categories.
	The solution must be capable of passively gathering details unique to mobile devices traffic to identify a wide variety of mobile operating systems, mobile applications and associated mobile device hardware.
	Should support more than 2500 application layer and risk-based controls that can invoke tailored intrusion prevention system (IPS) threat detection policies to optimize security effectiveness.
	Must be capable of providing network-based detection of malware by checking the disposition of known files in the cloud using the SHA-256 file-hash as they transit the network and capability to do dynamic analysis on-premise (if required in future) on purpose built appliance
	The Appliance OEM must have its own threat intelligence analysis center and should use the global footprint of security deployments for more comprehensive network protection.
	The detection engine should support capability of detecting and preventing a wide variety of threats (e.g., malware, network probes/reconnaissance, VoIP attacks, buffer overflows, P2P attacks, etc.).
	Should be able to identify attacks based on Geolocation and define policy to block on the basis of Geo-location
	The detection engine should support the capability of detecting variants of known threats, as well as new threats

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	<p>The detection engine must incorporate multiple approaches for detecting threats, including at a minimum exploit-based signatures, vulnerability-based rules, protocol anomaly detection, and behavioural anomaly detection techniques. Identify and explain each type of detection mechanism supported.</p> <p>Should support Open based application ID for access to community resources and ability to easily customize security to address new and specific threats and applications quickly</p> <p>The integrated solution should also provide URL filtering functionality for up to 200 million URL's, up to 60 different categories for URL</p>
<b>6</b>	<p><b>Management</b></p> <p>The management platform must be accessible via a web-based interface and ideally with no need for additional client software</p> <p>The management platform must provide a highly customizable dashboard.</p> <p>The management platform must be capable of integrating third party vulnerability information into threat policy adjustment routines and automated tuning workflows</p> <p>The management platform must be capable of role-based administration, enabling different sets of views and configuration capabilities for different administrators subsequent to their authentication.</p> <p>Should support REST API for monitoring and config programmability</p> <p>The management platform must provide multiple report output types or formats, such as PDF, HTML, and CSV.</p> <p>The management platform must support multiple mechanisms for issuing alerts (e.g., SNMP, e-mail, SYSLOG).</p> <p>The management platform must provide robust reporting capabilities, including a selection of pre-defined reports and the ability for complete customization and generation of new reports.</p> <p>The management platform must risk reports like advanced malware, attacks and network</p> <p>The management platform must include an integration mechanism, preferably in the form of open APIs and/or standard interfaces, to enable events and log data to be shared with external network and security management applications.</p>

### L2 PoE/PoE+ Switch

Sl. No.	Minimum Specifications
1	19" Rack Mountable stackable switch with min 24 Nos. 10/100/1000 copper input POE/PoE+ (15.4W) ports and additional support of 4x1G SFP, support for external/internal redundant power supply.

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2	Switch should support for minimum 96 Gbps of forwarding throughput & minimum 70 mbps forwarding rate
3	The switch should support dedicated stacking port separate from uplink ports with 80 Gbps of stacking bandwidth to put minimum 8 switches into a single stack group.
4	Switch should have static, default IP routing enabled from day one.
5	Switch shall have IEEE 802.3ad Link Aggregation Control Protocol (LACP) with up to 8 links (ports) per trunk.
6	It shall have IEEE 802.1s Multiple Spanning Tree Protocol and provide legacy support for IEEE 802.1d STP and IEEE 802.1w RSTP or equivalent technology and static routes.
7	Switch should have feature to protect access ports using port security, TACACS/TACACS+, Radius, storm control, Access Control List both port, VLAN based.
8	Switch should have queuing as per IEEE 802.1P standard on all ports with mechanism for traffic shaping and rate limiting features for specified Host, network, Applications etc.
9	Should have Power supply 230 Volt 50Hz input
10	The switch should support IPv6 Guard, IPv6 RA-Guard, IPv6 DHCP- Guard, Source-Guard features
11	Switch should support automated image installation, configuration & automatic configuration of per port QoS to reduce switch provisioning time & effort.
12	Must have SNMP v1, v2, v3 from day one
13	Should have CLI and GUI based management console port.
14	The switch should support IEEE 802.3az from day-1
15	The switch should be IPv6 ready
16	The proposed switch should be EAL2/ NDPP certified by common Criteria body at the time of delivery.

## Fixed Camera with Outdoor Housing and Lens – 2MP - JICCC

Sl. No.	Parameter	Minimum Specifications
1	Image sensor	1/3"Progressive Scan CMOS or better
2	Lens	CS Mount: 5-50mm, DC-Iris, Megapixel IR corrected Lens
3	True Day and Night	Yes

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4	Minimum Illumination / Light Sensitivity	Color: 0.3 lux F1.4 B/W: 0.08 lux F1.4 or Better
5	IR Filter	Automatic Built in IR Cut filter
6	Shutter Speed	1s to 1/3000
7	Video Compression	H.265 High, Main, Base profile and MJPEG
8	Resolutions and frame rates (H.265)	1920 x 1080
9	Video Streams	Minimum 3
10	Power Supply	Power over Ethernet (PoE/PoE+) IEEE 802.3af Class 2
11	Digital I/O ( Alarms)	DI x 1 DO x 1
12	Local storage	SD Card Slot with 128GB Support
13	Image Settings	Color, Brightness, Sharpness, Contrast, White balance, Image Mirroring, Text and image overlay, Privacy mask, Rotation: 0°, 90°, 180°, 270°, Exposure control, Exposure zones, Fine tuning of behaviour at low light, Mirror Image
14	Supported Protocol	IPv4 & v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, CIFS/SMB, SMTP, Bonjour, UPnP ,SNMPv1/v2c/v3(MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH
15	Security	IEEE 802.1x, IP Address Filter, Password Protection, Digest Authentication
16	ONVIF	Profile S
17	API	The interface shall be available for integration with 3rd party analytics and applications in public domain free of cost
18	Operating Conditions	- 10°C to 50°C, Humidity 10–100% RH (condensing)
19	Privacy Mask	Required with Minimum 2 Zones
20	Image Configuration	The camera allows include/ exclude area in any shape in order to reduce false alarms and bandwidth/ storage
21	GOV Length	It is possible to vary the GOV length in the camera setting for better control on bandwidth

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22	Wide Dynamic Range	Minimum 120 dB True or Better
23	Event Triggers	Motion Detection, Edge storage events, External Input, Time Scheduled, Camera Tampering, Software alarms.
		The camera shall be able to send and received trigger directly from any other camera without interface of VMS.
24	Event Actions	FTP or HTTP or network share, EMAIL, Notification via HTTP to other camera or device, Pre and post alarm video buffering, External Output Trigger, PTZ Preset, Guard Tour
25	Firmware Upgrade	The firmware upgrade shall be done though web interface, The firmware is available free of cost
26	Embedded Applications	The camera shall provide a platform allowing the upload of third party applications into the camera
27	Memory	512 MB RAM, 256 MB Flash with Support for Edge Based analytics from 3rd Party
28	Housing	IP 66 Rated IK 10 rated for outdoor use
29	Certifications	CE, FCC, IEC, EN, UL
30	Warranty	3 years OEM warranty

### High Definition PTZ Dome Camera (JICCC building)

Sl. No.	Parameter	Minimum Specifications
1	Image Sensor	1/3" Progressive Scan CMOS or better
2	Operating Frequency	Min 50 Hz
3	Day/ Night Operation	Automatic with IR Cut Filter
4	Minimum Illumination	Colour: 0.3 Lux @ 30 IRE
		B/W": 0.01 @ 30 IRE or better
5	high-speed pan-tilt functionality	360° endless pan range and a 180° tilt range
6	Optical Zoom	30x Minimum & 12x Digital Zoom, Total 360x Zoom or better
7	Lens	4.3-129 mm or better
8	Pan, tilt, manual and present speed	0.5° - 350°/s or better

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	The speed shall be applicable for Manual, Tour and Pre-set Mode	
9	Image Resolution	1920 x 1080 or better
10	Compression	H.265 Baseline, Main and High Profiles, Motion JPEG
11	Frame Rate and Bit Rate	25 FPS at all resolutions with Controllable Bit Rate/ Bandwidth and Frame Rate. In CBR Priority to be defined for Video quality or frame rate and the bandwidth upper limit shall not exceed the defined limit
12	GOP/ GOV	Ability to change the GOP/GOV Length to optimize the bandwidth and storage
13	Video Streams	Minimum 3 Streams @ 1920x1080, H265, 25 fps
14	Motion Detection	Yes built in with multiple configurable areas in the video stream
15	Electronic Shutter	1/33000 s to 2 s or better
16	Electronic Exposure & Control	Automatic/ Manual
17	Wide Dynamic Range	120 dB or Better
18	Backlight Compensation	Required
19	Electronic Image Stabilization	Required
20	Image Freeze on PTZ	Required
21	Privacy Masks	Minimum 10 configurable 3D zones or better
22	Pre-set Positions	Minimum 256 or better
23	Image Flip	Yes Automatic
24	Guard Tour	Minimum 2 Nos
25	Built In Heater & FAN	Required
26	Temperature Control	Required
28	Audio	NA
29	Alarm	Min 2 Alarm input/ Output ports or better
30	On-screen directional indicator	Required

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31	Compression	The camera shall support H.265 implementation to support scene adaptive bitrate control, in order to lower bandwidth and storage requirements.
		The camera shall support automatic dynamic GOP for optimal bitrate utilization. The camera shall support automatic dynamic ROI to reduce bitrate in un-prioritized regions.
32	Event Triggers	<p>The camera shall be able to send and receive trigger directly from any other camera without interface of VMS.</p> <p>Live Stream Accessed, Motion Detection, Shock</p> <p>Detection, Audio Detection, Network, Temperature, Manual Trigger, Virtual Inputs, Alarm Inputs, PTZ: Error, Moving, Preset Reached, Ready, Storage Disruption, Storage Recording, System Ready, User schedule</p>
33	Event Actions	<p>File upload via FTP, SFTP, HTTP and email</p> <p>Notification via email, HTTP and TCP</p> <p>Pre- and post-alarm video buffering, External output activation, PTZ present, guard tour, Video recording to edge storage, Day/night mode, Overlay text</p>
34	Pixel Counter	Built in
35	Edge Storage	Built in SD card slot with support up to 128 GB with Class 10 speed
36	Storage	The Cameras shall have the feature to directly record the videos/images onto storage without any Software
37	Protocols	At least IP, HTTP, HTTPS, SSL/TLS, TCP, ICMP, SNMPv1/v2c/v3 (MIB-II), RTSP, RTP, UDP, IGMP, RTCP, SMTP, FTP, DHCP, UPnP, ARP, DNS, DynDNS, SOCKS, NTP, CIFS/SMB. IPv4 & IPv6 and Bonjour
38	Text Overlay	Date & time, and a customer-specific text, camera name, graphical image etc.
41 42	Security	Password protection, IP address filtering, HTTPS encryption,
		IEEE 802.1Xa network access control, Digest authentication, User access log
43	Firmware Upgrade	The firmware upgrade shall be done through web interface, The firmware shall be available free of cost

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44	Logs	The camera shall provide minimum 200 logs of latest connections, access attempts, users connected, changes in the cameras etc.
	Interface	RJ 45, 100 Base TX
45	Enclosure	Die Cast Aluminium, IK10 rated, IP66 rated, polycarbonate clear dome and sunshield, PVC free complying to WEEE Standards
46	Mount	Wall / Pole Mount
47	Power requirements	Power over Ethernet (PoE/PoE+) IEEE 802.3at Type 2 Class 4, max. 24 W, Typical 9W; 24 V DC max. 30 W
48		24 V AC, max. 40 VA or better
49	Operating Temperature	-25 °C to 55 °C or better
50	Operating Humidity	10–95% RH (condensing) or better
51	Certification	UL, CE, FCC
33	Embedded Applications	The camera shall provide a platform allowing the upload of third party applications into the camera
34	Application Programmers Interface	The interface shall be available for integration with 3rd party analytics and applications in public domain free of cost
35	Onvif	S required
51	Warranty	Min 3 Years OEM warranty

### Online UPS

Sl. No.	Parameter	Minimum Specifications
1	Capacity	Adequate capacity to cover all above IT Components at respective location. Indicative capacity JICCC – 50 KVA, Viewing center – 10 KVA, Traffic Signals – 1KVA
2	Output Wave Form	Pure Sine wave
3	Input Power Factor at Full Load	>0.90
4	Input	Three Phase 3 Wire for over 5 KVA
5	Input Voltage Range	305-475VAC at Full Load
6	Input Frequency	50Hz +/- 3 Hz
7	Output Voltage	400V AC, Three Phase for over 5 KVA UPS
8	Output Frequency	50Hz +/- 0.5% (Free running); +/- 3% (Sync. Mode)
9	Inverter efficiency	>90%

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10	Over All AC-AC Efficiency	>85%
11	Technology	• True Online Double Conversion
		• IGBT technology
		• PWM inverter switching technology
12	UPS shutdown	UPS should shutdown with an alarm and indication on following conditions 1)Output over voltage 2)Output under voltage 3)Battery low 4)Inverter overload 5)Over temperature 6)Output short
13	Battery Backup	60 minutes in full load
14	Battery	VRLA (Valve Regulated Lead Acid)
15	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.
16	Audio Alarm	Battery low, Mains Failure, Over temperature, Inverter overload, Fault etc.
17	Cabinet	Rack / Tower type, 75KW/ 150KW/ 200KW configurations
18	Operating Temp	0 to 65 degrees centigrade

## Diesel Genset

Sl. No.	Item	Minimum Specifications
1	General Specifications	<ul style="list-style-type: none"> <li>Auto Starting DG Set mounted on a common base frame with AVM (Anti-Vibration) pads, residential silencer with exhaust piping, complete conforming to ISO 8528 specifications and CPCB certified for emissions.</li> <li>KVA rating as per the requirement to provide the supply for JICCC</li> </ul>
2	Engine	Radiator cooled/air cooled/Water cooled, multi cylinder, 1500 RPM/3000 RPM diesel engine, with electronic/manual governor and electrical starting arrangement complete with battery, conforming to BS 5514/ ISO 3046/ IS 10002
3	Fuel	High Speed Diesel (HSD)

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4	Alternator	Self-exciting, self-regulating type alternator rated at 0.8 PF or better, 415 Volts, 3 Phase, 4 wires, 50 cycles/sec, 1500 RPM, conforming to IS 4722/ BS 5000, Windings of 100% Copper, class H insulation, Protection as per IP 23.
5	AMF (Auto Main Failure) Panel	<p>AMF Panel fitted inside the enclosure, with the following: It should have the following meters/indicators:</p> <ul style="list-style-type: none"> <li>· Incoming and outgoing voltage</li> <li>· Current in all phases</li> <li>· Frequency</li> <li>· KVA and power factor</li> <li>· Time indication for hours/minutes of operation</li> <li>· Fuel Level in fuel tank, low fuel indication</li> <li>· Emergency Stop button</li> <li>· Auto/Manual/Test selector switch</li> <li>· MCCB/Circuit breaker for short-circuit and overload protection</li> <li>· Control Fuses</li> <li>· Earth Terminal</li> <li>· Any other switch, instrument, relay etc. essential for Automatic functioning of DG set with AMF panel</li> </ul>
6	Acoustic Enclosure	The DG set shall be provided with acoustic enclosure / canopy to reduce the sound level and to house the entire DG set (Engine & Alternator set) assembly outside (open-air). The enclosure must be weather resistant powder coated, with insulation designed to meet latest MOEF/CPCB norms for DG sets, capable to withstand climate. The enclosure must have ventilation system, doors for easy access for maintenance, secure locking arrangements etc.
7	Fuel Tank Capacity	It should be sufficient and suitable for containing fuel for minimum 12 hours continuous operation, Complete with level indicator, fuel inlet and outlet, air vent, drain plug, inlet arrangement for direct filling and set of fuel hoses for inlet and return.

### **7.3.2 Network Backbone**

- i. The MSI shall provide the network with sufficient capacity available on Lease to JSCL for entire project duration for connectivity from field locations to data center and from Data Center to Disaster Recovery site.
- ii. The MSI shall provide network connectivity at all required locations as mentioned in the document. No location shall be left un-covered irrespective of existing network is available or new network has to be laid
- iii. MSI shall make a third party agreement with service provider and JSCL.
- iv. In case if network is not available at particular location, MSI has to make an agreement with Service Provider to provide network connectivity from required location.
- v. The MSI shall provide end to end connectivity from all locations to Central Location in Data Centre through various technologies mentioned here but not limited to Point to Point / SD-WAN / MPLS-VPN etc. over fibre #
- vi. The MSI shall be responsible to provide all Active / Passive equipment's from Central Location to Last point of connectivity
- vii. The MSI shall upgrade the equipment's free of cost, if required in future, to ensure that services run smoothly and SLA is not breached
- viii. The MSI shall be responsible to provide any Monitoring / Managing Software which shall be required to monitor/ manage the Leased network
- ix. All the Locations must be connected in Ring till the last point of connectivity from two different sides The Leased network shall be future scalable and support upgrade in terms of network, bandwidth and field components etc.
- x. The MSI shall be responsible for O&M of leased network for the said period from the date of lease of network
- xi. Any addition in the number of locations shall need to be connected as per the agreed terms and conditions for already connected sites. Same terms and conditions shall be applicable for change or removal of any site from earlier selected sites
- xii. Preventive and regular checks of power plant battery, generator, ac & remote alarm units
- xiii. Maintaining history of events, analysis and reporting, public liaison with concerned authority

## **7.4. CCTV City Surveillance**

This Component covers planning & implementation of the Surveillance system comprising cameras and other field equipment at identified locations. Actual placement of pole & number of cameras at each location, type of cameras, fixation of height & angle for the cameras to ensure maximum coverage shall be done in consultation with Jalandhar Police Department.

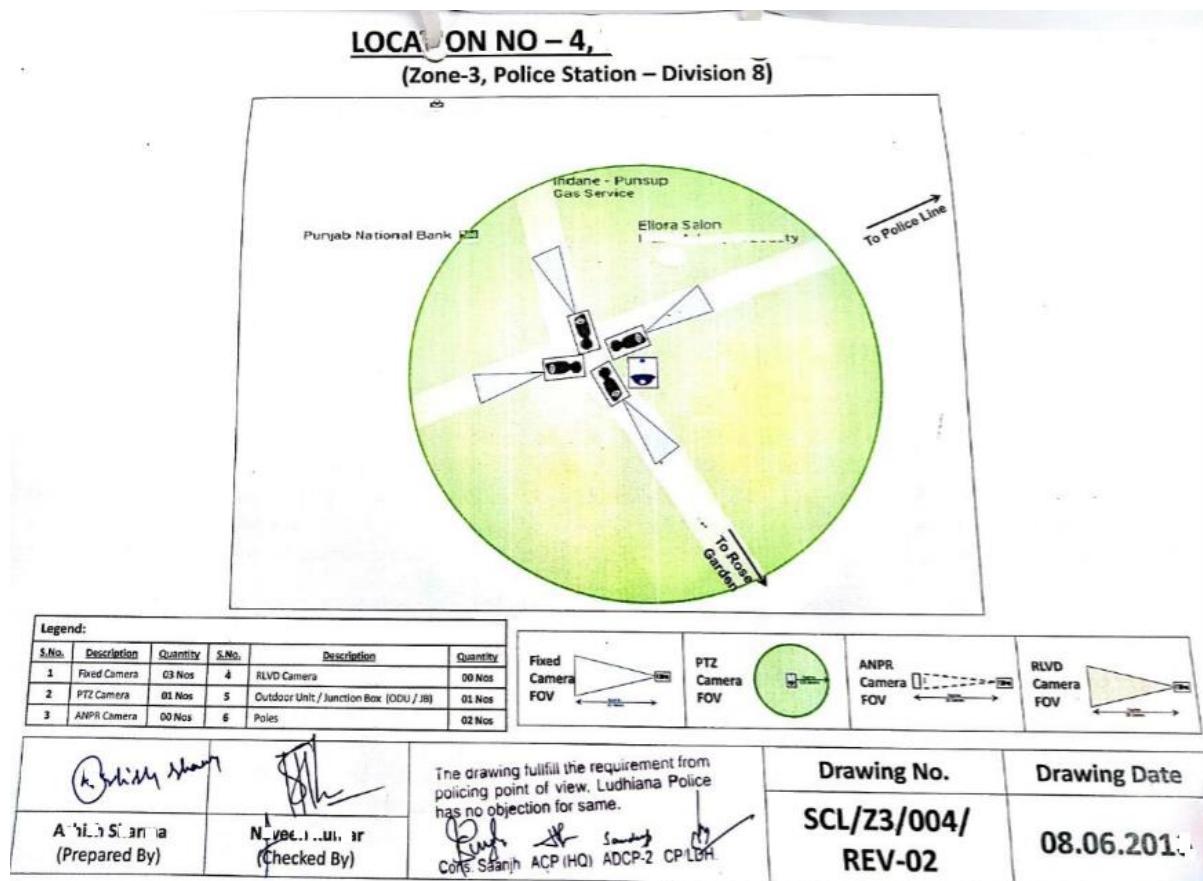
MSI along with Jalandhar police shall talk to nearby private/public property owners and get permissions to place the junction boxes. These junction boxes may be placed on terrace or underground parking spaces or mounted on wall/ceiling in the identified property. The necessary accessories shall be part of cost estimates.

The surveyors shall also finalize the approximate location of foundation for junction box and camera poles. The route for all the underground cable laying shall be finalized during this survey (wherever required).

System shall provide inter-operability of hardware, operating system, software, networking, printing, database connectivity, reporting, and communication protocols. MSI shall prepare the detailed report for field level requirements e.g. Cameras (types & numbers), Camera Mounting requirements, Power Requirements, Connectivity Requirements etc. for perusal of JSCL and designated agency. MSI shall also study the process requirements of police to configure and customize the system and implement the processes as per the defined project timelines.

Every detail, finalized during the survey, shall be demarcated on an AutoCAD drawing and submitted to JSCL or designated agency and Jalandhar police in the form of a detailed site survey report along with other details for its approval in the format below

**Sample of AutoCAD diagram is as follows:**



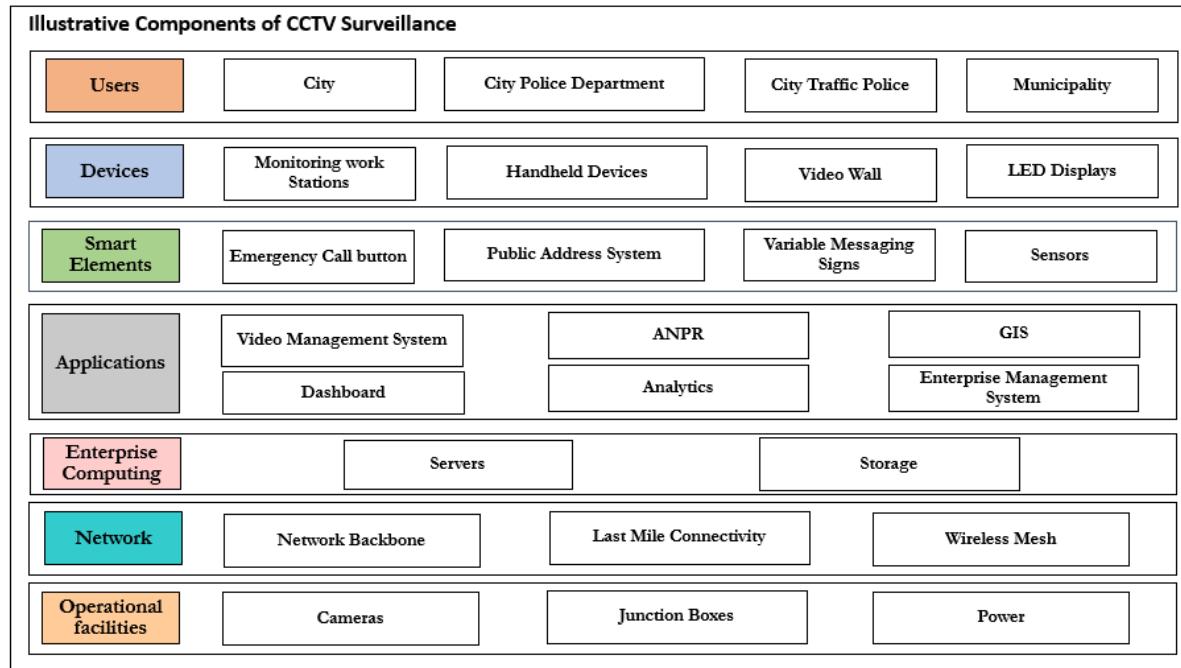
#### 7.4.1. Components of CCTC City Surveillance

The CCTV City Surveillance shall comprise the following:

- PTZ cameras, Fixed box cameras & Body cameras
- Network Video Recorder, Video Management Server & Video Analytics
- Establish Network Connectivity to transfer the data from field devices to the Data Center & Integrated Command Control Center (JICCC)
- Set up City Surveillance Operations at JICCC with required software platform capability to aggregate incoming data streams onto a single platform, provide analytics results in real time
- IT infrastructure including hardware and software at JICCC and DC for the management of the edge devices, command centre.
- Develop strategies and system processes to assist in city surveillance with video analytics and implement Standard Operating Procedures.
- Develop a consolidated database of incidents

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- Develop a data analytics infrastructure and deploy a specialised team



*Figure: Illustrative components of CCTV Surveillance*

### Field Level Hardware

An Indicative list of the field level hardware to be provide by MSI is as follows:

1. Cameras (Fixed Box Cameras, PTZ Cameras, Body cameras etc.) with external/internal IR, Wipers and bird filters)
2. Local processing unit for ANPR, RLVD etc.
3. Face recognition System (FRS)
4. Switches
5. Outdoor Cabinets
6. Pole for cameras / Mast
7. Junction box
8. UPS
9. Networking and power cables and other related infrastructure

#### 7.4.2. Key Performance Indicators

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The KPIs for CCTV Surveillance shall be the following:

- a. City Surveillance should cater to an effective Monitoring and Management with appropriate decision support mechanisms.
- b. City surveillance must ensure a pro-active 24\*7 monitoring of PAN city parameters that capture video footages of all junctions across the road network of Jalandhar and project the feeds to the proposed Command and Control center without time lag on real time basis.
- c. City Surveillance System must ensure and provide a secure and safe environment for the citizens with intelligent and effective use of video analytics and integrated platform for all concerned departments.
- d. The surveillance prime equipment i.e. High Definition Camera units which includes fixed box, and PAN-Tilt-Zoom, must be located at a suitable position wherein the required area is properly capture. The intensity of captured footage should be enough to sustain the clarity as per the required zooming levels. Industry leading practices must be adopted during the implementation phase w.r.t positioning and mounting the cameras, poles and junction boxes.
- e. The surveillance system shall be to provide proactive security as opposed to reactive security on PAN city basis with a clear defined objective of each HD camera unit.
- f. The surveillance System shall provide inter-operability of hardware, operating system, software, networking, printing, database connectivity, reporting, and communication protocols.
- g. It has to be ensure that the pole is well place for vibration resistance adhering to the road safety norms. In addition, the poles erected to mount cameras are good, both qualitatively and aesthetically.
- h. Appropriate branding / color-coding of junction boxes should be done, to warn mischief mongers against tampering with the equipment at the junction with the needful operational equipment. Cameras needs to be protected from the on field challenges of weather, physical damage and theft.
- i. Video Management System must allow users to view a count of analytics events on the video pane while video is being display.
- j. Each intersection should be fitted with outdoor cabinets dimensioned to host all equipment necessary to operate enforcement systems and traffic surveillance systems
- k. The data retention of minimum 30 days has to be maintained at JICCC.

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- l. The city surveillance system must ensure real time and event based monitoring of the city, situation/ rule based alerts including early warnings for prevention and avoidance of unwanted incidents like riots, flooding, etc.
- m. The system should support automated response based on events including communication of alerts to relevant authorities like Fire, Hospitals, etc. for swift response in case of emergencies.
- n. The system should have access to historic video data for investigative purposes as stated earlier.
- o. IP based Public Address System shall also be used as part of the information dissemination system at various locations in the city. These systems shall be deployed at identified junctions to make public interest announcements.
- p. The feed from video shall be accessed from multiple locations as mentioned in list of viewing centres.
- q. Wipers and bird filters shall be installed for all the cameras

### 7.4.3. Functional Requirements

#### Requirements:

- All CCTV hardware products (Model wise) offered in the project should be min UL, CE, FCC, RoHS certified
- The OEM for CCTV Camera should have technical support presence with its employees on its payroll in India. This will ensure long term after sales support & spare support from the OEM. MSI to produce documentary proof to establish the eligibility
- The OEM should have CMMI certification
- OEM should be in the well repeated in Video surveillance equipment manufacturing and deployment
- Local Service/support must be available
- The server sizing shall be done with maximum of 70% utilization
- Edge level processing shall be planned to reduce use of network bandwidth and improve faster processing. For example, Face Recognition System, ANPR, SVDS (with ANPR) etc.

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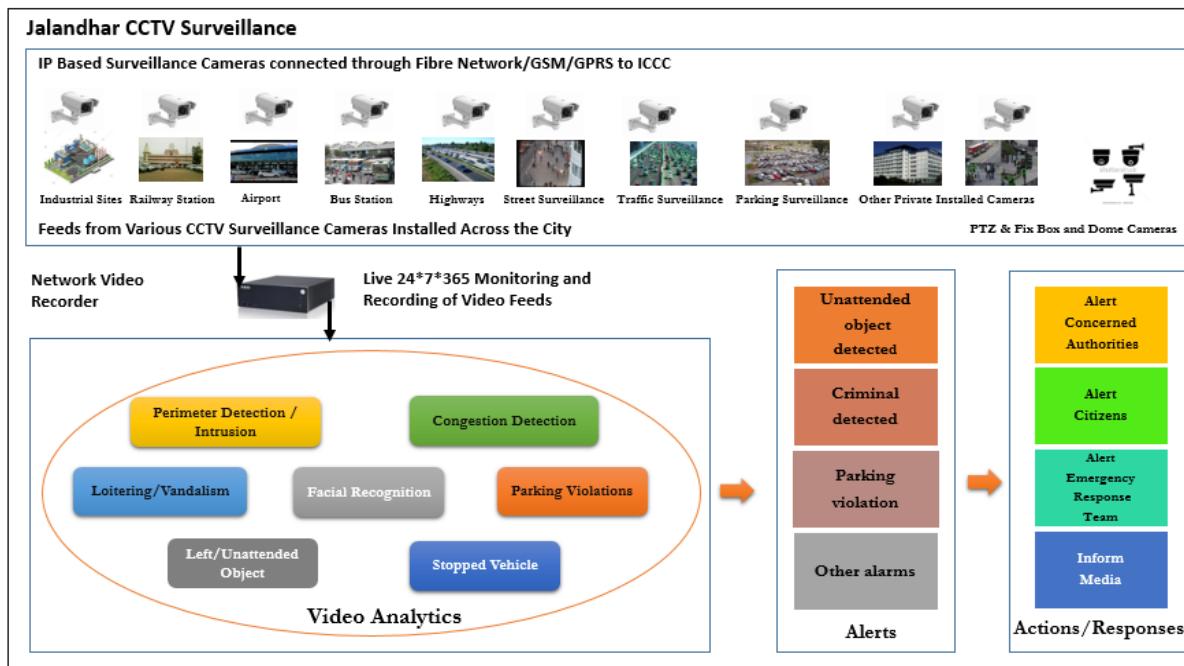


Figure: Illustrative representation of CCTV Surveillance

### Functional Requirements:

- Jalandhar City Surveillance System shall consist of:
  - a) PTZ Cameras, Fixed Box Cameras, PTZ cameras and Body cameras etc.
  - b) Video Management System (VMS) including central software application.
  - c) Camera Accessories i.e., Power Supplies, Cable, Connectors and associated accessories for an integrated system.
- The cameras implemented as part of this project shall be rated for operations in outdoor environment (for outdoor installations) and depending on the objective/application, shall be of different configurations including PTZ or fixed cameras.
- All the Cameras shall be IP based.
- Cameras shall have an integral receiver/driver that shall be capable of controlling pan-tilt, zoom and focus locally and also remotely from the JICCC.
- All cameras shall support real-time video content analysis.
- Event (alarm) Handling: -
  - a) The camera shall be capable of recording an event as pre and post event images to on-board SD Media Card and on IP BASED NVR. Events may be triggered using camera motion detection or from an external device input such as a relay.

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- b) When triggered from an external input or the camera's motion detector, the camera shall be capable of sending JPEG images via e-mail and/or sequences of images to an FTP server or on-board compact flash and IP BASED NVR.
- c) A relay output shall be available upon the activation of the camera's motion detector or external relay input. The relay output may also be manually activated from the live view screen.

### **Video Management System (VMS)**

Video Management System (VMS) shall bring together physical security infrastructure and operations and shall use the IP network as the platform for managing the entire surveillance system. End users shall have rapid access to relevant information for analysis.

This shall allow operations managers and master system integrator (MSI) to build customized video surveillance networks that meet their exact requirements. Software suite shall be a scalable and flexible video management system that could be easily managed and monitored. Scalable system shall permit retrieval of live or recorded video anywhere, anytime on a variety of clients via a web browser interface.

Video management server, on which the VMS is hosted upon, shall run seamlessly in the background to manage connections, access and storage. Video management server shall accept the feed from IP Camera installed at field locations. Server shall stream incoming video to a connected storage. VMS shall support video IP fixed colour / B &W cameras, PTZ / Dome cameras, infrared cameras, low light/IR cameras and any other camera that provides a composite PAL video signal.

### **General requirements:**

- Central software application to be installed at the JICCC shall be able to run on any PC based on standard operating systems and shall be license free.
- Video Management System (VMS) shall be non-proprietary and open ended to support integration with JICCC platform.
- Perpetual licenses with Software Assurance shall be procured
- Central Application Server shall allow user to view live video stream.
- Software shall consist of a single client application and the client software shall not be dependent on, nor require any connection to, a central management or configuration server.
- The client software shall be installable without any need for software or hardware license.
- Dockable windows shall include:

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1. Site Explorer
  2. Alarms/Events window
  3. PTZ and advanced telemetry functions
  4. Monitors window
  5. Maps window
- The system shall support a distributed architecture with no single point of failure.
  - Video shall normally stream direct from camera to client; streaming via a proxy or intermediate server shall not be the normal function of the system but may be selected as an option.
  - A client need not ask “permission” to connect to a camera. The handshake between client and camera shall be done directly.
  - There shall be no single management server. System management shall be distributed throughout the system.
  - VMS shall allow the overlay of time and date and site information on live video panes, either on all panes, or selected pane only. In addition, the overlay may consist of a user-provided transparent PNG or JPEG file.
  - VMS shall allow users to view live video and review recorded video at the same time.
  - VMS shall be ONVIF compliant.
  - Users shall be able to display any camera view (virtual pre-set).
  - VMS shall allow users to reveal the hidden zone in live video if the user has the appropriate permission.
  - Users shall be able to save the current zoom/scroll position as a camera view (virtual pre-set).
  - Administrators shall be able to configure hidden zones on fixed cameras.
  - VMS shall allow the display of analytics levels on video.
  - Users shall be able to take a snapshot of one image or all images currently displayed and saved as a bitmap or JPEG image to a configurable location. This should include zoomed images.
  - Users shall be able to print a snapshot of an image displayed in a video pane direct on a printer (colour or grayscale, depending on printer).
  - Users shall be able to replay currently viewed live video by a single mouse click for replays from 10, 15 or 30 seconds before current time or from alarm time.
  - Users shall be able to configure the size for text and icons displayed on video panes. Text and icons can be fixed size or adjust automatically when video pane size changes.
  - In the event of the video connection failing, the Video Management System shall display a clear error message with the option to also display the last video frame received.

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- Event Counting; The Video Management System shall allow users to view a count of analytics events on the video pane while video is being displayed. The Video Management System shall allow users to reset the event count for a camera.
- The Video Management System shall support binary inputs on IP Cameras, encoders, decoders and alarm panels.
- The Video Management System shall support video loss alarm inputs.
- The Video Management System shall support network loss alarm inputs.
- The Video Management System shall support fault alarm inputs, including:
  - a) Raid degraded
  - b) License failure
  - c) Recording failure
  - d) Redundant power failure
  - e) Redundant network failure
- The Video Management System shall support analytics alarm inputs, with separate events for each analytics filter.
- The Video Management System shall support alarm inputs from third party systems.
- The Video Management System shall enable multiple alarm inputs (detectors) to be grouped into an alarm zone.
- The Video Management System shall support inputs (detectors) that do not cause an alarm to be generate.
- The Video Management System shall support ‘AND’ logic between detectors so that the alarm input is activated only when both detectors are activated with a defined time period.
- The Video Management System shall support detectors that are activated and deactivated by different inputs e.g. activate on a binary input from one device and deactivated on a binary input from another device.
- Users shall be able to dock the alarm viewing window below the Live View or Playback View windows.
- Users shall be able to sort the alarm information in various ways by clicking on column headings.
- The Video Management System shall support set and unset of alarm zones such that alarms are only generated when the alarm zone is set.
- Users shall be able to configure the time scheduled for each alarm zone – different start and end times for each day and multiple time per day.

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- Users shall be able to define specific dates and times within time schedules so that exceptions for holidays etc. can be specified.
- The Video Management System shall enable the same time schedule to be applied to multiple zones.
- Users shall have the option of restoring the previous view after an alarm has been cleared.
- Users shall be able to manually set and unset zones.
- Users shall be able to isolate faulty alarm inputs (detectors) such that they do not cause false alarms. Users shall be able to easily identify which alarm inputs are isolated and the reason for isolation.
- The Video Management System shall enable zones to be set and unset on an event.
- The Video Management System shall enable detectors to be isolated and restored on an event.
- Users shall be able to specify a priority for each alarm zone (1-10.).
- Users shall be able to configure the alarm sound for all alarm zones in a site or for each alarm zone individually. Sound can be from any .wav file and can be sounded once or repeated while the alarm is active.
- The Video Management System shall allow alarms to be configured to require text from a user at the point of acknowledging and at the point of clearing.
- The Video Management System shall allow an alarm procedure document (.html, text or URL) to be associated with a site or to an individual alarm zone. This procedure document shall be displayed when an alarm happens.
  - a) Users shall be able to configure the actions that should be performed when an alarm occurs:
  - b) Show video from camera, camera view or salvo in specified monitors
  - c) Stop video when alarm cleared
  - d) Move camera to pre-set position
  - e) Send email to multiple recipients, with option to include snapshots
  - f) Perform a relay action automatically
  - g) Start recording one or more cameras – records for specified duration
  - h) Auto-protect recording from a specified duration before the alarm
- Users shall be able to configure a second authorizing user for alarm clearing and relay actions – second user has to enter a password to authorize these functions.
- The Video Management System shall support the following for 3rd Party cameras through native protocols and / or ONVIF:

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- a) Motion detection events
- b) Record on motion
- c) Video loss
- d) Network loss
- e) Change video quality on event, including frame rate, resolution and bitrate
- Users shall be able to configure an unlimited number of alarm groups each containing a set of alarm zones and/or detectors.
- For each user or user group, it shall be possible to associate one or more video panes with each alarm group. This should also include analog monitors.
- Users shall be able to choose a display mode for alarm video. As multiple alarms come in, the video can either be “cascaded” across the chosen viewing panes or “queued” behind the chosen viewing panes. As alarms are clear, the associated video is clear from the chosen viewing panes. Cascaded video can either remain in the same video pane until cleared, or can move to the first available pane, as earlier alarms are clear.
- When all alarm video is clear from a viewing pane the Video Management System shall display video and layout being view before any alarm was display.
- The Video Management System shall remove any black screen monitoring analogue monitors from the normal site hierarchy.
- The Video Management System shall have permissions to determine which users or user groups get access to which alarm groups and which windows are used to display alarm video.
- Users shall be able to configure any of the available viewing panes or analogue monitors as a spot monitor for viewing significant live footage.
- The Video Management System shall provide a toolbar option on all live viewing panes to copy the current video stream into the spot monitor.
- The Video Management System shall keep an audit record of what video was started and stopped in the spot monitor, by which user and what times.
- The Video Management System shall allow the video sequence that was view in the spot monitor by a selected user in a selected time period to be exported as a single incident.
- Users shall be able to review all video watched by a selected user in a selected time period in an incident player. The video should be played back as one sequence in a single video pane.
- The Video Management System shall generate an alarm if any of the detectors within an alarm zone are activate.

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- The Video Management System shall not generate new alarms for subsequent detector activations within the same zone so that the user only has one alarm to handle.
- The Video Management System shall alert new alarms with flashing icon and optionally a sound.
- The Video Management System shall automatically perform the actions configured for the alarm zone or detector:
  - a) Show video from camera, camera view or salvo in specified video panes or monitors
  - b) Move camera to pre-set position
  - c) Stop video when alarm cleared
  - d) Send email to multiple recipients
  - e) Perform a relay action
  - f) Start recording one or more cameras
  - g) Auto-protect recording from a specified duration before the alarm
- When all alarm video is cleared from a viewing pane the Video Management System shall display video and layout being viewed before any alarm was displayed.
- From a looped replay, users shall be able to quickly jump to continuous replay from the alarm time.
- The users shall be able to display a map showing the location of the alarm.
- Users shall be able to view pending alarms in a list ordered by priority and time.
- Users shall be able to filter the alarm list to show alarms only from specific areas (sites and zones.).
- The Video Management System shall allow users to acknowledge alarms, entering alarm response text as required.
- The Video Management System shall allow users to edit the alarm response text at any time before the alarm is cleared.
- The Video Management System shall allow users to clear alarms, entering alarm response text as required.
- Users shall be able to find historical alarms matching specified criteria:
  - a) Alarm type
  - b) Alarm state (new, acknowledged, cleared)
  - c) From site(s)
  - d) From alarm zones(s)
  - e) User(s) who acknowledged or cleared

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f) Time range

- The Video Management System shall be able to escalate alarms to other user groups if the alarm is not acknowledged within a pre-defined time period.
- The Video Management System shall be able to escalate alarms to other user groups if the alarm is not cleared within a pre-defined time period.
- The Video Management System shall support different escalation time periods for different alarm priorities.
- The Video Management System shall be able to propagate an alarm to other areas (zones) if the alarm is not acknowledged within a pre-defined time period.
- Users shall be able to produce reports of historical alarms and events and export to RTF or CSV formats.
- Users shall be able to authorize an alarm to be clear, by a second user entering a password.
- Users shall be able to view live or recorded video associated with the alarm.
- The Video Management System shall ensure that alarms are held on an alarm server, not on a user's PC.
- The Video Management System (VMS) shall support integration with external data sources. An external Data Source shall be defined as any text string up to 320 characters.
- The VMS shall support up to 1 external data record every second.
- The VMS shall support up to 2 million data records.
- The VMS shall support the ability to search and filter data records using the following:
  - a) A partial text string to search data record
  - b) Source IP address of data
  - c) Name of Data source
- The VMS shall allow for the association of data records with video data.
- Integration shall be available via a freely available open interface. The interface shall be via a software development kit.
- Users shall be able to configure relay actions using binary outputs on IP Cameras, encoders and decoders.
- Users shall be able to configure relay actions using external outputs to 3rd party systems.
- The relay activation shall be pulsed with a configurable pulse time period.
- The Video Management System shall support latched relay outputs.
- Users shall be able to associate relay actions with specific cameras so that the actions are readily available when video is displayed from that camera.

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- The Video Management System shall perform relay actions on alarm and event.
- The Video Management System shall be able to perform relay actions on a time-schedule.
- The Video Management System shall automatically check for devices not on the network and notify users when not available.
- It shall be possible to define the users who get notified if devices become unavailable.
- Users shall be able to manage the bandwidth used for network scans by configuration of:
  - a) Monitor period (mins)
  - b) Minimum check interval (msec)
  - c) Perform fast check on log in
  - d) Perform fast check on refresh
- The Video Management System shall scan for devices using any combination of IP broadcast addresses, individual IP addresses or ranges of IP addresses.
- Users shall be able to turn off scanning of devices.
- Users shall be able to set sites to offline mode. In this mode, all automatic communication with the site will be halted, while still allowing requested traffic.
- Users shall be able to manually refresh any diagnostics view.
- The Video Management System shall notify users when device times are not synchronized with the viewing PC (more than 60 seconds out).
- The Video Management System shall provide a support information tool, which gathers together log files and site database into a zip file.
- Users shall be able to configure named user groups. A group can be granted administrator rights:
  - a) Full (can configure everything)
  - b) Restricted (can configure everything except users and groups)
  - c) No configuration rights (limited user functions only)
- The Video Management System shall be able to hide administration options from normal users. The user interface shall be cleanly split into administrative functions and operational functions. Users who do not have administrative rights shall get a much simpler interface so that they are not confused by visible but disabled features.
- Users shall be able to configure named user accounts and allocate them to user groups.
- Users shall be able to enable and disable user accounts.
- Users shall be able to set-up a user to use either machine OS standard authentication or a password when he logs into the Video Management System.

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- Users shall be able to limit the total number of video streams (live or recorded) that a user or member of a user group can display at once.
- Users shall be able to limit the number of time-based thumbnail images that a user or member of a user group will display at once.
- Users shall be able to allocate each user group or user a priority that is used when controlling PTZ cameras.
- Users shall be able to grant global permissions to user groups or users (global permissions do not apply to specific objects such as cameras):
  - a) PTZ hold (allows a user to keep control of a PTZ camera when not moving it)
  - b) Video lockout (allows a user to perform a video lockout on any site of camera)
- Users shall be able to grant permission for user groups and/or users to access any object in the system (sites, cameras, monitors, salvos, alarm zones, detectors and relays.) For each object access can be limited by function: -
  - a) List – see object in the user interface
  - b) View – view video from cameras, sequences, salvos and guard tours
  - c) Transmit audio (speak) to a camera
  - d) Playback recording from a camera or salvo
  - e) Record – make an instant recording of a camera
  - f) Export video clips or take snapshots from a camera
  - g) Control a PTZ camera
  - h) Display video on a monitor or video wall or activate a relay
  - i) Respond to alarms from an alarm zone
  - j) Hidden zone (live or playback) – access video behind a hidden zone
  - k) Audio (live or playback) – receive audio from a device
  - l) Set and unset an alarm zone
  - m) Isolate and restore a detector
  - n) Work offline
  - o) Configure pre-sets and access the camera menus
- Users shall be able to reset access permissions on individual objects to use the access permissions of their parent site.
- Users shall be able to configure application settings specific to each PC,
  - a) Enable or disable scheduled tasks
  - b) Enable or disable the application as the topmost window

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- c) Location for snapshot images
- d) Format of snapshot image (bitmap or JPEG)
- e) Folder for snapshot image
- f) Replay incident in live or Playback view
- g) Use software or hardware assisted video renderer
- h) Use de-interlace filtering on live view by default
- i) Use de-interlace filtering on playback by default
- j) Set video de-interlacing
- k) Enable or disable use of a CCTV keyboard
- l) Serial port for CCTV keyboard
- m) CCTV keyboard type
- n) Video pane text scale factor (% of the default text size)
- o) Resize text on video panes in proportion to video pane size
- p) Video pane icon size (normal, medium, large)
- q) Select icon size on video panes in proportion to video pane size
- r) Date / time display on video panes (none, all, selected)
- s) Load bookmarks on start up
- t) Spot monitor (external monitor or specified video pane)
- u) Protect recordings by default when exporting
- v) Write date and time on exported recordings
- Users shall be able to prevent simultaneous listen and speak (full duplex audio).
- Users shall be able to configure the use of buffered playback when reviewing recordings.
- Users shall be able to enable or disable alert messages.
- Users shall be able to log into the Video Management System manually.
- It shall be possible to start the Video Management System from the command line with the following options:
  - a) Username and password
  - b) Normal, full screen or video-only modes
  - c) Site database
- The Video Management System shall allow users to log out and log in without closing the application.
- The Video Management System shall have an option to require all users to re-enter their password when logging out.

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- The Video Management System shall remember display settings on a PC for each user at log off and restore settings at log in:
  - a) Which cameras are displayed in which video panes
  - b) PTZ controls displayed
  - c) Map window position
  - d) Alarm window position
  - e) Video window positions (default hidden)
  - f) Main window size and position and site explorer width
  - g) Recording calendar displayed
- Users shall be able to change their own password (if given write permission to the site database).
- Users shall be able to change their default location on the tree hierarchy.
- Users shall be able to lockout all other users preventing them from viewing or recording video from a selected camera or all cameras in a selected site.
- The Video Management System shall support an audit trail that can log user actions to an industry standard database e.g. SQL Server.
- Users shall be able to specify the authentication method to be used between the client application and the audit trail database:
  - a) Local user password
  - b) Windows user password
- The audit trail shall log the following user actions to the audit trail database:
  - a) User logged on
  - b) User attempted to log on and was denied access
  - c) User logged off
  - d) User changed "home" site
  - e) User acknowledged an alarm
  - f) User cleared an alarm
  - g) User received an alert message (e.g. device not available)
  - h) User starting playing back a recording (forward)
  - i) User started playing back a recording (backwards)
  - j) User stopped playing back a recording
  - k) User denied playing back a recording or playback failed
  - l) User took control of a PTZ camera

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- m) User released control of a PTZ camera
- n) Second user authorized relay action
- o) Second user authorized alarm to be cleared
- p) Second user denied authorizing a relay or alarm to be cleared
- q) Export recordings
- r) Protect recordings
- s) Manual start or stop recording
- t) User log out denied
- u) User starts playing live video from a specific camera
- v) User stops playing live video from a specific camera
- w) Creation, deletion or editing items stored in the Video Management System configuration database
- x) User created a bookmark
- The audit trail shall log the following information for each entry in the audit log:
  - a) Date and time that the user performed the action
  - b) Name of the user performing the action
  - c) DNS name of computer running in JICCC
  - d) The name of the application writing to the log
  - e) A string naming the type of action performed e.g. Log on
  - f) Name and matrix number of the object that the action applies to e.g. camera name and number
  - g) Further information about the action, in a structured form e.g.: “Alarm Time: 16-Feb-06 10:11:41, Alarm Response: False alarm”
  - h) Severity (applies to error message received log entry only)
- The user shall be able to export a report from the audit trail database into a standard reporting tool, e.g. Excel.
- The Video Management System shall discover IP Video devices on a network either by broadcast address or unicast addresses for each device.
- The Video Management System shall allow configuration of IP Video System devices via their web configuration interface.
- The Video Management System shall enable mass configuration of devices, in particular encoder settings on IP cameras and encoders.

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- Administrators shall be able to view video from each stream at the same time as making changes to the media parameters on an encoder to aid configuration.
- Administrators shall be able to upgrade the firmware on IP Video System devices - multiple devices can be upgraded in one go.
- Administrators shall be able to create a hierarchy of sites and sub-sites for organizing cameras and other items by location.
- Administrators shall be able to set the time-zone on a site - different sites can each have their own time zone.
- Users shall be able to reorder sites under their parent site (sites are ordered by number).
- The Video Management System shall be able to automatically create a site hierarchy within a site database containing IP Video System devices visible on the network.
- Users shall be able to create sequences and salvos within the sites, set up 24/7 recording for each camera and enable video loss and network loss alarms.
- Users shall be able to add cameras, monitors, alarm panels, alarm servers and IP BASED NVRs to sites by dragging and dropping, selecting from a list or manually entering the IP Address and name.
- Users shall be able to remove devices from sites.
- Users shall be able to move devices, and other items such as sequences, salvos, and sub sites from one site to another by dragging and dropping.
- Users shall be able to enter a localized display name for cameras, monitors, alarm panels, alarm servers and IP BASED NVRs which overrides the name stored on the device.
- The Video Management System shall enable a copy of the configuration database to be cached locally on each user workstation to ensure continuity of operation when a connection to the central database is not available.
- The Video Management System shall support a configuration database that is divided into multiple ‘segments’, e.g. one segment for each site. The Video Management System shall allow each segment to be configured and accessed independently.
- The Video Management System shall support user access permissions so that only authorized users can access specific segments.

## **Video Display System**

- Shall view live or recorded video from resizable and movable windows
- Should have an ability to perform video controls for video systems from workstation
- Shall play, fast-forward, rewind, pause, and specify time to play recorded video
- Shall take a video still image (snapshot) from live or recorded video
- Shall export video for user specified time and duration
- Shall have the capability to move PTZ cameras
- Shall view Video in Video Matrix
- Shall display in 1x1, 2x2, 3x3 and 4x4 window formats
- Shall enable operator to specify video windows to be displayed in matrix
- Shall enable matrix settings to be saved per user
- Shall view either live or recorded video can be displayed in the video matrix window.
- Shall enable video snapshot to be taken and saved from any window pane in the matrix view
- Shall rotate video in “virtual” video guard tour
- Shall rotate through multiple video views based on predefined video camera sequence and duration.
- Shall enable the user to pause the rotation of video and resume the video rotation again
- Shall enable times between new video to be adjusted
- Shall enable both live video and recorded video to be played through the video guard tour.
- Shall enable alarms to be generated from any video pane
- Shall enable user to only view and control video for which they have been assigned permissions by the administrator
- Shall manually create an alarm from the live or recorded video with specified severity and description.

## **Recording and Storage**

- The storage solution proposed is that the video feeds would be available for 30 days. After 30 days, the video feeds would be archive unless it is flagged or marked by the Police or by JSCL for investigation or any other purpose. The video feeds of all relevant cameras capturing the incident in question would be stored until the Police or JSCL deem it good for deletion.

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- For incidents that are flagged by the Police, JSCL or any court order, the video of the relevant portion from all relevant cameras should be stored/archived separately for investigation purposes and a committee at JSCL can decide when this video feed can be deleted.
- The Recording Servers/System, once configured, shall run independently of the Video Management system and continue to operate in the event that the Management system is off-line.
- The system shall support the use of separate networks, VLANs or switches for connecting the cameras to the recording servers to provide physical network separation from the clients and facilitate the use of static IP addresses for the devices.
- The system shall support H.265 or better, MPEG-4 and MJPEG compression formats for all IP cameras connected to the system.
- The system should not limit amount of storage to be allocated for each connected device.
- The system shall allow for the frame rate, bit rate and resolution of each camera to be configured independently for recording. The system shall allow the user to configure groups of cameras with the same frame rate, bit rate and resolution for efficient set-up of multiple cameras simultaneously.
- The system shall support archiving or the automatic transfer of recordings from a camera's default database to another location on a time programmable basis without the need for user action or initiation of the archiving process. Archiving shall allow the duration of the camera's recordings to exceed the camera's default database capacity. Archives shall be located either on the recording server or on a connected network drive. If the storage area on a network drive becomes unavailable for recording, the system should have the ability to trigger actions such as the automatic sending of email alerts to necessary personnel.
- Bandwidth optimization - The Recording Server / System shall offer different codec (H.265, MJPEG, MPEG-4, etc.) and frame rate (CIF, 4CIF, QCIF) options for managing the bandwidth utilization for live viewing on the Client systems.
- From the Client systems, the user shall have the option of having video images continually streamed or only updated on motion to conserve bandwidth between the Client systems and the Recording Server.
- The Recording Server/System shall support Camera devices from various manufacturers.
- The Recording Server/System shall support the PTZ protocols of the supported devices listed by the camera OEMs.

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- The system shall support full two-way audio between Client systems and remote devices i.e. CCTV.
- Failover Support - The system shall support automatic failover for Recording Servers. This functionality shall be accomplished by Failover Server as a standby unit that shall take over in the event that one of a group of designated Recording Servers fails. Recordings shall be synchronized back to the original Recording Server once it is back online. The system shall support multiple Failover Servers for a group of Recording Servers.
- SNMP Support - The system shall support Simple Network Management Protocol (SNMP) in order for third-party software systems to monitor and configure the system. The system shall act as an SNMP agent which can generate an SNMP trap as a result of rule activation in addition to other existing rule actions.

## **Video Analytics System**

- The Video Analytics shall be designed to provide Intelligent Video Analysis for 24/7 surveillance with support for devices from different vendors.
- Support any architecture namely distributed, centralized and hybrid.
- Support system openness without using any proprietary format.
- Support commercial-off-the-shelf computing hardware without the need of any proprietary hardware.
- Able to produce reliable analytics at lower resolutions like 4CIF resolution in order to save the computation.
- Able to process at variable resolution and frame rate when if necessary.
- It shall support open platform Video Management System (VMS).
- It shall provide ONVIF (Open Network Video Interface Forum) device discovery.
- It shall get video from camera or VMS and send alarms to VMS to be viewed in VMS client.
- It shall stream the Analytics Video to VMS using open interface protocol like ONVIF.
- It shall support multiple regions of analytics on single video feed.
- It shall support multiple features to be enabled for each of the regions.
- It shall support feature based scheduling so that that alarms can be enabled or disabled for a certain period of time.

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- It shall support both Virtual line and Virtual area based features. The virtual area can be of any shape and can be bound by at least 10 end points.
- It shall support both indoor and outdoor environment.
- It shall support setting of minimum and maximum object size for detection.
- It shall support masking of area in a view.
- It shall support object masking.
- It shall support color detection for vehicle & Object.
- It shall support alarms to filter based on object color, size, speed and aspect ratio.
- It shall support analytics capability to run both on server as well as edge (on camera).
- It shall support simultaneous running of different features both on edge as well as server for same camera.

All cameras should support motion detection, camera tampering and audio analytics. All cameras must be capable to run two analytics in addition to motion detection and camera tampering as required at any given time.

Solution shall be so design to have automated PTZ camera control for zooming in on interesting events like motion detection etc. as picked up by camera without the need of human intervention.

Surveillance system shall have the capability to deploy intelligent video analytics software on any of the selected cameras. This software shall have the capability to provide various alarms & triggers. The software shall essentially evolve to automate the Suspect activity capture and escalation; eliminate the need of human observation of video on a 24x7 basis.

Analytics software shall bring significant benefit to review the incidences and look for suspicious activity in both live video feeds and recorded footages.

Various video analytics that shall be offered on identified cameras are

1. Parking Violation
2. Wrong/One-way detection
3. Triple riding
4. Helmet detection
5. No Number Plate Detection
6. Detection and classification of human, animal and vehicle
7. 'Vehicle of interest' tracking by colour, speed, number plate

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8. Unwanted/ banned vehicle detection
9. Incident detection
10. Repeat offenders
11. Heavy vehicle no entry tracking
12. Stopped vehicle
13. Slow traffic/congestion detection
14. Crowd detection
15. Motion detection
16. Stopped pedestrian
17. Graffiti and Vandalism detection
18. Walking against mandatory flow/pedestrian movement
19. Unattended/abandoned object and tracking
20. Object Classification and facial recognition
21. Behavioural Biometry: Identification through multiple behaviour (Optional)
22. Person climbing barricade
23. Person collapsing
24. Tripwire/Intrusion
25. Video fire detection
26. Target zone data for people or vehicles entering and remaining in target zone
27. Real-time scene analysis and counting data based on user definable rules
28. Camera based analytics for Traffic Management
  - a) Red Light Violation Detection
  - b) Automatic Number Plate Detection
  - c) Speed Violation Detection System
  - d) Face Recognition System
29. Camera based analytics for Solid Waste Management
  - a) Debris and Garbage detection
  - b) Attendance of sanitation workers on site by face recognition
  - c) Sweeping and cleaning of streets/bins before and after
  - d) Garbage bin, cleaned or not
  - e) Tracking of garbage truck movement and Quantity of garbage dumped at dumpsite
30. System functions and reports:
  - a) Reduce false alarms

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- b) Alarms to be sent to Voice, visual, relay closure, email, or cell phone alarm
- c) Video/Camera events - signal lost and restored
- d) Auditing
- e) Customized alarm management
- f) Rule based scene analysis and reports
- g) Alarm Acknowledgement
- h) MIS reports including Heat maps

However, the list of functionalities mentioned are not limited to. MSI has to study the user requirements further and implement the solution.

The solution shall enable simultaneous digital video recording from network, intelligent video analysis and remote access to live and recorded images from any networked computer. It shall be able to automatically track and classify objects such as cars & people and push content to the respective security personnel as required for real time analysis. The system shall also have display of time line, customizable site map, live video, video playback, integrated site map, remote live view, multi-site capability, encryption, watermarking and event based recording.

All cameras should support motion detection, camera tampering and audio analytics. All cameras must be capable to run two analytics in addition to motion detection and camera tampering as required at any given time.

### **Face Recognition System:**

The facial recognition system shall be enabled at cameras identified by the purchaser. These cameras identified shall be installed at critical locations as identified by police department. The facial recognition system in offline mode shall be provided by the MSI in line with the requirement of police. Sufficient online and offline licenses shall be planned based on detailed system study or a unlimited open licences shall be made available.

The functional requirement specification of the facial recognition system is as follows:

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Sl. No.	Parameters	Minimum Specifications
<b>1</b>	<b>General Requirements</b>	<p>The facial recognition system should be able to integrate with IP Video Cameras as required in the solution and shall be able to identify multiple persons of interest in real-time, through leading-edge face recognition technology. The system shall be able to recognize subjects appearing simultaneously in multiple live video streams retrieved from IP surveillance cameras. The Facial recognition system should seamlessly be integrated to the network video recorders and the video management system</p> <p>The facial recognition system should be able to work on the server/desktop OS as recommended by OEM and provided by the Master System Integrator</p> <p>The user interface of the facial recognition system should have a report management tool without installation of any additional client software. It should be able to generate real time report such as Audit log report, Hit List Report, Daily Statistics Report, and Distribution Report.</p> <p>The facial recognition system should be accessible from 5 different Desktop/ laptops at any given time. When choosing a distributed architecture, the system shall be able to completely centralize the events and galleries from each local station into a unique central station, devoted to management and supervision</p> <p>The system should have ability to handle initial real-time watch list of at least 10,000 Faces (scalable to at least 1 Million faces) and 50 Camera Feeds simultaneously and generate face matching alerts</p> <p>The algorithm for facial recognition or the forensic tool should be able to recognise partial faces with varying angle</p> <p>The system should be able to detect multiple faces from live single video feed</p> <p>The system should have combination of eye-zone extraction and facial recognition</p> <p>The system should have short processing time and high recognition rate</p> <p>The system should be able to recognize faces regardless of vantage point and any facial accessories/ hair (glasses, beard, expressions)</p> <p>Face detection algorithms, modes and search depths should be suitable for different environments such as fast detection, high accuracy etc. The FRS system shall use of GPU technology instead of Traditional CPUs, to greatly improve the computational performance in crowded environments.</p> <p>The system should be able to identify and authenticate based on individual facial features</p> <p>The system should be compatible with the video management system</p>

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Sl. No.	Parameters	Minimum Specifications
2		<p>The system should have capability for 1:1 verification and 1:N identification matching</p> <p>The system should be able to integrate with other systems in future such as 'Automatic fingerprint identification system (AFIS)' etc.</p> <p>The system should be able to support diverse industry standard graphic and video formats as well as live cameras</p> <p>The system should be able to match faces from recorded media</p> <p>The system should be able to detect a face from a group photo</p> <p>The system should be able to trace from stored videos of any format</p> <p>The system should have bulk process of adding faces in the system</p> <p>The system should allow users to search or browse captured faces (based on date or time range), export any captured image for external use with a capability to support a Handheld mobile with app for windows OS or android OS to capture a face on the field and get the matching result from the backend server</p> <p>The proposed solution should provide the ability to assign different security levels to people and places. It should alert security staff when someone is spotted in an area where they're not permitted, whilst allowing them free access to non-restricted/public areas</p> <p>The system should be able to detect faces in different environmental changes like rain, wind, fog and poor light</p> <p>The system should have the facility to categorize the images like "Remember this person" or "hit-list" or "wanted".</p> <p>The OEM should have deployed the solution in India</p> <p>The system shall be able to do the parallel processing of long videos, so that operators can start working quickly even if videos are big</p>
		<p>System shall be integrated with existing database as required</p> <p>The system should have the capability to link the captured data to CCTNS application using a Unique key / cases number/ FIR number and be able to send required reports / BI analysed data / raw data to CCTNS application and receive acknowledgement</p> <p>System should have the capability to generate the fortnightly / monthly detailed report of the data shared with the CCTNS application. This will be required and support while conducting the forensic internal audits</p> <p>System should have the capability to integrated the Analytics Engine module with CCTNS application, so that at point of time if required, the intelligence capabilities of solution will benefit in smart policing</p> <p>The search module of our smart city solution designed under integration requirement of CCTNS application should have the capability to perform forensic data analytics and cyber threat intelligence to analyse and anticipate where the likely threats are coming from and when, increasing readiness</p>

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Sl. No.	Parameters	Minimum Specifications
3	Case Management	The system shall be able to create cases corresponding to investigation operations
		The system shall be able to manage videos and photos within a certain case
		The system shall be usable by numerous investigators or video analysts together on the same case, working in parallel or in series, so that big cases could be processed efficiently
		The system shall make the findings of one operator immediately and easily available to all other operators, to increase video / photo case analysis efficiency and speed
		The system shall give a holistic view of all videos and photos of a case, so that operators get a full picture of the case (and not limited view, item by item)
		The system shall include purge capability at the case level or at the video level
		The system shall include the ability to backup and restore cases
4	Video and Photo Management	The system shall be able to manage video flow from IP cameras as RTSP streams
		The system shall be able to record live video flows or to rely on external video flow recording (e.g. in a DVR), to offer the same functionality on past live video than on recorded videos
		The system shall be able to manage videos up to 4K resolution, with no limitation in length or frame rate
		The system shall be able to ingest and manage any photo in JPEG or PNG format, of any size
5	Data Management	The system shall be able to manage context metadata on video and images (geographical location, image acquisition conditions, time stamp).
		The system shall allow edit, detect, and extract content metadata from videos and photos
		The System should allow Navigation of videos based on timestamp
		The system shall be able to detect and extract content metadata from the live and recorded video and photos of a certain case: for person's face, body and vehicle's license plate
		System's users shall be able to control which metadata is extracted from the videos and photos of a case, individually at the video or photo level

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Sl. No.	Parameters	Minimum Specifications
		<p>With face metadata, the system shall be able to detect and record a best image of the face, the gender and age range of the corresponding person, and generate a feature vector making it possible to use face for biometric comparison</p> <p>With person body metadata, the system shall be able to detect and record a best image of the person, the color of the upper body and lower body of the person</p> <p>With license plate meta data, the system shall be able to detect and record a best image of the license plate, and the OCR corresponding to this license plate</p> <p>User friendly interface for browsing videos and photos such as filtering, album view and support adding descriptive text and sharing</p> <p>Meta data shall provide filtering like face, body, license plate, age, gender, upper body, lower body, colour, moving object etc.</p> <p>The system shall provide functions for colour marking in images included in reports and blurring out areas for privacy reasons</p> <p>The system shall provide operator with fast viewing tools on video: video display at variable speeds</p> <p>The system shall provide operators with most efficient abstract of individual videos: concatenation of sequence which are likely to be where wrong doing or suspect activity can be seen, restricted area of the video., face, people seen by their body, either in the full video or on a restricted area of the video, license plates</p> <p>The system shall display where specific types of detection have been found, as heat maps at any time or at a selected timeframe</p> <p>The system shall make it easy for operators to determine if multiple different people have been together / are related</p>
6	Alerts	<p>The system shall be able to search by face, in real time, in live video flows, people recorded in watch list and raise alerts when someone recorded in a watch list has been seen. Alerts review shall be available to operators</p> <p>The system shall offer parameters to select which faces detected in real time will be matched against the watch lists, in order to minimize false alerts</p> <p>The system shall include an advanced alert presentation user interface, both for watch list alerts and tracking alerts, by which the operator shall be able to see where the alert happened (on a map), the context of the alert, the person causing the alert and the person recorded in a watch list or tracked.</p>

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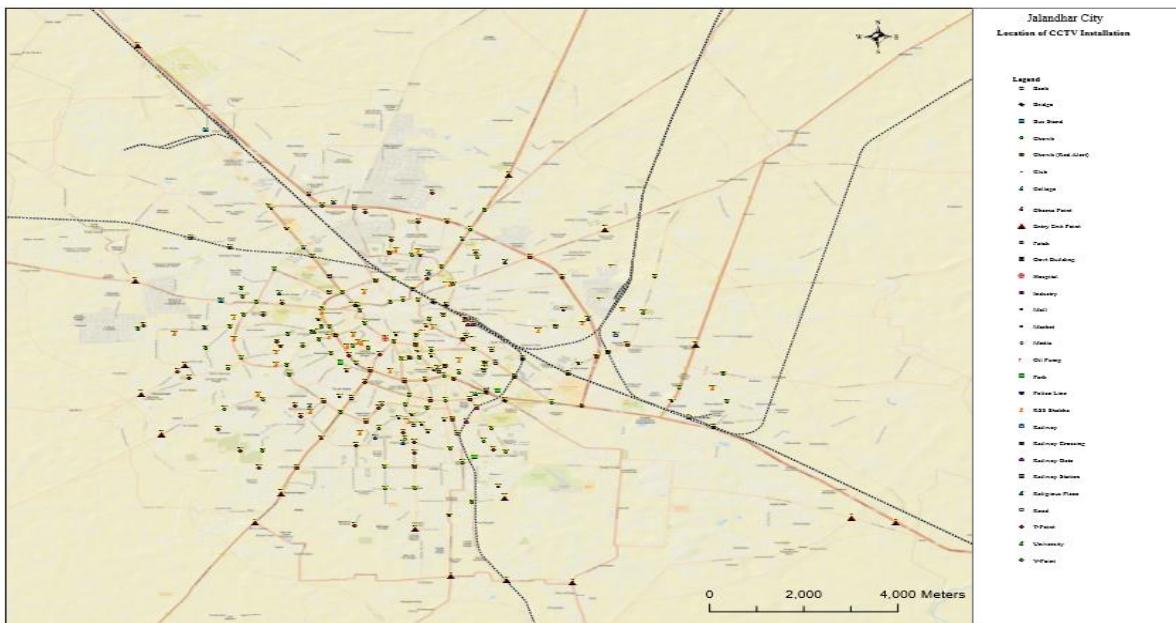
Sl. No.	Parameters	Minimum Specifications
		<p>The system shall include a personalizable alert presentation user interface, where it is possible depending on operator right to select which kind of alerts are received and to tune the threshold used for the generation of alerts, at the camera and watch list levels.</p> <p>The system shall be capable of sending out the alerts as notifications, so that external systems and users could also see the alerts</p> <p>The system shall include a query capability to search detections within the whole case by textual description</p>
7	Search	<p>The query results shall be easily displayed as a list of suitable respondents</p> <p>The query results shall be easily displayed as a map showing where the suitable respondents were seen</p> <p>The system shall display the path of respondents on a map</p> <p>The system shall make it easy for operator to visualize detect objects trajectories</p> <p>The query results shall be easily displayed as a graph where suitable respondent will be linked to each other if they appear on the same video or photo (i.e. together) in a configurable time interval</p>
8	Watch list Management	<p>The system shall come with watch lists management capabilities, where watch list will contain person data represented by face</p> <p>The system shall be able to attach watch lists to cases, so that upon detection of a face in a case, the face would be compared to all the watch lists attached to the case, and the corresponding comparison results could be shown to operators</p> <p>The system shall automatically associate a face detection to a watch list element when the comparison yields a score that is high enough</p> <p>A watch list search review interface should be proposed to operators, so that they could easily determine who in the available watch lists was seen in the videos and photos of a certain case</p> <p>Watch list management shall include deduplication of watch list content, so that it could be known if a given person already belongs to a watch list</p> <p>Watch list management shall include the ability to add a face detected in a case into a give watch list in one click</p> <p>The system shall be able to import face images in its watch lists by batch</p>
9	Security	<p>The system shall manage access control of operators</p> <p>The system shall manage security (access restriction) on watch lists</p> <p>The system shall manage security (access restriction) on cases</p> <p>The system shall manage security (ability to use) on available functions</p> <p>The system shall manage users preferences (please specify what is managed)</p>

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Sl. No.	Parameters	Minimum Specifications
10	Reports	The system shall include the ability to produce reports easily usable for investigators and in court
		The system shall come with a set of management reports
		The system shall come with dashboards showing the activity of the system

### 7.4.4. Geographic Locations for Installation of CCTV

The 154 locations identified by Jalandhar Police for installation of CCTV City Surveillance system are mapped as below



Sr	Location	Long_DMS	Lat_DMS	Long_DD	Lat_DD
1	Issa Nagar	75° 32' 24.454" E	31° 22' 46.455" N	75.54012601	31.37957081
2	Verka Milk Plant	75° 33' 35.532" E	31° 21' 47.952" N	75.55987	31.36332
3	Sanjay Gandhi Nehar Pulli	75° 34' 6.728" E	31° 21' 36.313" N	75.56853569	31.36008708
4	Hardev Nagar	75° 33' 17.028" E	31° 20' 9.636" N	75.55473	31.33601
5	Gaji Gulla Chowk	75° 34' 21.288" E	31° 20' 29.400" N	75.57258	31.3415

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Sr	Location	Long_DMS	Lat_DMS	Long_DD	Lat_DD
6	Y-Point Bhagat Singh Colony	75° 33' 44.646" E	31° 21' 38.076" N	75.56240175	31.36057679
7	Sehnai Palace Chowk	75° 33' 50.718" E	31° 19' 23.379" N	75.56408821	31.32316082
8	Sabji Mandi Chowk	75° 34' 10.373" E	31° 20' 2.512" N	75.56954799	31.33403119
9	Gulab Devi Road	75° 33' 49.328" E	31° 20' 18.620" N	75.56370218	31.33850557
10	OBC Kapurthla Chowk	75° 33' 44.413" E	31° 20' 0.891" N	75.56233696	31.3335809
11	Shakti Nagar Park	75° 34' 6.120" E	31° 19' 41.012" N	75.56836657	31.32805881
12	Adarsh Nagar Near Gita Mandir	75° 33' 49.376" E	31° 19' 38.486" N	75.56371562	31.32735714
13	ShaheedUdam Singh Nagar	75° 34' 11.720" E	31° 19' 33.126" N	75.56992225	31.32586844
14	Shetla Mata Mandir Chowk	75° 34' 31.889" E	31° 20' 10.500" N	75.57552462	31.3362499
15	Doaba Chowk	75° 35' 6.994" E	31° 20' 40.771" N	75.58527624	31.34465874
16	Bhaghat Singh Chowk	75° 34' 58.263" E	31° 19' 54.208" N	75.58285087	31.33172455
17	Damoria Pull under Bridge	75° 34' 8.569" E	31° 20' 6.993" N	75.56904704	31.33527589
18	Damoria Pull over Bridge	75° 35' 9.863" E	31° 20' 7.308" N	75.58607309	31.33536344
19	Adda Tanda Road Phatak	75° 34' 46.891" E	31° 20' 21.967" N	75.57969196	31.33943537
20	Adda Hoshiarpur Chowk	75° 34' 51.300" E	31° 20' 11.305" N	75.58091678	31.33647353
21	Phagwara Gate Market	75° 34' 56.263" E	31° 19' 48.808" N	75.58229531	31.33022455
22	Park Corporation Office	75° 34' 50.563" E	31° 19' 42.308" N	75.58071198	31.32841899
23	Milap Chowk	75° 34' 49.020" E	31° 19' 40.200" N	75.58028333	31.32783333
24	Sikka Chowk	75° 34' 16.320" E	31° 19' 28.200" N	75.5712	31.3245
25	Circuit House	75° 34' 44.760" E	31° 19' 19.380" N	75.5791	31.32205
26	TV Center	75° 34' 7.980" E	31° 19' 14.340" N	75.56888333	31.32065

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Sr	Location	Long_DMS	Lat_DMS	Long_DD	Lat_DD
27	Civil Hospital Jalandhar	75° 34' 28.164" E	31° 19' 37.214" N	75.57448993	31.32700389
28	Desh Bhagat Yadgar Hall Near BMC Chowk	75° 34' 1.440" E	31° 19' 7.860" N	75.56706667	31.31885
29	Ali Baba Mobile Center Turn towards SUS Nagar	75° 34' 24.306" E	31° 19' 22.746" N	75.57341845	31.32298503
30	SBI Main Branch Civil Line Jal	75° 34' 44.640" E	31° 19' 20.340" N	75.57906667	31.32231667
31	Park Near Loins Club Lajpat Nagar Jal	75° 34' 31.440" E	31° 19' 7.320" N	75.5754	31.3187
32	Shakti Nagar Park	75° 34' 1.920" E	31° 19' 30.180" N	75.5672	31.32505
33	Rock Garden	75° 34' 9.540" E	31° 19' 33.960" N	75.56931667	31.3261
34	Gujral Nagar Market	75° 34' 59.820" E	31° 19' 21.540" N	75.58328333	31.32265
35	Gakhal Puli (City Ceiling)	75° 31' 40.192" E	31° 18' 46.651" N	75.52783104	31.31295851
36	Kot Sadiq Nehar Puli Kala Sangia Road	75° 31' 54.083" E	31° 18' 9.785" N	75.53168981	31.30271797
37	Babrik Chowk	75° 33' 20.295" E	31° 19' 12.982" N	75.5556374	31.32027283
38	Kari Chowk Basti Danishmanda	75° 32' 39.966" E	31° 19' 10.076" N	75.54443509	31.3194656
39	Adda Basti Shiekh	75° 33' 22.155" E	31° 19' 4.076" N	75.55615417	31.31779894
40	Peer Chowk Jhandiya Wala	75° 33' 42.460" E	31° 19' 36.234" N	75.56179453	31.32673178
41	Y-Point Evening College Basti Nau	75° 33' 31.283" E	31° 19' 30.725" N	75.55868981	31.3252013
42	T-Point St Soldier College Basti Danishmanda	75° 32' 13.078" E	31° 19' 1.299" N	75.53696609	31.31702748
43	Guru Nanak Colony Wala Chowk	75° 32' 37.489" E	31° 18' 33.208" N	75.54374696	31.3092244
44	Ghas Mandi Chowk	75° 33' 3.986" E	31° 18' 41.326" N	75.55110726	31.31147951
45	Dusehra Ground Kala Sanghia Road	75° 33' 0.572" E	31° 18' 46.340" N	75.55015899	31.31287214

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Sr	Location	Long_DMS	Lat_DMS	Long_DD	Lat_DD
46	Nahal Pulli	75° 32' 10.237" E	31° 19' 12.655" N	75.53617695	31.32018192
47	Geeta Colony	75° 32' 32.987" E	31° 18' 14.748" N	75.5424965	31.30409654
48	T-Point Near Entry/Exit BMC Flyover Opposite HDFC Bank near Narinder cinema	75° 35' 15.000" E	31° 19' 0.000" N	75.5875	31.31666667
49	T-Point Link Road Near Khalsa School	75° 34' 14.000" E	31° 18' 58.000" N	75.57055556	31.31611111
50	Chowk Gol Market	75° 34' 41.514" E	31° 18' 5.951" N	75.57819832	31.30165301
51	T-Point Near No-Exit Model Town	75° 34' 40.308" E	31° 18' 11.694" N	75.57786344	31.30324829
52	Diaryan Chowk	75° 34' 23.685" E	31° 18' 15.617" N	75.57324591	31.30433799
53	Liberty Chowk	75° 35' 14.223" E	31° 18' 23.822" N	75.58728409	31.30661732
54	Chowk near KFC Model Town	75° 34' 37.385" E	31° 18' 25.007" N	75.57705152	31.30694625
55	HDFC Currency Chest Cool Road	75° 35' 17.385" E	31° 18' 10.949" N	75.58816263	31.30304128
56	Shivani Sharma Park Model Town market	75° 34' 44.334" E	31° 18' 21.773" N	75.57898169	31.3060481
57	Mata Gujri Park GTB Nagar	75° 34' 10.651" E	31° 18' 11.234" N	75.56962528	31.30312042
58	Mata Rani Chowk Model Town	75° 34' 57.475" E	31° 18' 12.234" N	75.58263195	31.30339843
59	Abadpura T-Point Mall Road	75° 34' 25.332" E	31° 18' 37.177" N	75.57370342	31.31032703
60	Taramount Hotel	75° 34' 23.371" E	31° 18' 34.248" N	75.57315852	31.30951325
61	T-Point Gill Farm Mithapur	75° 34' 6.787" E	31° 16' 46.976" N	75.56855183	31.27971548
62	Mithapur Chowk Near School	75° 34' 48.452" E	31° 16' 43.702" N	75.58012549	31.27880623
63	Chowk Subhana Near Ganda Nala	75° 35' 27.460" E	31° 17' 8.428" N	75.59096111	31.28567453
64	Under Brigde Defence Colony	75° 35' 50.106" E	31° 18' 40.477" N	75.59725168	31.31124355
65	Railway Phatak near Cambridge School	75° 35' 23.499" E	31° 18' 21.673" N	75.58986075	31.30602017

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Sr	Location	Long_DMS	Lat_DMS	Long_DD	Lat_DD
66	Railway Phatak Defence Colony	75° 35' 30.612" E	31° 18' 34.336" N	75.59183675	31.30953786
67	Dayanand Chowk Garha	75° 35' 50.965" E	31° 17' 53.775" N	75.59749038	31.29827095
68	Choti Baradari Chowk	75° 35' 41.099" E	31° 18' 15.210" N	75.59474986	31.30422493
69	T-Point PPR Market	75° 34' 48.053" E	31° 17' 53.473" N	75.5800148	31.29818705
70	Sangha Chowk	75° 34' 27.642" E	31° 17' 40.173" N	75.57434513	31.29449242
71	Cheema Chowk	75° 34' 48.156" E	31° 17' 40.199" N	75.58004344	31.29449977
72	Kukki Dhab Chowk	75° 34' 27.899" E	31° 17' 20.328" N	75.57441651	31.28897993
73	Inter State Bus Stand Jalndhar	75° 35' 29.959" E	31° 18' 46.405" N	75.59165539	31.31289023
74	Chopati Market	75° 35' 45.726" E	31° 17' 22.434" N	75.59603507	31.2895649
75	Baba Sweetshop Phase-I	75° 35' 42.386" E	31° 17' 56.102" N	75.59510711	31.29891718
76	Sweety Park	75° 35' 29.315" E	31° 17' 49.043" N	75.59147631	31.29695634
77	Golden Avenue Chowk	75° 35' 35.649" E	31° 18' 4.063" N	75.59323579	31.30112874
78	Andh Vidayala Phase-II	75° 35' 12.702" E	31° 17' 57.004" N	75.58686172	31.29916786
79	Subhana Chowk Cantt Road	75° 35' 49.982" E	31° 17' 12.238" N	75.59721714	31.2867328
80	Gulshan Hotel	75° 35' 36.420" E	31° 21' 34.148" N	75.59345009	31.35948554
81	Hoshiarpur Road Near Gulmarg City Mor	75° 36' 58.927" E	31° 21' 16.387" N	75.61636857	31.35455187
82	Kali Mata Mandir T-point	75° 34' 32.182" E	31° 21' 6.814" N	75.57560605	31.35189274
83	Transport Nagar T-Point Near Police station	75° 35' 0.240" E	31° 21' 49.644" N	75.5834	31.36379
84	Sanjay Gandhi Nagar T-Point Nehalpuli	75° 34' 14.196" E	31° 21' 32.328" N	75.57061	31.35898
85	Guja Peer Chownk	75° 34' 50.664" E	31° 21' 23.004" N	75.58074	31.35639

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Sr	Location	Long_DMS	Lat_DMS	Long_DD	Lat_DD
86	Dargah Peer Baba Nimboo Shah ji	75° 35' 50.352" E	31° 20' 46.968" N	75.59732	31.34638
87	Aman Nagar Road near GP Tower T-Point	75° 35' 10.619" E	31° 21' 23.533" N	75.58628292	31.35653692
88	Aman Nagar Morh Near KMV college	75° 35' 21.156" E	31° 21' 7.560" N	75.58921	31.3521
89	T-Point Angoora Dia Bela Santokhpura	75° 35' 30.228" E	31° 20' 55.248" N	75.59173	31.34868
90	Nimbuawali Gali	75° 35' 31.308" E	31° 20' 50.640" N	75.59203	31.3474
91	Sodal Chowk	75° 34' 30.864" E	31° 20' 54.852" N	75.57524	31.34857
92	Devi Talab Mandir	75° 34' 57.901" E	31° 20' 36.995" N	75.58275026	31.34360964
93	Thapra Bagichi	75° 34' 35.220" E	31° 20' 57.516" N	75.57645	31.34931
94	KalishNagar Near Mandir	75° 34' 50.484" E	31° 20' 56.832" N	75.58069	31.34912
95	Court Road Chowk	75° 35' 18.780" E	31° 19' 6.180" N	75.58855	31.31838333
96	Madan Flour Mill Chowk	75° 35' 21.360" E	31° 19' 36.000" N	75.58926667	31.32666667
97	Kamal Palace Chowk	75° 35' 9.060" E	31° 19' 11.760" N	75.58585	31.31993333
98	Alaska Chowk	75° 35' 28.800" E	31° 19' 27.540" N	75.59133333	31.32431667
99	Railway Crossing Guru Nanak Pura West	75° 36' 33.600" E	31° 19' 5.340" N	75.60933333	31.31815
100	Railway Crossing Sant Nagar Fatak	75° 36' 2.460" E	31° 19' 19.140" N	75.60068333	31.32198333
101	Railway Crossing Ladowali Road	75° 35' 56.940" E	31° 19' 2.640" N	75.59915	31.3174
102	Front of Police Line	75° 35' 37.440" E	31° 18' 51.180" N	75.59373333	31.31421667
103	Puda Ground opp DC Office	75° 35' 36.385" E	31° 19' 10.911" N	75.59344041	31.31969752
104	Bank of Badodha Railway Road Currency Chest	75° 35' 23.580" E	31° 19' 39.240" N	75.58988333	31.32756667

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Sr	Location	Long_DMS	Lat_DMS	Long_DD	Lat_DD
105	SBI Shastari Market Currency Chest	75° 35' 41.160" E	31° 19' 26.460" N	75.59476667	31.32401667
106	SBI Mandi Fanttan Ganjh Railway Road Currency Chest	75° 35' 23.396" E	31° 19' 38.805" N	75.58983215	31.3274459
107	Neta Ji Park Master Tara Singh Nagar	75° 35' 18.720" E	31° 19' 17.220" N	75.58853333	31.32145
108	Rly Stn Gate No 1	75° 35' 28.300" E	31° 19' 50.200" N	75.59119444	31.33061111
109	Rly Stn Gate No 2	75° 35' 24.800" E	31° 19' 50.200" N	75.59022222	31.33061111
110	Rly Stn Gate No 3	75° 35' 23.000" E	31° 19' 54.600" N	75.58972222	31.33183333
111	Nangal Shama Chowk	75° 38' 1.320" E	31° 19' 31.140" N	75.6337	31.32531667
112	Suchi Pind Pulli	75° 37' 33.420" E	31° 20' 33.000" N	75.62595	31.3425
113	Dhillwan Chowk	75° 37' 56.131" E	31° 19' 12.557" N	75.63225849	31.32015475
114	Batha Road	75° 36' 25.020" E	31° 19' 47.760" N	75.60695	31.32993333
115	Dakoha Railway Choke Point	75° 38' 13.740" E	31° 18' 16.380" N	75.63715	31.30455
116	Chugitti Railway Choke Point	75° 37' 1.080" E	31° 19' 24.300" N	75.61696667	31.32341667
117	Partap Palace Chowk	75° 37' 14.460" E	31° 19' 31.260" N	75.62068333	31.32535
118	Under Brij Chugitti	75° 36' 53.340" E	31° 19' 20.340" N	75.61481667	31.32231667
119	Guru Nanak Dev University Campus Ladowali Road	75° 37' 25.320" E	31° 20' 1.080" N	75.6237	31.33363333
120	Rama Mandi Main Market	75° 37' 45.060" E	31° 18' 39.840" N	75.62918333	31.31106667
121	Guru Nanak Pura Main Market	75° 36' 41.040" E	31° 19' 13.920" N	75.6114	31.32053333
122	Sainik Vihar	75° 38' 13.020" E	31° 18' 52.200" N	75.63695	31.3145
123	Kamal Vihar	75° 36' 13.020" E	31° 19' 44.340" N	75.60361667	31.32898333

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Sr	Location	Long_DMS	Lat_DMS	Long_DD	Lat_DD
124	Wadala Chowk	75° 33' 27.213" E	31° 17' 39.582" N	75.55755923	31.29432846
125	Rejant Park Avtar Nagar	75° 33' 57.000" E	31° 19' 14.940" N	75.56583333	31.32081667
126	Sethi Battery T-Point Model House	75° 33' 25.980" E	31° 18' 35.880" N	75.55721667	31.30996667
127	Udey Nagar Chowk	75° 33' 3.617" E	31° 17' 55.200" N	75.55100477	31.29866677
128	Chara Mandi Butta Mandi	75° 33' 44.022" E	31° 18' 7.064" N	75.56222846	31.30196235
129	Mata Rani Chowk	75° 33' 45.626" E	31° 18' 39.834" N	75.56267388	31.31106494
130	Park near Gurdwara Singh Saba Model House Road	75° 33' 36.497" E	31° 18' 30.921" N	75.56013813	31.30858927
131	Wadala Road Phase-II	75° 33' 1.130" E	31° 17' 39.431" N	75.55031395	31.29428632
132	T-Point Nakhawala Bagh	75° 32' 48.324" E	31° 17' 54.932" N	75.54675665	31.29859215
133	Waryana Morh	75° 31' 36.112" E	31° 20' 29.091" N	75.5266977	31.34141425
134	T-Point Leather Complex	75° 31' 41.685" E	31° 19' 49.411" N	75.52824591	31.33039199
135	T-Point Shashtri Nagar	75° 33' 13.471" E	31° 19' 33.957" N	75.55374198	31.32609921
136	T-Point Mithu Basti(Near Patwar Khana)	75° 33' 4.000" E	31° 19' 59.000" N	75.55111111	31.33305556
137	Pull Nehar KPT Road	75° 32' 59.463" E	31° 20' 9.893" N	75.54985071	31.33608132
138	Pull Nehar S.B.L.S Nagar	75° 33' 11.739" E	31° 20' 39.838" N	75.55326077	31.34439955
139	Jagiwan Ram chowk	75° 32' 49.000" E	31° 19' 19.000" N	75.54694444	31.32194444
140	Sher Singh Pull Nehar	75° 32' 24.684" E	31° 19' 28.398" N	75.54019011	31.32455502
141	Basti Peer Dad Chowk(Lakkar Wala Pull)	75° 32' 41.336" E	31° 19' 47.692" N	75.54481564	31.32991434
142	Leather Complex Chowk( Ganda Nala)	75° 31' 38.000" E	31° 19' 46.000" N	75.52722222	31.32944444

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Sr	Location	Long_DMS	Lat_DMS	Long_DD	Lat_DD
143	Raj Nagar Morh Near Wine Shop	75° 32' 50.000" E	31° 20' 15.000" N	75.54722222	31.3375
144	Baba Budha Ji Pull	75° 32' 50.746" E	31° 19' 58.575" N	75.54742938	31.33293763
145	Adda Basti Bawa Khel	75° 32' 35.034" E	31° 20' 11.548" N	75.54306507	31.33654117
146	Sports Market Y- Point	75° 33' 16.180" E	31° 19' 29.670" N	75.55449451	31.32490834
147	Tarveni Park Dilbagh nagar	75° 32' 44.000" E	31° 19' 37.000" N	75.54555555	31.32694444
148	Rohni Colony Basti Peer Dad	75° 32' 3.000" E	31° 19' 42.000" N	75.53416667	31.32833333
149	Khambra Gate	75° 32' 58.416" E	31° 16' 49.764" N	75.54956	31.28049
150	Pholriwal Gate	75° 35' 13.020" E	31° 16' 0.732" N	75.58695	31.26687
151	Rly. Phatak Pholriwal	75° 35' 51.432" E	31° 15' 56.988" N	75.59762	31.26583
152	Y Point Dhina	75° 36' 36.576" E	31° 15' 55.296" N	75.61016	31.26536
153	Pragpur Chungi	75° 40' 18.919" E	31° 16' 49.481" N	75.67192184	31.2804115
154	Railway Station Jalandhar Cantt.	75° 37' 56.620" E	31° 18' 25.276" N	75.63239442	31.3070211

### 7.4.5. Technical Specifications:

#### High Definition Fixed Box Camera

Sl. No.	Parameter	Minimum Specifications
1	Image Sensor	1/2.8" progressive scan RGB CMOS
2	Operating Frequency	50 Hz
3	Day/ Night Operation	Yes with IR Cut Filter
4	Minimum Illumination	Colour: 0.2 Lux @ 30 IRE B/W": 0.01 @ 30 IRE 0 Lux with Built in or External IR, IR Range 50 Meters
5	Low light Capability	The camera shall be able to provide usable Color video in low light conditions
6	Lens	8-50 mm IR corrected, CS-mount lens, P-Iris
7	Electronic Shutter	1/30000 s to 2 s or better

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8	Image Resolution	1920 x 1080, 1280 x 720, 800 x 450, 480 x 270, 320 x 240
9	Compression	H.265 in High and Base profile, MPEG4, MJPEG
10	Frame Rate and Bit Rate	25 FPS at all resolutions with Controllable Bit Rate/ Bandwidth and Frame Rate
11	Video Streams	The camera shall be able to setup and stream out minimum three (3) stream profiles. Each stream profile can have its own compression, resolution, frame rate and quality independently
12	Motion Detection	Yes built in with multiple configurable areas in the video stream
13	Pan Tilt Zoom	Digital PTZ
14	Frame Rate and Bit Rate	Up to 50 fps at all resolutions
15	Electronic Exposure & Control	Automatic/ Manual
16	Wide Dynamic Range	120 dB or better
17	Backlight Compensation	Required
18	Privacy Masks	Minimum 20 configurable 3D zones
19	Connectors	1 Input & 1 Output for Alarm Interface
20	Event Triggers	Intelligent video, Edge Storage event, External Input, Audio Level, Motion Detection, Day/Night Mode, Network, Time scheduled, 3rd Party Analytics, Manual Trigger, Alarm Input Trigger
21	Event Actions	File upload: FTP, HTTP, network share and email Notification: email, HTTP and TCP PTZ function, Edge Storage/ Storage, Pre & Post Alarm Recording, Actions configurable by web interface, External Output activation
22	Edge Storage	Built in SD card slot with support up to 128 GB with Class 10 speed
23	Built in installation aids	Focus assistant, Pixel counter, Remote back focus
24	Storage	The Cameras shall have the feature to directly record the videos/ images onto NAS/SAN without any Software or integration
25	Protocols	IPv4/v6, HTTP , HTTPS b, SSL/TLS b, QoS Layer 3 DiffServ, FTP , CIFS/SMB, SMTP, Bonjour, UPnP™,SNMPv1/v2c/v3 (MIB - II), DNS, DynDNS, NTP, RTSP, RTP,TCP, UDP,IGMP,RTCP,ICMP, DHCP,ARP, SOCKS
26	Text Overlay	Date & time, and a customer-specific text, camera name, graphical image etc.

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27	Security	Password protection, IP address filtering, HTTPS encryption, IEEE 802.1Xa network access control, Digest authentication, User access log
28	Firmware Upgrade	The firmware upgrade shall be done through web interface, The firmware shall be available free of cost
29	Logs	The camera shall provide minimum 200 logs of latest connections, access attempts, users connected, changes in the cameras etc.
30	Interface	RJ 45, 100 Base TX
31	Enclosure	IP66-and NEMA-4X-rated casing (polyester polycarbonate blend)
32	Power requirements	Vendor to Specify
33	Operating Temperature	-10 °C to 60 °C
34	Operating Humidity	Humidity 10–95% RH (condensing)
35	Certification	UL, CE, FCC, IEC
36	Application Programmers Interface	The interface shall be available for integration with 3rd party analytics and applications in public domain free of cost
37	Housing, Mount and IR	Shall be of the same make of OEM or better
38	Onvif	S Required
39	Warranty	Min 3 Years OEM Warranty

### High Definition PTZ Dome Camera

Sl. No.	Parameter	Minimum Specifications
1	Image Sensor	1/3" Progressive Scan CMOS or better
2	Operating Frequency	Min 50 Hz
3	Day/ Night Operation	Automatic with IR Cut Filter
4	Minimum Illumination	Colour: 0.3 Lux @ 30 IRE B/W": 0.01 @ 30 IRE or better
5	high-speed pan-tilt functionality	360° endless pan range and a 180° tilt range
6	Optical Zoom	30x Minimum & 12x Digital Zoom or better
7	Lens	4.3-129 mm or better
8	Pan, tilt, manual and pre-set speed  The speed shall be	0.5° - 350°/s or better

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	applicable for Manual, Tour and Pre-set Mode	
9	Image Resolution	1920 x 1080 or better
10	Compression	H.265 Baseline, Main and High Profiles, Motion JPEG
11	Frame Rate and Bit Rate	25 FPS at all resolutions with Controllable Bit Rate/ Bandwidth and Frame Rate. In CBR Priority to be defined for Video quality or frame rate and the bandwidth upper limit shall not exceed the defined limit
12	GOP/ GOV	Ability to change the GOP/GOV Length to optimize the bandwidth and storage
13	Video Streams	Minimum 3 Streams
14	Motion Detection	Yes built in with multiple configurable areas in the video stream
15	Electronic Shutter	1/33000 s to 2 s or better
16	Electronic Exposure & Control	Automatic/ Manual
17	Wide Dynamic Range	120 dB or Better
18	Backlight Compensation	Required
19	Electronic Image Stabilization	Required
20	Image Freeze on PTZ	Required
21	Privacy Masks	Minimum 10 configurable 3D zones or better
22	Pre-set Positions	Minimum 256 or better
23	Image Flip	Yes Automatic
24	Guard Tour	Minimum 2 Nos
25	Built In Heater & FAN	Required
26	Temperature Control	Required
27	Alarm	Min 2 Alarm Input / Output ports or better
28	On-screen directional indicator	Required
29	Compression	<p>The camera shall for its H.265 implementation support scene adaptive bitrate control, in order to lowering bandwidth and storage requirements.</p> <p>The camera shall support automatic dynamic GOP for optimal bitrate utilisation. The camera shall support automatic dynamic ROI to reduce bitrate in un-prioritized regions.</p>

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30	Event Triggers	The camera shall be able to send and receive trigger directly from any other camera without interface of VMS. Live Stream Accessed, Motion Detection, Shock Detection, Audio Detection, Network, Temperature, Manual Trigger, Virtual Inputs, Alarm Inputs, PTZ: Error, Moving, Pre-set Reached, Ready, Storage Disruption, Storage Recording, System Ready, User schedule
31	Event Actions	File upload via FTP, SFTP, HTTP and email Notification via email, HTTP and TCP Pre- and post-alarm video buffering, External output activation, PTZ pre-set, guard tour, Video recording to edge storage, Day/night mode, Overlay text
32	Pixel Counter	Built in
33	Edge Storage	Built in SD card slot with support up to 128 GB with Class 10 speed
34	Storage	The Cameras shall have the feature to directly record the videos/images onto storage without any Software
35	Protocols	At least IP, HTTP, HTTPS, SSL/TLS, TCP, ICMP, SNMPv1/v2c/v3 (MIB-II), RTSP, RTP, UDP, IGMP, RTCP, SMTP, FTP, DHCP, UPnP, ARP, DNS, DynDNS, SOCKS, NTP, CIFS/SMB. IPv4 & IPv6 and Bonjour
36	Text Overlay	Date & time, and a customer-specific text, camera name, graphical image etc.
37	Security	Password protection, IP address filtering, HTTPS encryption, IEEE 802.1Xa network access control, Digest authentication, User access log
38	Firmware Upgrade	The firmware upgrade shall be done through web interface, The firmware shall be available free of cost
39	Logs	The camera shall provide Minimum 200 logs of latest connections, access attempts, users connected, changes in the cameras etc.
40	Interface	RJ 45, 100 Base TX
41	Enclosure	Die Cast Aluminium, IK10 rated, IP66 rated, polycarbonate clear dome and sunshield, PVC free complying to WEEE Standards
42	Mount	Wall / Pole Mount

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43	Power requirements	Power over Ethernet (POE/PoE+) IEEE 802.3at Type 2 Class 4, max. 24 W, Typical 9W; 24 V DC max. 30 W 24 V AC, max. 40 VA or better
44	Operating Temperature	-10 °C to 60 °C or better
45	Operating Humidity	10–95% RH (condensing) or better
46	Certification	UL, CE, FCC
47	Embedded Applications	The camera shall provide a platform allowing the upload of third party applications into the camera
48	Application Programmers Interface	The interface shall be available for integration with 3rd party analytics and applications in public domain free of cost
49	Onvif	S required
50	Warranty	Min 3 Years OEM warranty

### Multi Sensor 360° Panoramic View PTZ Camera

Sl. No.	Parameter	Minimum Specifications
1	General Requirements	The camera should be manufacturer's official product line designed for commercial / industrial 24x7x365 use. The camera and camera firmware should be designed and developed by same OEM.
2	General Requirements	The camera should be based upon standard components and proven technology using open and published protocols
3	Image Sensor	Minimum 4 x 3MP, 1/3.2" CMOS - (Total) 12MP or better
4	Lens Specs	F2.0, Day/night (infrared cut filter); Options of 2.8/4/8/12/16 MM wide angle Lens
5	Video Resolution	1920 X 1080 or better
6	Minimum illumination	Colour: 0.6 lux or better, Monochrome: 0.05 Lux or better with IR
7	Video Compression	H.265, Motion JPEG
8	Frame Rate	25fps or better
9	Wide Dynamic Range	100 dB or better
10	Camera Angle Adjustment	Pan: - ±90° Tilt: - 28° - 92° Rotate: - ±90°
11	Network Interface	100 Base-T ports
12	Power Supply	POE/POE+ IEE 802.3af compliant
13	Industry Standards	ONVIF Compliant

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14	Certifications	UL, FCC
15	Enclosure Type	IP66; IK 10
16	Operating Temperature	-10° C to 60° C or better
17	Operating Humidity	0 - 90%
18	Supported Network protocols	Minimum of the following RTSP, RTP/TCP, RTP/UDP, HTTP, DHCP protocols to be supported
19	Support	The system should not be an end of life / end of service product.

### Bullet Camera

Sl. No	Parameter	Minimum Specifications
1	Image Sensor	1/3" progressive scan RGB CMOS or better
2	Operating Frequency	50 Hz
3	Day/ Night Operation	Yes with IR Cut Filter
4	Minimum Illumination	Color: 0.3 Lux @ 30 IRE F1.4; 0 Lux with IR
5	Mechanical Pan Tilt Adjustment	Pan: ± 135°, Tilt: 0° – 90°
6	Lens	3 - 10 mm, IR corrected, P-Iris, Megapixel Lens with remote zoom and focus
7	Electronic Shutter	1 s to 1/25000 s or better
8	Image Resolution	1920 x 1080 or better
9	Compression	H.265 compression or equivalent with 3 Mbps or lower speed at 1920 X 1080 @ 30 FPS per stream and MJPEG
10	Frame Rate and Bit Rate	Up to 50 FPS at all resolutions with Controllable Bit Rate/ Bandwidth and Frame Rate. In CBR Priority to be defined for Video quality or frame rate and the bandwidth upper limit shall not exceed the defined limit
11	Image reproduction	The camera shall have the capability to produce Colored video images in low light conditions
12	Video Streams	The camera shall be able to setup and stream out minimum three (3) stream profiles. Each stream profile can have its own compression, resolution, frame rate and quality independently
13	Motion Detection	Yes built in with multiple configurable areas in the video stream
14	Image Configuration	The Camera shall be able to Include or Exclude any area of any size/ dimension within the scene in order to Eliminate False alarm and also optimize the bandwidth and storage
15	Pan Tilt Zoom	Digital PTZ
16	Wide Dynamic Range	120 dB or better

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17	Backlight Compensation	Required
18	IR	30 Meter (Built in or External) Optimized IR with adjustable intensity and angle
19	Alarm Connectors	1 Input & 1 Output for Alarm Interface
20	Event Triggers	Live Stream Accessed, Motion Detection, Day/Night Mode, Network, Temperature, , Camera Tampering, Edge Storage Disruption, Video Analytics, Manual Trigger
21	Event Actions	FTP, HTTP, network share, email Notification: email, PTZ function, Edge Storage/ Storage, Pre & Post Alarm Recording, Actions configurable by web interface, WDR Mode, External Output Trigger, Text Overlay
22	Edge Storage	SD Card Slot with 64GB Support Class 10 speed
23	Protocols	IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, CIFS/SMB, SMTP, Bonjour, UPnP, SNMPv1/v2c/v3 (MIB - II), DNS, DynDNS, NTP, RTSP, RTP,TCP, UDP, IGMP,RTCP,ICMP,DHCP,ARP,SOCKS, SSH
24	Text Overlay	Date & time, and a customer-specific text, camera name, graphical image etc.
25	Security	Password protection, IP address filtering, HTTPS encryption, IEEE 802.1X network access control, Digest authentication, User access log
26	Firmware Upgrade	The firmware upgrade shall be done through web interface, The firmware shall be available free of cost
27	Interface	RJ 45, 100 Base TX
28	Memory	512 MB RAM, 256 MB Flash or better
29	Enclosure	IP66 rated and NEMA-4X-rated casing Polycarbonate/Aluminium, IK 08
30	Power requirements	PE IEEE 802.3af / POE+ IEEE 902.3at compliant
31	Operating Temperature	-20 °C to 50 °C
32	Operating Humidity	Humidity 10–95% RH (condensing)
33	Certification	UL, CE, FCC, IEC,
34	Application Programmers Interface	The interface shall be available for integration with 3 <sup>rd</sup> party analytics and applications in public domain
35	Embedded Applications	The camera shall provide a platform allowing the upload of third party applications into the camera
36	Mount	Wall Mount/ Pole Mount
37	Onvif	S Required
38	Warranty	5 Years OEM warranty
39	Security	Detection of camera tampering and Detection of Motion should be possible using either camera or VMS
40	Functional	Self-cleaning / anti-dust / hydro-phobic coating features

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41	White Balance	Auto and Manual setting
42	Support	The system should not be an end of life / end of service product
43	General Requirements	The camera should be manufacturer's official product line designed for 24x7x365 use.
44	General Requirements	The camera should be based upon standard components and proven technology using open and published protocols

### Body Camera

Sl. No	Parameter	Minimum Specifications
1	Dimensions	95.9 mm x 52.2 mm x 27.6 mm (3.78" x 2.06" x 1.09") ±5%
2	Weight	100-150 Grams
3	Lens	f/2.0 , 130° wide angle
4	Connection Interface	USB 2.0
5	Storage	64 Gb or Higher
6	Wi-Fi	Yes
7	Bluetooth	Yes
8	Microphone	Yes
9	Battery Life (Fully Charged)	12 Hours or more
10	Resolution	Full HD 1080P
11	Frame Rate	30 FPS
12	Operating Temperature	-20°C (-4°F) ~ 65°C (149°F)
13	Storage Temperature	-25°C (-13°F) ~ 70°C (158°F)
14	IP Rating	IP67
15	Viewing Angel	130° (diagonal)
16	IR	Built-in
17	Required Accessories	USB cable/360° rotatable clip/Adapter/Velcro holder

### 7.5. Intelligent Traffic Management

Jalandhar, a city that has urbanized rapidly in recent years and due to usage of more cars than bikes, has witnessed enormous growth in traffic volumes, which have, resulted in several traffic problems in and around the city, such as traffic jams, increase in number of road accidents etc. Therefore, it is intended to develop an Adaptive Traffic Control System (ATCS) & Automated Traffic Counting and Classification (ATCC). ATCS, which would aim at improving the efficiency

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and effectiveness of the traffic on arterial and VIP roads in Jalandhar roads and ATCC (Automated Traffic Counting and Classification), shall be implemented at the traffic junctions, which are standalone.

To realize the benefits of ATMS & ATCC, it is pertinent to adopt an approach that includes technology based regulation, intervention, information and enforcement system to improve the mobility, discipline and safety on Jalandhar roads. Therefore, ATMS & ATCC is envisaged with multiple applications, including Adaptive Traffic Control System and Automated Traffic Counting and Classification (ATCC), Red Light Violation Detection (RLVD) systems, Automatic Number Plate Recognition (ANPR), Speed Violation Detection Systems (SVDS), Pelican Signals, Variable Message System (VaMS), eChallans, Traffic Surveillance Cameras & Pelican signals amongst others which will ensure that the intended outcomes have been accomplished.

ATMS & ATCC integrates various sub systems (such as CCTV, vehicle detection, communication, Local processing units, variable message signs etc.) in a coherent single interface that provides real time data on status of traffic and predicts traffic conditions for more efficient planning and operations. Thus, a system such as ATMS & ATCC shall aim to help police and security agencies to take proactive/ reactive measures and ensure safe & smooth environment on road. Wherever the current Jalandhar City CCTV Surveillance System cameras can be utilized for the traffic management, necessary integration is expected.

The technical solution should cater to the following challenges:

1. Traffic congestion and huge waiting time
2. No right of way to 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 Jalandhar City traffic flow

Specifically, MSI should make sure that below mentioned technical capabilities must be link with Integrated City Management Control Centre:

- a) Installation of Traffic Light Aspects with all accessories at the selected junctions.
- b) Adaptive Traffic Control System (ATCS)
- c) Automated Traffic Counting and Classification (ATCC)

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- d) Red Light Violation Detection (RLVD) system
- e) Automatic Number Plate Recognition(ANPR)
- f) Speed violation detection (SVDS)
- g) Pelican signals
- h) Emergency call box
- i) E-Challan System
- j) Traffic Surveillance
- k) Real Time Traffic Analytics Platform
- l) PAS system
- m) Variable Message Sign boards
- n) Integration with Vahan and Sarathi databases
- o) Integration with GIS Map
- p) Additional components like timer etc. shall be added as required based on the detailed study
- q) Repair of existing signals should be considered as part of BID DOCUMENT (like timer were observed)
- r) Existing functional signals for the implementation of ATCS and ATCC shall be verified and should be considered to extend the life of signal
- s) All traffic elements should be branded to showcase as smart city elements

The scope of work shall include but will not be limited to the following broad areas.

1. **Scoping and Feasibility Study:** Conduct a detailed scoping study and develop a comprehensive project plan, including:
  - Feasibility study for finalization of detailed technical architecture and project plan
  - Development of traffic management plans for individual signal controls and groups of signal controllers along with pre-planned intervention strategies for special scenarios
  - Site surveys to identify need for junction improvement, junction signage, lane markings and other necessary site infrastructure
  - Site Clearance obligations & other relevant permissions.
2. **Field Equipment:** Design, Supply, Installation and Commissioning of following field equipment envisaged in ATMS:

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- Adaptive Traffic Control System at Signalized traffic junctions
- Variable Message Signs (detailed out in subsequent section)
- Red Light Violation Detection system
- E-Challan System
- Emergency call box etc. as mentioned above

3. **Network Connectivity:** Provision of Network Connectivity for ATMS equipment/solution

- Developing necessary connectivity for ATMS
- Integrating live data streams from other traffic information systems such as real time public transport bus location data, parking information systems, etc.

4. **Hardware and Software Infrastructure:** Design, Supply, Installation and Commissioning of IT Infrastructure at JICCC and DC: This shall consist of following activities:

- Basic Site preparation services
- IT Infrastructure including server, storage, other required hardware, application portfolio and licences
- Centralized platform for traffic data analytics and signal optimization
- JICCC infrastructure including operator workstations, video walls, IP phones, joystick controller etc.
- Establishment of LAN and WAN connectivity at JICCC and DC
- Application Integration Services & SMS gateway

5. **Capacity Building:** Preparation of operational manuals, training documents and capacity building support, including:

- Preparation and implementation of the Information security policy, including policies on backup and redundancy plan
- Preparation of revised traffic signal control plans, alternate signal control plans, KPIs for performance monitoring of transport network, dashboards for MIS
- Training of the city authorities and Traffic Police personnel on operationalization of the system
- Acceptance testing
- System and configuration Documents, User Documents

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- Setting up Helpdesk Services and provide support to users at Jalandhar traffic police and other associated stakeholder locations in compliance to the defined SLAs.
6. Warranty and Annual Maintenance: provide maintenance services for the software, hardware and other IT infrastructure installed as part of ATMS project for a period of 4 years.

The surveyors shall also finalize the approximate location of foundation for junction box and camera poles. The route for all the underground cable laying shall be finalized during this survey (wherever required). Every detail, finalized during the survey, shall be demarcate on an AutoCAD drawing by the MSI and submitted to JSCL or designated agency and Jalandhar police in the form of a detailed site survey report along with other details for its approval in the specified format.

## Component Architecture

The schematic diagram below shows the systems envisaged under ATMS & ATCC and the information flow across the systems to be integrated.

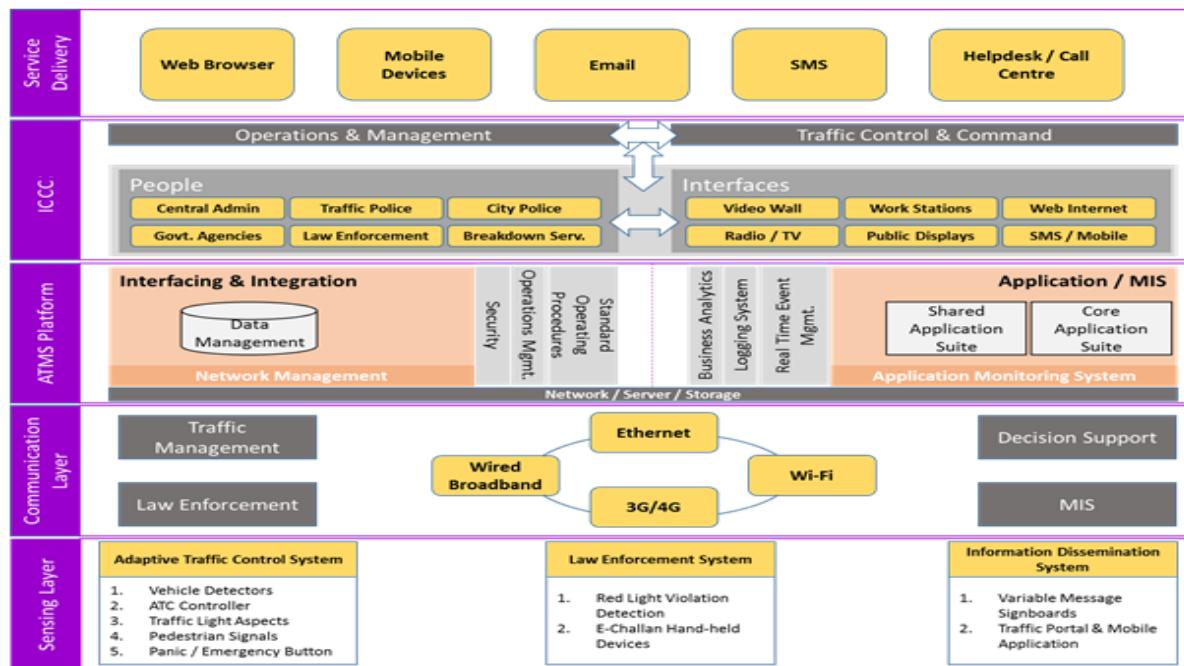


Figure: Logical Architecture of ATMS/ATCC Solution

## Solution Requirements

## Detailed Project Report for Jalandhar Integrated Smart Solutions

The MSI shall be responsible for Supply, Installation, Implementation and Operation & Maintenance of Jalandhar Surveillance System for a period of Four Years from the date of Go-Live. The indicative requirements are broadly categorized into following:

Sl. No.	Parameters	Minimum Specifications
<b>1</b>	Min Signalling System Infrastructure at field locations	<p>1. Public Announcement System (PAS), Emergency call box</p> <p>2. Supply, Install, Implement and Maintenance of IP based cameras with IR</p> <ul style="list-style-type: none"> <li>a. Fixed box Cameras</li> <li>b. PTZ Cameras</li> <li>c. RLVD</li> <li>d. ANPR</li> <li>e. SVDS</li> </ul> <p><b>Additional features for the camera :</b></p> <p>Camera to support Adaptive Traffic Control System (ATCS)</p> <p>Camera to support ANPR</p> <p>Camera to support RLVD</p> <p>Camera that support Analytics</p> <p>Sensor/optical analytics required for (ATCS and ATCC)</p> <p>Note: There is pole and traffic light aspects installation required for traffic signals and cameras as required. The cameras should be installed using appropriate fittings. Installation configuration and maintenance of poles &amp; required power, backup, network connectivity and any other additional hardware and software fittings is in the scope of MSI.</p> <p>Data Retention Period: 30 days</p> <p>The detailed location wise camera distribution will be describe in bid document</p>
<b>2</b>	Network Infrastructure	<p>1. Between camera &amp; aggregation point – Field location</p> <p>2. Between aggregation points &amp; Data center</p> <p>3. Between Data Center &amp; JICCC</p> <p>4. Between Data Center &amp; viewing/monitoring center and satellite control center</p>

## Detailed Project Report for Jalandhar Integrated Smart Solutions

		5. It is envisaged that the MSI will coordinate and take services of the existing Network Providers in Jalandhar like BSNL, Airtel, Railtel etc. However, a tri-party Agreement among JSCL, MSI & the Network Service Providers would be signed in order to meet networking requirements as defined within Service Level Agreement.
3	Data Center	<p>1. Supply &amp; installation of all the requisite ICT Infrastructure including server, storage, network components and peripherals to handle 100% load along with provisioning for redundancy</p> <p>2. Supply &amp; installation of all the requisite Non IT infrastructure like furniture, AC, and interior work etc. excluding the civil work at the space, which will be provided by JSCL</p>
4	Integrated Command Control Center	1. Supply & installation of all the IT & Non IT infrastructure such as the Video Wall, Workstation, AC, and interior work, etc. excluding civil work at the space provided by JSCL
5	Applications at JICCC	<p>1. Video Management System (VMS)</p> <p>2. Video Analytics (VA)</p> <p>3. Red Light Violation Detection (RLVD) System</p> <p>4. Automatic Number Plate Recognition (ANPR) System</p> <p>5. Integration with RTO applications like Vahan / Parivahan to extract details like Owner Name, Address, Age, Engine Number, Chassis Number, vehicle Registration Date,, vehicle Registration City, Type, Model, City ,State</p> <p>6. Analyse and implement User specific requirement implementation</p> <p>7. ATCS, ATCC Implementation</p>
6	Capacity Building	MSI is to provide all Technical & Functional training/capacity building/handholding for the designated officials/staff/personnel on a continuous basis

### **7.5.1. Key Performance Indicators**

The KPIs for the project are as follows:

- a. **Improve Journey Time Reliability:** Improve reliability in journey times between various locations, so that citizens can experience an enhanced quality of road based transportation, through improving sustainability and efficiency in operation of the road network
- b. **Increased Traffic Signal Efficiency:** Reduction in traffic delays, optimized cycle times at intersection to regulate and maintain free flow of traffic to enhance the efficiency of the transport infrastructure.
- c. **Increase Operational Efficiency:** Jalandhar Traffic Police intends to spend more time on the public facing functions. Thus, Information technology solutions should help in reducing the repetitive paperwork/records and making the back-office functions more efficient.
- d. **Improve Customer Services:** The traffic services to the public can be improve through the user-friendly presentation of the various traffic information in real time through sharing of all relevant data feeds for public consumption.
- e. **Safety Improvement:** The real time traffic monitoring and intelligent traffic systems can prevent accidents by recognizing and thus responding to the potentially dangerous situation in advance. It shall also provide safety for pedestrians.
- f. **Higher Productivity:** Achieving improvement in the productivity, logistics and other economic activities by obtaining the precise-real time information on transport due to the availability of data on traffic flow in key areas of the city.
- g. **Real Time Information, Event Tracking & Response, and Fast Access to Stored Information:** The real time information at the JICCC shall enable the operator to take necessary actions based on the type of information. Sending an emergency vehicle to the spot, arranging alternate route to VIP convoys, diverting the traffic to different routes are some of the actions that can be taken based on the Real Time Information. It shall be possible to track a particular event using the cameras installed at the traffic junction. A vehicle, violating the traffic could be tracked and penalized at the next traffic junction based on the number plate.
- h. **Creating awareness for public:** Through sign boards, awareness on road traffic rules and safe driving precautions shall be imparted to road users.

## Detailed Project Report for Jalandhar Integrated Smart Solutions

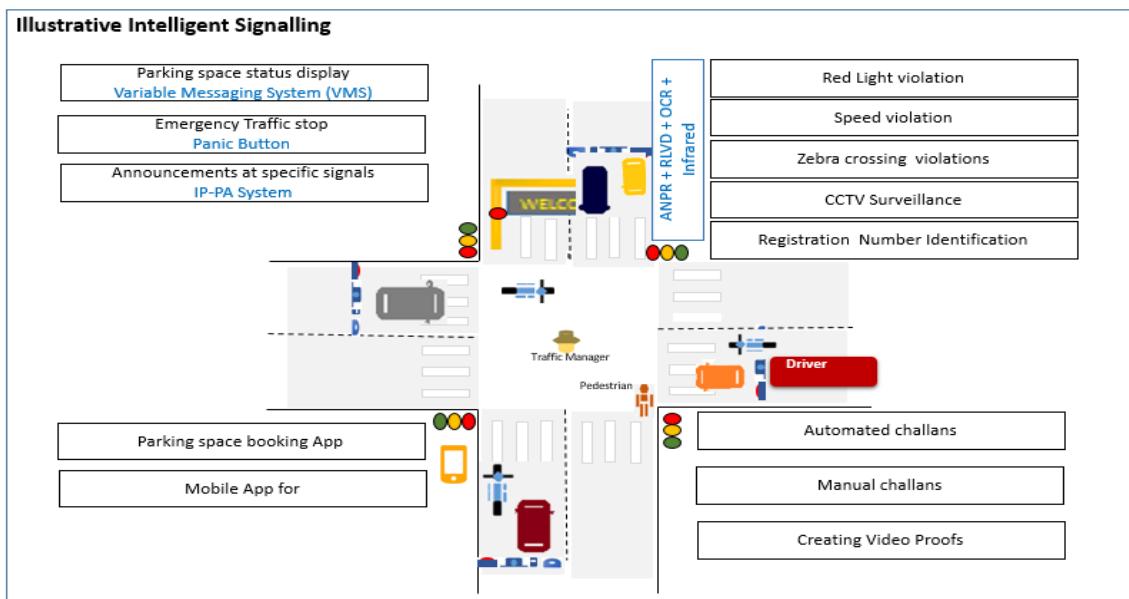
- i. **Enforcement:** Effective enforcement of traffic violation, checking and monitoring shall reduce the traffic related offences of Red Light violations
- j. **Create a platform for sharing traffic information across the city:** There is a critical need to create a platform for sharing traffic related information among traffic police and citizens in order to increase the effectiveness of Adaptive Traffic Control System.
- k. **Planning & Operations:** Intelligent Signal planning & operational aspects shall be handled at command center using City Operations Platform/IoT Platform (COP).
- l. **Integration:** Intelligent Signalling aspects shall be enabled by integration with City Operations Platform and GIS Maps.

### 7.5.2. Components of Intelligent Signalling

- 1. Adaptive Traffic Control System (ATCS) – Video based Vehicle detection (integrated signals forming a green tunnel), Signal controller, Traffic light aspects, poles, power supply provisioning and related accessories and associated civil work including cabling for successful operation of the system
- 2. Automated Traffic Counting and Classification (ATCC) – Video based Vehicle detection (Independent signal control), Signal controller, Traffic light aspects, poles, power supply provisioning and related accessories and associated civil work including cabling for successful operation of the system
- 3. Red Light Violation Detection (RLVD) System along with related accessories and required mounting infrastructure including civil work for successful operation of the system
- 4. Automatic Number Plate Recognition (ANPR) system along with related accessories and required mounting infrastructure including civil work for successful operation.
- 5. Speed violation detection system with automated e-challan
- 6. Pelican Signals
- 7. Traffic Surveillance Cameras along with related accessories and required mounting infrastructure including civil work for successful operation of the system
- 8. Public Address Systems for dissemination of critical information.
- 9. Emergency call box for use of citizens to notify JICCC / public authorities regarding emergent situations.
- 10. Video Management Server & Video Analytics server
- 11. E-Challans Systems

## Detailed Project Report for Jalandhar Integrated Smart Solutions

12. Variable Messaging Sign Boards
13. Establish Network Connectivity to transfer the data from field devices to the Data Center / DR and Integrated Command Control Center (JICCC)
14. Set up Traffic Operations at JICCC with required software platform capability to aggregate incoming data streams onto a single platform, provide traffic flow estimates for near term future on a real time basis and assist in analysing impact of alternate traffic management strategies.
15. IT infrastructure including hardware and software at JICCC and Local DC for the management of the edge devices signals, command centre and the traffic management software platform
16. 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.
17. Develop a consolidated database of incoming real time data for future analysis and evaluation purposes. It is envisaged that the proposed adaptive traffic control system will incorporate historic trends for development of traffic management strategies and adaptive control strategies.



*Figure: Illustrative diagram of ATMS/ATCC Solution*

### 7.5.3. Existing Junctions

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Traffic Police has over the last few years, put in a number of traffic signals to help commuters navigate traffic with ease. Traffic Police has already put around 26 Traffic Signal systems at important road intersections across city. Out of which 6 signals are non-functional which all be considered for upgradation. The detailed list of 26 existing and proposed signals is provided as below:

Sr. No.	Name of the Junction	No of Legs	Traffic Signal Functional
1	T-Point PAP	3	Non-functional
2	BSF Chowk	3	Functional
3	Sutlej Cinema Chowk	4	Non-functional
4	BMC Chowk	5	Timer non-functional
5	Guru Nanak Mission Chowk	4	Functional
6	Dr. BR Ambedkar Chowk	4	Timer non-functional
7	Football Chowk	4	Functional
8	Adarsh Ngr Chowk	4	Functional
9	Kapurthala Chowk	4	Functional
10	Work Shop Chowk	4	Functional
11	Maqsudan Chowk	3	Functional
12	Pathankot Chowk	4	Timer non-functional
13	Lama Pind Chowk	4	Functional
14	Kishan Pura Chowk	4	Non Functional
15	Gpo Chowk	3	Functional
16	PNB Chowk	3	Functional
17	Basti adda Chowk	4	Functional
18	Patel Chowk	4	Functional
19	Ravidass Chowk	4	Non-functional
20	Manbro Chowk	4	Functional
21	Chun Mun Chowk	4	Functional
22	Samra Chowk	4	Functional
23	Geeta Mandir Chowk	4	Functional
24	Model Town Mkt. Chowk	3	Functional
25	Urban Estate Ph.-2	4	Functional
26	T-Point Sodal Mandir	3	Functional

Arms	Number of Junctions
3	7
4	18
5	1

The following figure illustrates the junctions which, are functional, non-functional signals, arterial road and VIP road for which ATCS shall be installed. ATCC shall be install at three locations at an identified junction during the detailed survey by MSI.

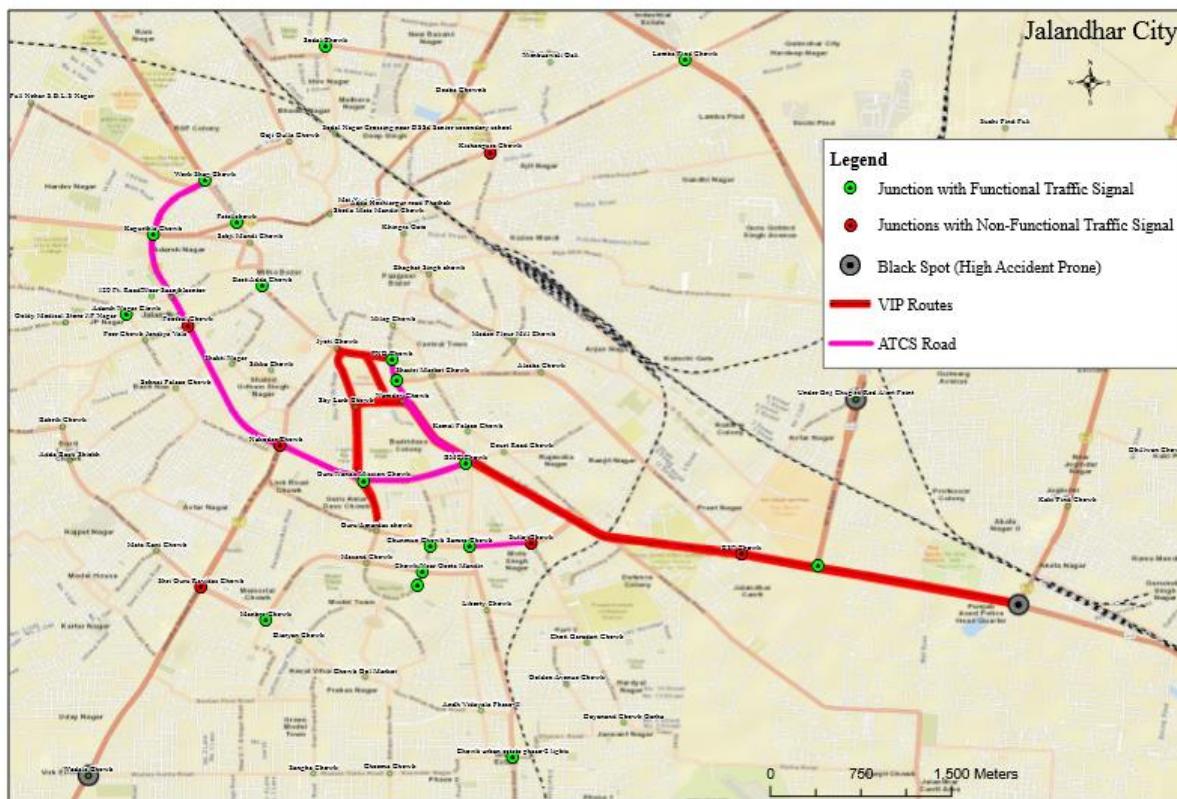


Figure – ATCS road, VIP road, Functional and Non-functional junctions

#### 7.5.4. Infrastructure at ITMS

This component covers planning & implementation of the Signalling System comprising cameras and other field equipment at locations identified by JSCL. However, actual placement of pole & number of cameras at each location, type of cameras, fixation of height & angle for the cameras to ensure maximum coverage should be undertaken in consultation with Jalandhar Police / Traffic Police.

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

A detailed survey shall be conduct, by the MSI along with a team from JSCL and Jalandhar Police, at each of the strategic locations. This survey shall finalize the position of all field equipment's and the orientation/ field of view of the cameras. Appropriate field of view snapshot shall be taken by a handheld camera for future reference at the time of survey. The surveyors shall also finalize the approximate location of foundation for junction box and poles. The route for all the underground cable laying shall be finalized during this survey (wherever required). Every detail, finalized during the survey, shall be demarcated on an AutoCAD drawing by the MSI and submitted to JSCL in the form of a detailed site survey report along with other details for its approval.

The system shall provide inter-operability of hardware, operating system, software, networking, printing, database connectivity, reporting, and communication protocols. MSI shall prepare the Detailed Report for field level requirements such as Cameras (types & numbers), Camera Mounting requirements, Power Requirements, Connectivity Requirements etc. for perusal of JSCL. Indicative list of the field level hardware to be provide by MSI is as follows:

1. Cameras with IR illuminators (Fixed Box, PTZ, ANPR, RLVD cameras etc.)
2. IR illuminators - External
3. Local processing unit for ANPR / RLVD cameras
4. Switches
5. Outdoor Cabinets
6. Pole for cameras / Mast
7. Outdoor Junction box
8. UPS
9. Networking and power cables, solar panels and other related infrastructure

## **Supply & Installation of Camera Infrastructure**

Based on detailed field survey as mentioned above, MSI shall be required to supply, install and commission the surveillance and monitoring systems at the identified locations and thereafter undertake necessary work towards its testing. MSI shall use industry-leading practices during the implementation phase w.r.t positioning and mounting the cameras, poles and junction boxes.

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

Some of the checkpoints that need to be adhered to by the MSI while installing / commissioning cameras are as follows:

1. Ensure that surveillance and monitoring objective is met while positioning the camera such that the required field of view is being captured as finalized in field survey
2. Ensure that camera is protect from the field challenges of weather, physical damage and theft.
3. Make proper adjustments to have the best possible image / video captured.
4. Ensure that the pole is well place for vibration resistance adhering to the road safety norms.
5. Deployment of Collision preventive barriers around the junction box & pole foundation in case it is install in collision prone place.
6. Deployment of Appropriate branding or colour coding (Police/JSC Branding) of poles and junction boxes, to warn mischief mongers against tampering with the equipment at the junction.

### **Installation of Poles/Cantilevers/Gantry if required**

1. The MSI shall ensure that all installations are done as per satisfaction of the JSCL.
2. For installation of CCTV Cameras, PTZ Cameras, Public Address System, etc. MSI shall provide appropriate poles & cantilevers and any supporting equipment.
3. MSI shall be required to supply, install, configure and integrate surveillance cameras at the identified locations and thereafter undertake necessary work towards their commissioning.
4. MSI shall ensure that the poles erected to mount cameras are good, both qualitatively and aesthetically
5. MSI shall use the industry leading practices while positioning and mounting the cameras and ensure that the pole / mast implementation is vibration resistant. Arrangements for bird scare spikes on top of camera shall be made to prevent birds from sitting on top of camera box.
6. The poles shall be install with base plate, pole door, pole distributor block and cover.
7. Base frames and screws shall be deliver along with poles and installed by the MSI.
8. In case the cameras need to be install beside or above the signal heads, suitable stainless steel extensions for poles need to be provide and installed by the MSI so that there is clear line of sight.

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

9. MSI shall be responsible to undertake required structural analysis regarding the regulated load conditions and considering the respective wind load while installing the poles / cantilevers for cameras
10. MSI shall provide structural calculations and drawings for the approval of JSCL. The design shall match with common design standards as applicable under the jurisdiction of JSCL.
11. MSI shall coordinate with concerned authorities / municipalities for installation.
12. Poles and cabinet shall be so design such that all elements of the field equipment could be easily install and removed.
13. MSI shall ensure that physical look of the installation area returns to neat & tidy conditions after installation of poles, cantilevers etc. The placement shall be design keeping in mind the normal flow of vehicular traffic and pedestrian movement is not disturbed.

### **UPS for field locations**

1. UPS shall serve as a backup for commercially available utility power at the intersections and shall ensure no-break functioning of all field components at each intersection in event of failure of utility power supply
2. MSI shall carry out a study and identify locations to provide UPS backup, depending upon power situation across Jalandhar City, to meet the camera and other field equipment's uptime requirements.
3. MSI shall install UPS at the identified intersections in secure, tamper-proof housing in corrosion resistant cabinets.
4. MSI shall ensure that the UPS is suitably protect against storms, power surges and lightning.
5. MSI shall provide UPS for efficient heat dissipation without air conditioning. It shall be able to withstand temperatures prevalent in Jalandhar throughout the year.

## **Outdoor Cabinets / Junction Boxes**

1. Each intersection shall be fitted with outdoor cabinets dimensioned to host all equipment necessary to operate enforcement systems and traffic surveillance systems that will be defined in the bid document
2. The cabinets provided shall be plug and play
3. MSI shall reserve additional room in the intersection controller cabinet to accommodate the future system requirements
4. The size of outdoor cabinet / Junction Boxes shall be sufficient to house all the system components, which may be install at the intersection or nearby. Boxes shall be dustproof and impermeable to splash-water (IP65 or better). They shall be suitable for Jalandhar's environmental conditions. They shall have separate lockable doors for:
  - a. Power cabinet: This cabinet shall house the electricity meter, online UPS system and the redundant power supply system
  - b. Control cabinet: This cabinet shall house the controllers for all the field components at that particular location e.g. ANPR, PTZ, RLVD, Fixed box cameras etc.
5. Internal cabinet cabling shall be designed for an easy connection and disconnection of the equipment and power
6. The cabinets shall be of robust construction and shall include 3-point security-locking mechanisms to prevent unauthorized access to the field equipment
7. Temperature and Humidity Control: All enclosure compartments shall be equipped with a natural convection air circulation system via provision of air circulation filters that shall not require maintenance and shall allow free circulation of air inside the enclosures to prevent overheating as well as the build-up and effects of humidity and heat, without permitting the entry of elements that might endanger system operation

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

8. MSI shall ensure that all the hardware is placed inside the junction boxes that could withstand temperatures prevalent in Jalandhar throughout the year

### **Civil and Electrical Works**

1. MSI shall be responsible for carrying out all the civil & Electrical work required for setting up all the field components of the system including:
  - a. Preparation of concrete foundation for MS-Poles & cantilevers
  - b. Laying of GI Pipes (B Class) complete with GI fitting
  - c. Hard soil deep digging and backfilling after cabling
  - d. Soft soil deep digging and backfilling after cabling
  - e. Chambers with metal cover at every junction box, pole and at road crossings
  - f. Concrete foundation from the Ground for outdoor racks
2. MSI shall provide power to the cameras through the aggregation point. Since this component has dependency on approval from local authorities, it is recommended that MSI plans this requirement well in advance & submits the application to the concerned electricity distribution agency with requisite fees, as applicable.
3. MSI shall carry out all the electrical work required for powering all the components of the system
4. Electrical installation and wiring shall conform to the electrical codes of India
5. MSI shall make provisions for providing electricity to the cameras (ANPR, PTZ, and Fixed) via Junction Box, housing the UPS/SMPS power supply, with minimum backup that will be defined in bid document
6. For the wired Box cameras, MSI shall provision for drawing power through PoE/ PoE+ (Power over Ethernet), while PTZ cameras shall be powered through dedicated power cable laid separately along with STP/SFTP cable
7. Registration of electrical connections at all field sites shall be done in the name JSCL
8. MSI shall house the electricity meters inside the power cabinet as mentioned in the controller Cabinet section as above.

## **Earthing and Lightning Proof Measures**

1. MSI shall comply with the entire specified Technical Specifications taking into account lightning-proof and anti-interference measures for system structure, equipment type selection, equipment earthing, and power and signal cable laying.
2. Corresponding lightning arrester shall be erected for the entrance cables of power line, video line, data transmission cables
3. All interface board and function board, interfaces of equipment shall adopt high speed photoelectric isolation to reduce the damage to integrated circuit CMOS (Complementary metal–oxide–semiconductor chip due to the surge suppression
4. Install the earthing devices for the equipment, including lightning earthing, protection earthing and shielded earthing. All earthing shall meet the related industry standards
5. The earthing cable shall be install in a secure manner to prevent theft and shall be rust proof. Earthing down lead and the earthing electrode shall be galvanized.

## **Public Address System (PAS)**

Public Address System shall be used at the intersections as identified by JSCL to make important announcements for the citizens / 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. The system shall contain an IP based amplifier and use PoE/ PoE+ power that could drive the speakers. The system shall also contain the control software that could be used to control/monitor all the components of the system that includes Controller, Calling Station & keypad, Amplifier (Mixing & Booster).

## **Emergency Call Box**

Emergency box shall be installed at intersections identified by JSCL to improve the safety and security of citizens within the city where they can seek assistance from JICCC's Emergency Response Team. Emergency call box will enable citizens to establish a two-way audio (microphone and speaker) – video (video camera and a video screen) communication link with operation staff

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

at JICCC. On pressing the emergency button, the system will establish a connection with Emergency Response Team call taker and the video shall be display on the video wall in the JICCC.

### **Speed Violation Detection Systems**

- The speed violation detection system captures speed of the vehicles, which are passing through this system. The speed detection system detects speed of the vehicle and compares with the speed limit set in the configuration. If the actual speed of the vehicle is more than the speed limit, then it triggers the ANPR system to capture the number plate of the vehicle. Both the number plate and actual speed of the violated vehicle will be stored in the system. The system detects speed accuracy of 10% (+/-) of the actual vehicle speed.
- The number plate deciphered are stored in the deciphered database. The number plate not deciphered by ANPR system are stored in the non-deciphered database. Later the non-deciphered number plate is manually further classified into soiled, broken and vernacular number plate.
- All the deciphered number plate of violated vehicles e-Challans generated automatically. Non deciphered number plate of violated vehicles e-Challans are generated manually

#### **7.5.5. General Requirements**

1. JSCL shall assist in obtaining all necessary go ahead, legal permissions, NOC (No Objection Certificate) from various departments to execute the project. MSI shall have to identify and obtain necessary legal / statutory clearances for erecting the poles and installing cameras, for provisioning of the required power, etc. MSI shall provide & manage all necessary paper work to pursue permission from respective authorities. No commercial/legal fees (except the RoW charges) shall be applicable to JSCL for obtaining the necessary permissions.
2. The MSI shall provide all material required for mounting of components such as cameras and other field equipment. All mounting devices for installation of CCTV cameras to enable pan and tilt capabilities shall be included in the costs of the respective component. The same is also applicable to crossheads and cross arms, mounting brackets, stainless steel bands, screws and other accessories.

## **Detailed Project Report for Jalandhar Integrated Smart Solutions**

3. All the equipment, Hardware, Software and workmanship, which form a part of the MSI services, will be under O&M to be undertaken by the MSI throughout the project duration.
4. MSI shall also get comprehensive insurance from reputed insurance company for the project duration for all the equipment's/components installed under this project.
5. MSI shall ensure all the equipment's installed in the outdoor locations are vandal proof and in case the equipment is damaged /stolen for reasons whatsoever, it shall repair/replace the same in the specified time as per SLAs at no extra cost to the JSCL. All such costs shall be factor in the comprehensive insurance of field equipment for the duration of the project.
6. Preventive maintenance shall be carried out once in a quarter along with corrective maintenance and when calls are placed by JSCL or its designated agency.
7. In addition to above, the MSI shall be fully responsible for all maintenance activities for the period between installation of equipment and roll-out of the system.
8. During implementation, if observed that any camera / field equipment requires change in the field of view / orientation, it shall be done by MSI without any extra cost.
9. In case of request for change in location of field equipment post installation, the same shall be borne by JSCL at either a unit rate as per commercials or a mutually agreed cost.
10. It is assumed that the existing signal infrastructure like poles etc. shall be reused and electronic components shall be replaced for which warranty is applicable in Operations and Maintenance period.

### **7.5.6. Functional Requirements**

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No.	Functions	Minimum Specification
1	General	<ul style="list-style-type: none"> <li>▪ The requirements mentioned for various IT / Non-IT components are indicative and should be used for benchmarking purpose only.</li> <li>▪ All IT Components should support IPv4 and IPv6</li> <li>▪ The user interface of the system should be a user friendly Graphical User Interface (GUI).</li> <li>▪ Critical core components of the system should not have any requirements to have proprietary platforms and should conform to open standards.</li> <li>▪ For custom-made modules, industry standards and norms should be adhered to for coding during application development to ensure debugging and maintenance is easier. Object oriented programming methodology must be followed to facilitate sharing, componentizing and re-use of standard code. Before hosting the application, it shall be subjected to application security audit (by any of the CERTIN empanelled vendors) to ensure that the application is free from any vulnerability; and approved by the JSCL.</li> <li>▪ All the JSCL Machines / Servers shall support static assigned IP addresses or shall obtain IP addresses from a DNS/DHCP server.</li> <li>▪ Cameras and the Video Management / Video Analytics Software should be ONVIF Core Specification ‘2.X’ or ‘S’ compliant and provide support for ONVIF profiles such as Streaming, Storage, Recording, Playback, and Access Control.</li> </ul>
2	Traffic Signal Controller	<ul style="list-style-type: none"> <li>▪ The Traffic Signal Controller equipment is a 32-bit or 64-bit microcontroller with solid-state traffic signal lamp switching module with the ability to program any</li> </ul>

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No.	Functions	Minimum Specification
		<p>combination of traffic signal stages, phases and junction groups. The controller will ideally have a conflict monitoring facility to ensure that conflicting, dangerous are pre-flagged at the programming stage and these are disallowed even during manual override phase.</p> <ul style="list-style-type: none"> <li>▪ The Traffic Signal Controller will be adaptive so that it can be controlled through the central traffic control centre as an individual junction or as part of group of traffic junctions along a corridor or a region. The signal controller design must be flexible for the junction could be easily configured to be part of any corridor or group definition and could be changed through central command controller easily.</li> <li>▪ Site specific configuration data shall be stored in a non-volatile memory device (FLASH memory) easily programmable at the site through keypad or laptop. A minimum of 512KB flash memory and 128KB RAM shall be provided. Volatile memory shall not be used for storing the junction specific plans or signal timings.</li> <li>▪ All timings generated within a traffic signal controller shall be digitally derived from a crystal clock, which shall be accurate to plus or minus 100 milliseconds.</li> <li>▪ The controller shall provide a real time clock (RTC) with battery backup that sets and updates the time, date and day of the week from the GPS. The RTC shall have a minimum of 10 years' battery backup with maximum time tolerance of 10 seconds per day.</li> <li>▪ The controller shall have the facility to update the RTC time from ATCS server, GPS and through manual entry.</li> <li>▪ The controller shall be capable of communicating with the ATCS server through Ethernet on a managed leased line</li> </ul>

Sl. No.	Functions	Minimum Specification
		<p>network or any other appropriate stable communication network</p> <p><b>A) Police Panel:</b></p> <p>The controller shall provide the following facilities in a separate panel with provision for lock and key arrangements for use by the Traffic Police.</p> <ul style="list-style-type: none"> <li>▪ Four Hurry Call switches: The Hurry Call mode will provide the means to force the controller to a defined stage, without violating safety clearances. A pre-emption input may be used to demand the Hurry Call mode to give right of way to emergency vehicles. It should be possible to configure the Hurry Call switches to any stage as per site requirements.</li> <li>▪ One Forced Flash Switch: Activation of this switch should force the signal to Flashing Amber / Flashing Red.</li> <li>▪ One Auto / Manual Switch: Activation of this switch should enable manual operation of the controller. Deactivation of the manual switch shall continue from the current stage without interruption.</li> <li>▪ One Manual Advance Pushbutton Switch: In manual operation mode, the stages appear in the sequence specified in the signal plan timetable. Activating the pushbutton switch shall terminate the currently running stage and start the next, without violating safety clearances.</li> <li>▪ One Junction OFF Switch: Activating this switch should put OFF all signal lamps. On deactivation of the switch the traffic signal controller shall resume its normal operation without violating any safety clearances.</li> </ul> <p><b>B) Modes of Operation:</b></p>

## Detailed Project Report for Jalandhar Integrated Smart Solutions

Sl. No.	Functions	Minimum Specification
		<p>The traffic signal controller shall have the following modes of operation:</p> <ul style="list-style-type: none"> <li>▪ <b>Fixed Time:</b> In fixed time (pre-timed) mode the traffic signal controller shall execute stage timings according to the site specific timetable maintained in the traffic signal controller FLASH memory. Inputs from vehicle detectors shall be ignored in this mode and no pre-emption shall be made on any stage. Cycle time remains constant in every cycle execution for a given time period.</li> <li>▪ <b>Vehicle Actuation with All Stages Pre-emption:</b> In the vehicle actuation with all stages pre-emption mode, the traffic signal controller shall execute stage timings as per demand from vehicle detectors within the constraints of minimum Green, Maximum Green running period for the stage and Cycle time stored in the traffic signal controller FLASH memory. Pre-emption shall be possible for all demand-actuated stages. Cycle time may vary in every cycle execution.</li> <li>▪ <b>Semi-Actuation:</b> In the semi-actuation mode, the traffic signal controller shall execute stage timings in the vehicle actuated stages as per demand from vehicle detectors within the constraints of minimum Green, Maximum Green running period for the stage and Cycle time stored in the traffic signal controller FLASH memory. All other stages shall execute the Maximum green time configured for the stage. Pre-emption shall be possible for all demand-actuated stages. Cycle time may vary in every cycle execution.</li> <li>▪ <b>Stage Skipping:</b> The traffic signal controller shall not execute the stage enabled for skipping when there is no</li> </ul>

Sl. No.	Functions	Minimum Specification
		<p>vehicle demand registered for the stage till clearance amber time of the previous stage.</p> <ul style="list-style-type: none"> <li>▪ <b>Vehicle Actuation with Fixed Cycle length:</b> In vehicle actuation with fixed cycle length mode, the traffic signal controller shall execute stage timings as per demand from vehicle detectors within the constraints of minimum Green, Maximum Green running period for the stage and Cycle time shall be maintained constant during a given timeslot. Pre-emption to be carried out for all demand actuated stages except for Priority Stage.</li> <li>▪ <b>Full ATCS (FATCS):</b> In FATCS mode, the traffic signal controller shall execute stage timings as per demand within the constraints of minimum Green, Maximum Green running period for the stage and Cycle time specified by the Central Computer during every cycle switching. Pre-emption for all demand-actuated stages except Priority Stage shall be possible in this mode. The traffic signal controller shall identify a communication failure with the central computer within a specified time period. In such an event the signal plan timings shall be executed from the local timetable stored in the traffic signal controller FLASH memory. Fall-back mode of the traffic signal controller shall be vehicle actuated. On restoration of the communication with central computer, the traffic signal controller shall automatically resort to FATCS mode.</li> </ul> <p>The traffic signal controller shall accept commands for remote selection / de-selection of the following from the Central Computer at JICCC.</p> <ul style="list-style-type: none"> <li>○ Hurry Call</li> <li>○ Flashing Amber / Flashing Red</li> </ul>

Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>○ Junction Off</li> </ul> <p>If not reverted to the normal operation within the time period listed below, the traffic signal controllers shall timeout the commands and operate normally:</p> <ul style="list-style-type: none"> <li>○ Hurry Call – 5 Minutes</li> <li>○ Flashing Amber / Flashing Red – 30 Minutes</li> <li>○ Junction Off – 30 Minutes</li> </ul> <p>The traffic signal controller shall report the following to the Central Computer through the communication network every cycle or on an event as appropriate.</p> <p>Green time actually exercised for each approach (stage pre-emption timing) against the Green running period set for the approach by the Central Computer.</p> <p><b>Mode of Operation</b></p> <ul style="list-style-type: none"> <li>○ Lamp failure, if any</li> <li>○ Output short circuit, if any</li> <li>○ Detector failure, if any</li> </ul> <p><b>C) Traffic Signal Controller Operating Parameters</b></p> <p>Phases - The controller shall have facility to configure 32 Phases either for vehicular movement, filter green, indicative green, pedestrian movement or a combination thereof.</p> <ul style="list-style-type: none"> <li>▪ It shall be possible to operate the filter green (turning right signal) along with a vehicular phase. The filter green signal shall flash for a time period equal to the clearance amber period at timeout when operated with a vehicular phase.</li> <li>▪ The pedestrian phase signal shall be configured for flashing red or flashing green aspect during pedestrian clearance.</li> <li>▪ It shall be possible to configure any phase to the given lamp numbers at the site.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Stages – The controller shall have facility to configure 32 Stages.</li> <li>▪ Cycle Plans – The controller shall have facility to configure 24 Cycle Plans and the Amber Flashing / Red Flashing plan. It shall be possible to define different stage switching sequences in different cycle plans. The controller shall have the capability for a minimum of 32 cycle switching per day in fixed mode of operation.</li> <li>▪ Day Plans – The controller shall have facility to configure each day of the week with different day plans. It shall also be possible to set any of the day plans to any day of the week. The controller shall have the capability to configure 20-day plans.</li> <li>▪ Special Day Plans – The controller shall have facility to configure a minimum of 20 days as special days in a calendar year</li> <li>▪ Starting Amber – During power up the controller shall initially execute the Flashing Amber / Flashing Red plan for a time period of 3 Seconds to 10 Seconds. The default value of this Starting Amber is 5 Seconds. Facility shall be available to configure the time period of Starting Amber within the given limits at the site.</li> <li>▪ Inter-green – Normally the inter-green period formed by the clearance Amber and Red extension period will be common for all stages. However, the controller shall have a facility to program individual inter-green period from 3 Seconds to 10 Seconds.</li> <li>▪ Minimum Green – The controller shall allow programming the minimum Green period from 5 Seconds to 10 Seconds without violating the safety clearances.</li> </ul>

Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ It should not be possible to pre-empt the minimum Green once the stage start commencing execution.</li> <li>▪ All Red – Immediately after the Starting Amber all the approaches should be given red signal for a few seconds before allowing any right of way, as a safety measure. The controller shall have programmability of 3 Seconds to 10 Seconds for All Red signal.</li> <li>▪ Signal lamps monitoring – The controller shall have inbuilt circuitry to monitor the lamp status.</li> <li>▪ Green – Green Conflict Monitoring – The controller shall have a facility to list all conflicting phases at an intersection. The controller should not allow programming of these conflicting phases in a Stage. A hardware failure leading to a conflict condition (due to faulty devices or short circuit in the output) shall force the signal into Flashing Amber/ Flashing Red.</li> <li>▪ Cable less Synchronization – It shall be possible to synchronize the traffic signal controllers installed in a corridor in the following modes of operation, without physically linking them and without communication network. GPS enabled RTC shall be the reference for the cable less synchronization.</li> <li>▪ Fixed Time mode with fixed offsets.</li> <li>▪ Vehicle Actuated mode with fixed offsets.</li> </ul>

#### **D) Input and Output facilities**

- Lamp Switching: The controller shall have minimum 64 individual output for signal lamp switching, configurable from 16 to 32 lamp groups where in each group is RED, AMBER & GREEN. The signal lamps may be operating on appropriate DC/AC voltage of applicable rating.

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Detector Interface: A minimum of 16 vehicle detector inputs shall be available in the controller. All detector inputs shall be optically isolated and provided with LED indication for detection of vehicle.</li> <li>▪ Communication Interface: The traffic signal controller shall support Ethernet interface to communicate with the ATCS server.</li> <li>▪ Power Saving: MIS is requested to propose appropriate energy saving mechanisms and approaches. The traffic signal controller shall have a facility to regulate the intensity of signal lamps during different ambient light conditions.</li> <li>▪ Real-time Clock (RTC): The GPS receiver for updating time, date and day of the week information of the traffic signal controller should be an integral part of the traffic signal controller.</li> <li>▪ The traffic signal controller shall update the date, time and day of the week automatically from GPS during power ON and at scheduled intervals.</li> <li>▪ Manual entry for date, time and day of week shall be provision for setting the traffic signal controller RTC (Real Time Clock).</li> <li>▪ It shall be possible to set the RTC from the Central Server when networked.</li> <li>▪ Keypad (optional): The traffic signal controller shall have a custom made keypad or should have provision for plan upload and download using PC/laptop/Central Server.</li> <li>▪ Operator Display (optional): The traffic signal controller shall optionally have a LED backlit Liquid Crystal Display (LCD) as the operator interface.</li> </ul>

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Sl. No.	Functions	Minimum Specification
3	Vehicle Detectors	<ul style="list-style-type: none"> <li>▪ Solution / product should be able to count vehicles at each arm of the traffic junctions. The outputs of the detectors shall indicate the presence of vehicles and shall be used to influence the operation of the traffic signal controller and shall generate counts, demands and extensions for right-of-way. Means shall be provided so that a detector may be connected to demand and / or extend a phase movement as specified.</li> <li>▪ Specific placement of the detectors (upstream, downstream, stop line, exit etc.) for independent straight and right turn signals.</li> <li>▪ The detector shall be able to count vehicles in non-lane based mixed traffic flow conditions and differentiate between different vehicle types (two-wheeler, three-wheeler, car, HGV, etc.). The accuracy of counts shall be bigger than 90% over all light and weather conditions.</li> <li>▪ A detector that does not change its status at least once during a stage execution shall be notified to the Central Computer (in ATCS mode) at the termination of the associated stage.</li> </ul>
4	Communication Network	<ul style="list-style-type: none"> <li>▪ Function of the Communication network is for remote monitoring of the intersection and its management. Real time data (like RTC time, stage timing, mode, events, etc.) from the traffic signal controller is required to be sent to the Central Computer in Traffic Management Centre. Central Computer running the ATCS application shall calculate and send optimum signal timings to all intersections in the corridor.</li> </ul>
5	ATCS Application software	Objective of the ATCS is to minimize the stops and delays in a road network to decrease the travel time with the help of state-of-the-art technology. The adaptive traffic control

Sl. No.	Functions	Minimum Specification
		<p>system will provide simulation based real time traffic flow modelling capability with the capacity to calculate traffic flows, OD movements, and queues and turning movement along entire primary road transport network in the defined study area covering the ATCS junctions and beyond. The Application software or platform will be able to predict traffic flow in the network for the near term over various interval horizons (e.g. T+5, T+10 ... T+30 mins). The ATCS application will provide estimated traffic flow for each of the junction to calculate optimal cycle times, effective green time ratios, and change intervals for all system traffic signal controllers connected to it either as individual junctions or groups of junctions. These calculations will be based up on assessments carried out by the ATCS application software running on a Central Computer based on the data and information gathered by vehicle detectors at strategic locations at the intersections controlled by the system. The ATCS application software shall be divided into two modules with the following as the expected capabilities of the individual modules</p> <p><b>Module 1: Real Time Traffic Prediction Capability</b></p> <ul style="list-style-type: none"> <li>▪ Shall provide a decision support tool for assessing strategies to minimize congestion, delays and emergency response time to events via simulation and planning tools linked with real time traffic data fusion and control of traffic Signalling infrastructure on ground.</li> <li>▪ Shall collect continuously information about current observed traffic conditions from a variety of data sources (like Bus GPS data, parking data, mobile phone data etc. MSI can propose alternate data sources that could be</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<p>integrated) and of different kind (traffic states, signal states, vehicle trajectories, incidents, road works etc.)</p> <ul style="list-style-type: none"> <li>▪ Shall infer a coherent and comprehensive observed traffic state (speeds, vehicular densities, and presence of queues) on all network elements, from above mentioned observations, including vehicle trajectories, through a number of map matching, data validation, harmonization and fusion processes.</li> <li>▪ Shall have a Graphical User Interface (GUI) to be able to display traffic state along the observed and unobserved parts of the network through GIS maps. The MSI is expected to create a layer of edge equipment within that GIS platform and integrate with ATMS modules of the transport network and must be able to display traffic flow, building of queues, delays, location of traffic signals and junctions, key Points of Interests (POI), Variable Message signs etc. In addition, the GUI must be: <ul style="list-style-type: none"> <li>✓ Flexible for the operators to zoom and navigate with ability to interact with objects on the map.</li> <li>✓ Should be interoperable across multiple platforms and key graphical results and MIS must be made available across the Web</li> <li>✓ Graphically present time-space diagram for selected corridors on desktop</li> <li>✓ Graphically present signal plan execution and traffic flow at the intersection on desktop</li> </ul> </li> <li>▪ Shall have the ability to predict, forecast and estimate the traffic pattern across the signals over the near term future (e.g. T+5, T+10, T+15, T+30 mins ... T + 1 hour)</li> <li>▪ Shall extrapolate the measurements made on a limited number of junctions and arms along the rest of the</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<p>unmonitored network, and obtain an estimation of the traffic state of the complete network and the evolution of this traffic state over the near term future (e.g. T+5, T+10, T+15, T+30 mins ... T + 1 hour)</p> <ul style="list-style-type: none"> <li>▪ Shall be able to forecast the traffic state with respect to current incidents and traffic management strategies (e.g. traffic signal control or variable message signs), improving the decision making capabilities of the operators even before problems occur</li> <li>▪ Shall provide customizable estimates of Key Performance Indicators (KPI) for alternate traffic management strategies to quickly assess the results</li> <li>▪ Shall provide calculated traffic flows estimation and forecast, queues and delays to Urban Control and Adaptive Traffic Control Systems, allowing for proactive Traffic Management and Control.</li> <li>▪ To raise alerts to the operator that trigger on customizable conditions in the network (starting with simple drops in flow, up to total queue lengths along emission sensitive roads surpassing a definable threshold); To distribute both collected and calculated traffic information via a variety of communication protocols and channels, ensuring high interoperability degree and thus acting as a “traffic data and information hub.</li> <li>▪ Shall include a traffic data warehouse (for minimum 4 years) for all historic traffic information gathered from the hardware installed on the road network. MSI to propose how data storage requirements could be minimized using consolidation techniques.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Shall operate in real time that is continuously updating the estimates on the state of the network and the travel times on the basis of data collected continuously over time.</li> <li>▪ Shall operate the traffic lights with the adaptive traffic controls, based on the current and forecasted traffic demand and the current incidents, thus optimizing the green waves continuously throughout the network</li> <li>▪ Shall be possible to interface the ATCS with a popular microscopic traffic flow simulation software for pre and post implementation analysis and study of the proposed ATCS control strategy.</li> </ul> <p><b>Module 2: Adaptive Traffic Control System</b></p> <ul style="list-style-type: none"> <li>▪ To operate the traffic lights with the adaptive traffic controls based on the current and forecasted traffic demand from the above Real Time Traffic Prediction Tool including the current incidents, thus optimizing the green waves continuously throughout the network.</li> <li>▪ Enable a smart public transport priority respecting the delays for all road users at once with the adaptive signal controller. To have the capability to integrate with Bus GPS data to identify oncoming buses at the junction and be able to provide priority clearance of buses.</li> <li>▪ Identify the critical junction (Master Junction) for each of the defined corridor or a region based on maximum traffic demand and saturation.</li> <li>▪ The critical junction cycle time estimated shall be used as the group cycle time i.e. cycle time common to all intersection in that corridor or region.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Stage optimization to the best level of service shall be carried out based on the traffic demand.</li> <li>▪ Cycle optimization shall be carried out by increasing or decreasing the common corridor cycle time based on the traffic demand within the constraints of minimum and Maximum designed value of cycle time.</li> <li>▪ Offset correction shall be carried out to minimize number of stops and delays along the corridor for the priority route and for the adjoining road network at once. Offset deviation shall be calculated with a traffic flow model based on the distance, traffic demand and speed between successive intersections and be corrected within 5 Minutes maximum.</li> <li>▪ The system shall have provision to configure priority for upstream signals as default. The ATCS software shall continuously check the traffic demand for upstream and downstream traffic and automatically assign the priority route to the higher demand direction.</li> <li>▪ The system shall use optimization algorithms that minimize a function based on the delays, number of stops and queue lengths simultaneously, using a traffic flow model, thus providing a true optimum for all road users.</li> <li>▪ Develop appropriate stage timing plans for each approach of every intersection under the ATCS, based on real time demand and the predicted traffic flow values from the traffic flow model.</li> <li>▪ Propose timing plans to every intersection under the ATCS at least every five minutes.</li> <li>▪ Calculate the current queue lengths for each approach that has detection cycle-by-cycle based on the succession of time gaps between cars.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Adjust the proposed timing plans second-by-second according to the current and past detector states and the current queue lengths for every intersection under detection.</li> <li>▪ Enable transit signal priority with minimize disruption of car traffic, dependent on predefined weights for public transport vehicles in comparison to individual traffic. In order to decrease the workload for operation and maintenance, each supply item (road network, lanes, signals and detectors) shall be supplied just once, so that the all macro and microscopic traffic models and the microscopic traffic flow software used for calibration and verification of the ATCS share the same supply.</li> <li>▪ Shall provide calculated traffic flows estimation and forecast, queues and delays to Urban Control and Adaptive Signal Control Systems, allowing for proactive Traffic Management and Control. Such estimation will be updated at least every 5 minutes or less, and will not be based on a machine learning approach that would not provide enough flexibility in case of unexpected events.</li> <li>▪ Should be able to route emergency vehicles to minimize the impact of events on the travel time of emergency vehicles.</li> <li>▪ Shall be able to export the calculated traffic flow data continually to a multi-modal journey-planner that allows all internet users in the city to find the best route with each traffic mode based on the current travel times in the network.</li> <li>▪ Identify Priority routes and synchronize traffic in the Priority routes.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Manage and maintain communication with traffic signal controllers under ATCS.</li> <li>▪ Maintain database for time plan execution and system performance.</li> <li>▪ Maintain error logs and system logs.</li> <li>▪ Generate Reports on request: - The ATCS shall generate standard and custom reports for planning and analysis.</li> </ul> <p><b>Reports</b></p> <p>System shall generate Corridor based and Intersection based reports. The application software shall generate the following reports, but not limited to the below. All the reports shall be possible for selected dates.</p> <ul style="list-style-type: none"> <li>▪ Intersection based reports</li> <li>▪ Stage Timing report – The report shall give details of time at which every stage change has taken place. The report shall show the stage sequence, stage timings and stage saturation of all stages of all cycles for a day. The saturation is defined as the ratio between the available stage timings to the actual stage timing executed by the traffic signal controller for the stage (stage pre-emption time).</li> <li>▪ Cycle Timing report – The report shall give details of time at which every cycle has taken place. The report shall show the cycle sequence and cycle timings for all the cycles in a day.</li> <li>▪ Stage switching report – The report shall give details of time at which a stage switching has taken place. The report shall show the stage sequence, stage timings and stage saturation for a day.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Cycle Time switching report – The report shall give details of time at which a cycle switching has taken place. The report shall show the cycle sequence and cycle timings for the cycle in a day.</li> <li>▪ Mode switching report – The report shall give details of the mode switching taken place on a day.</li> <li>▪ Event Report - The report shall show events generated by the controller with date and time of event.</li> <li>▪ Power on &amp; down: The report shall show time when the master is switched on, and last working time of the master controller.</li> <li>▪ Intensity Change – The report shall show the brightness of the signal lamp is changed according to the light intensity either manually through keypad or automatically by LDR with time stamp.</li> <li>▪ Plan Change – The report shall show the time of change of plan either through keypad or remotely through a PC or Server.</li> <li>▪ RTC Failure – The report shall show the time when RTC battery level goes below the threshold value.</li> <li>▪ Time Update – The report shall show the time when the Master controller updated its time either manually through keypad, automatically by GPS or through remote server.</li> <li>▪ Mode Change – The report shall show the time when Master controller's operating mode is changed either manually through keypad or a remote server. The typical modes are FIXED, FULL VA SPLIT, FULL VA CYCLE, FLASH, LAMP OFF and HURRY CALL.</li> <li>▪ Lamp Status Report – The report shall show lamp failure report with date and time of failure, color of the lamp and associated phase.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Loop Failure Report – The report shall show the date and time of detector failure with detector number and associated phase.</li> <li>▪ Conflict – The report shall show the conflict between lamps (RED, AMBER, GREEN) in the same phase or conflict between lamps with other phase.</li> <li>▪ Corridor Performance Report – The report shall show the saturation of all the intersections in a corridor for every cycle executed for the corridor and the average corridor saturation for a day.</li> <li>▪ Corridor Cycle Time Report – The report shall show the Corridor cycle time, Intersection cycle time, Mode of operation and degree of saturation of all the intersections in a corridor for every cycle for a day</li> </ul>

### Graphical User Interface

The application software shall have the following Graphical User Interface (GUI) for user friendliness, which will have the following functionalities in additions to those described above.

- User login – Operator authentication shall be verified at this screen with login name and password
- Network Status Display – This online display shall indicate with appropriate colour coding on site map whether an intersection under the ATCS is online or off. On double clicking the intersection, a link shall be activated for the traffic flow display for the intersection.
- Traffic Flow Display – This online display shall indicate the current traffic flow with animated arrows, mode of operation, stage number being executed and elapsed stage time.

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Saturation Snapshot – This display shall show the current saturation levels of all intersections in a corridor.</li> <li>▪ Reports Printing / Viewing – This link shall allow selection, viewing and printing of different reports available under ATCS</li> <li>▪ Time-Space Diagram – The time-space diagram shall display the current stages being executed at every intersection in a corridor with immediate previous history.</li> <li>▪ Junctions shall be plotted proportional to their distance on Y-axis and time elapsed for the stage in seconds on X-axis.</li> <li>▪ Junction names shall be identified with each plot.</li> <li>▪ Facility shall be available to plot the time-space diagram from history</li> <li>▪ Currently running stage and completed stages shall be identified with different colours.</li> <li>▪ Stages identified for synchronization shall be shown in a different colour.</li> <li>▪ Speed lines shall be plotter for stages identified for synchronization to the nearest intersection in both directions.</li> <li>▪ It should be possible to freeze and resume online plotting of Time-Space diagram.</li> <li>▪ The system shall have other graphical interfaces for configuring the ATCS, as appropriate</li> </ul>
6	<b>ATCC</b>	<ul style="list-style-type: none"> <li>▪ Central software application should be a browser-based software application that allows authorised operators and other users to perform all Traffic Management related and other functions.</li> <li>▪ The system integrates key operational functions such as event entry, addressing, sign control, traffic data, travel times and reporting in one simple solution that allows</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<p>users to identify and respond to incidents on the city network.</p> <ul style="list-style-type: none"> <li>▪ Central Application GUI shall allow authorized users of the software to access the system without the need for any client side software</li> <li>▪ Application GUI should allow each user to open multiple instances.</li> <li>▪ All active sensors shall be plotted on a map in central application.</li> <li>▪ Map should provide mouse-click functionality on icons, graphics and map areas to access to additional information on any map and user feature</li> <li>▪ Uploaded data should not be delete from individual field devices/ systems until the central system has provided confirmation that the data files have been successfully received.</li> <li>▪ Central application should have Standard Operation Procedures feature in which the system shall generate an automated Plan for every event generated in the system</li> <li>▪ Central application should be able to update its date and time applying time synchronization to servers using the internet and using this to in turn update the date and time on all system devices and workstations.</li> <li>▪ All active equipment shall have an internally maintained date and time clock synchronized at a time interval via the communications controller with the Central System date and time clock.</li> <li>▪ If the data connection to the central system is temporarily lost, all equipment shall seamlessly switch to an offline mode in which all data is temporarily stored in internal</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<p>memory and transmit to the central system as soon as the data connection is re-established.</p> <ul style="list-style-type: none"> <li>▪ It should be possible to “future-date” challan value so that they can be uploaded ahead-of-time and automatically activated at the planned date and time.</li> <li>▪ The reports should be non-editable.</li> <li>▪ All sub-systems and devices shall only allow access to authorized user group.</li> <li>▪ For all data transactions, the system security shall include authentication features to verify that all claimed source, recipient or user identities are correct and valid.</li> <li>▪ Central software application shall be an industry standard application</li> </ul>
7	Red Light Violation Detection Systems (RLVD)	<p><b>General</b></p> <ul style="list-style-type: none"> <li>▪ The following Traffic violations to be automatically detected by the system by using appropriate Non-Intrusive sensors technology:</li> <li>▪ Red Light Violation</li> <li>▪ Stop Line Violation</li> <li>▪ The system should be capable of capturing multiple infracting vehicles simultaneously in different lanes on each arm at any point of time with relevant infraction data like:</li> <li>▪ Type of Violation</li> <li>▪ Date, time, Site Name and Location of the Infraction</li> <li>▪ Registration Number of the vehicle through ANPR Camera system for each vehicle identified for infraction.</li> <li>▪ The system should be equipped with a camera system to record a digitized image and video of the violation, covering the violating vehicle with its surrounding and current state of signal (Red/Green/Amber) by which the</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<p>system should clearly show nature of violation and proof thereof:</p> <ul style="list-style-type: none"> <li>▪ When it violates the stop line.</li> <li>▪ When it violates the red signal.</li> <li>▪ Besides, a closer view indicating readable registration number plate patch of the violating vehicle for court evidence for each violation</li> <li>▪ The system shall be able to detect all vehicles infracting simultaneously in each lane/ arm at the junction as per locations provided. It should also be able to detect the vehicles infracting serially one after another in the same lane. The vehicles should be clearly identifiable and demarcated in the image produced by the camera system.</li> <li>▪ The Evidence image produced by the system should be wide enough to give the exact position of the infracting vehicles with respect to the stop line and clearly indicate colour of the Traffic light at the instant of Infraction even if any other means is being used to report the colour of the light.</li> <li>▪ The system should interface with the traffic controller to validate the colour of the traffic signal reported at the time of Infraction so as to give correct inputs of the signal cycle.</li> <li>▪ The Evidence and ANPR camera should continuously record all footage in its field of view to be stored at the local base station. This should be extractable onto a portable device as and when required. The option of live viewing of evidence cameras from the locations shall be available at the JICCC. The network should have the capability to provide the real time feed of the evidence</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<p>camera to the JICCC at the best resolution possible on the available network</p> <ul style="list-style-type: none"> <li>▪ The system shall be equipped with IR Illuminator to ensure clear images including illumination of the Number Plate and capture the violation image under low light conditions and night time.</li> <li>▪ In case of violation, lights should flash immediately</li> </ul>
		<p><b>Recording &amp; display information archive medium</b></p> <ul style="list-style-type: none"> <li>▪ The recording and display of information should be detailed on the snapshot of the infracting vehicle as follows: <ul style="list-style-type: none"> <li>○ Computer generated unique ID of each violation</li> <li>○ Date (DD/MM/YYYY)</li> <li>○ Time (HH:MM: SS)</li> <li>○ Equipment ID</li> <li>○ Location ID</li> <li>○ Carriageway or direction of violating vehicle</li> <li>○ Type of Violation (Signal/Stop Line)</li> <li>○ Lane Number of violating vehicle</li> <li>○ Time into Red/Green/Amber</li> <li>○ Registration Number of violating vehicle</li> </ul> </li> <li>▪ The size of file chunks that a camera should send to CC should be configurable</li> </ul>
		<p><b>On site-out station processing unit communication &amp; Electrical Interface</b></p> <ul style="list-style-type: none"> <li>▪ The system should automatically reset in the event of a program hang up and restart on a button press. However, the system should start automatically after power failure.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ The system should have secure access mechanism for validation of authorized personnel.</li> <li>▪ Deletion or addition and transfer of data should only be permit to authorized users.</li> <li>▪ A log of all user activities should be maintain in the system.</li> <li>▪ Roles and Rights of users should be defined in the system as per the requirements of the JSCL</li> <li>▪ All formats of the stored data with respect to the infractions should be Non Proprietary</li> <li>▪ The communication between the on-site outstation-processing unit housed in the junction box and the detection systems mounted on the cantilever shall be through appropriate secured technology.</li> <li>▪ The system should have the capability to transfer the data to SP's Office through proper encryption in real time and batch mode for verification of the infraction and processing of challan. Call forwarding architecture shall be followed to avoid any data loss during transfer</li> <li>▪ In the event that the connectivity to the SP's Office is not establish due to network/connectivity failures, then all data pertaining to the infraction shall be stored on site and will be transferred once the connectivity is re-established automatically. There shall also be a facility of physical transfer of data on portable device whenever required. There should be a provision to store minimum one week of data at each site on a 24x7 basis.</li> </ul> <p><b>Mounting Structure</b></p> <ul style="list-style-type: none"> <li>▪ Should be cantilever mounted and shall have minimum 6 Metres. height with appropriate vertical clearance under</li> </ul>

Sl. No.	Functions	Minimum Specification
		<p>the system from the Road surface to ensure no obstruction to vehicular traffic.</p> <ul style="list-style-type: none"> <li>▪ It should be capable to withstand high wind speeds and for structural safety, the successful MSI has to provide structural safety certificate from qualified structural engineers approved/ certified by Govt. Agency.</li> <li>▪ It shall be paint with one coat of primer and two coats of PU paint. The equipment including poles, mountings should have an aesthetic feel keeping in mind the standards road Infrastructure (e.g. Poles, Navigation boards etc.) currently installed at these locations. The equipment should look “one” with the surroundings of the location and not look out of place.</li> <li>▪ Rugged locking mechanism should be provided for the onsite enclosures and cabinets.</li> </ul> <p><b>RLVD - ANPR Application</b></p> <ul style="list-style-type: none"> <li>▪ It should be capable of importing violation data for storage in database server which should also be available to the Operator for viewing and retrieving the violation images and data for further processing. The application should allow for viewing, sorting, transfer &amp; printing of violation data.</li> <li>▪ It should print the photograph of violations captured by the outstation system which would include a wider view covering the violating vehicle with its surrounding and a closer view indicating readable registration number plate patch of the violating vehicle along with all data as per clause 4.</li> <li>▪ All outstation units should be configurable using the software at the Central Location</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Violation retrieval could be sort by date, time, location and vehicle registration number and the data structure should be compatible with Jalandhar Police database structure. It should also be possible to carry out recursive search and wild card search</li> <li>▪ The operator at the back office should be able to get an alarm of all fault(s) occurring at the camera site (e.g. sensor failure, camera failure, failure of linkage with traffic signal, connectivity failure, Camera tampering, sensor tampering).</li> <li>▪ The automatic number plate recognition Software will be part of the supplied system; Success rate of ANPR will be taken as 75% or better during the daytime and 40% or better during the night time with a standard number plate.</li> <li>▪ The application software should be integrated with the e-Challan software for tracing the ownership details of the violating vehicle and issuing/printing notices. Any updates of the software (OS, Application Software including any proprietary software), shall be updated free of cost during the project period by the MSI.</li> <li>▪ Image zoom function for number plate and images should be provided. In case the number plate of the infracting vehicle is readable only through the magnifier then in such cases the printing should be possible along with the magnified image</li> <li>▪ Various users should be able to access the system using single sign on and should be role based. Different roles which could be defined (to be finalized at the stage of SRS) could be Administrator, Supervisor, Officer, Operator, etc.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Apart from role based access, the system should also be able to define access based on location.</li> <li>▪ Rights to different modules / Sub-Modules / Functionalities should be role based and proper log report should be maintained by the system for such access.</li> <li>▪ Components of the architecture must provide redundancy and ensure that there are no single points of failure in the key project components. Considering the high sensitivity of the system, design shall be in such a way as to be resilient to technological sabotage. To take care of remote failure, the systems need to be configured to mask and recover with minimum outage</li> <li>▪ The evidence of Infraction should be encrypted and protected so that any tampering can be detect.</li> <li>▪ 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.</li> <li>▪ System shall use open standards and protocols to the extent possible and declare the proprietary software wherever used.</li> <li>▪ The user interface should be user friendly and provide facility to user for viewing, sorting and printing violations. The software should also be capable of generating query based statistical reports on the violation data.</li> <li>▪ The data provided for authentication of violations should be in an easy to use format as per the requirements of user</li> <li>▪ User should be provided with means of listing the invalid violations along with the reason(s) of invalidation without deleting the record(s).</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Basic image manipulation tools (zoom etc.) should be provided for the displayed image but the actual recorded image should never change.</li> <li>▪ Log of user actions be maintained in read only mode. User should be provided with the password and ID to access the system along with user type (admin, user).</li> <li>▪ Image should have a header/footer depicting the information about the site IP and violation details like date, time, equipment ID, location ID, Unique ID of each violation, lane number, Regn. Number of violating vehicle and actual violation of violating vehicle etc. so that the complete lane wise junction behaviour is recorded including (Speed of violating vehicle, notified speed limit, Signal Jumping, Stop Line Violation, Speed Violation with Registration Number Plate Recognition facility).</li> <li>▪ Number plate should be readable automatically by the software/interface. There should be user interface for simultaneous manual authentication / correction and saving as well. Number plate should be readable automatically by the software/interface. There should be user interface for simultaneous manual authentication / correction and saving as well</li> <li>▪ Interface for taking prints of the violations (including image and above details).</li> </ul>
<b>8</b>	e-Challan Application	<p>The objective of the e-Challan application is as follows:</p> <ul style="list-style-type: none"> <li>▪ Issuing challan for traffic violations on a 24x7 basis.</li> <li>▪ Maintaining the details pertaining to all the activities of the Traffic circles/violations/violators.</li> <li>▪ Providing requisite structured/unstructured information to the traffic management officials as and when required.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Generating various statutory reports for the administrative use and functioning of the Traffic unit in matters of prosecution of violators and monitoring the functioning of field officers.</li> <li>▪ Integrating and networking the system with state-of-the-art hardware and application software for the Traffic Police to access and using the information in their day-to-day work.</li> </ul> <p>The following are the key functional requirements of the e-Challan System:</p> <ul style="list-style-type: none"> <li>▪ E-challan system shall be able to retrieve vehicle owners details and vehicle data from RTO data base to minimize data entry</li> <li>▪ E-challan system shall be able to retrieve vehicle registration details and driving license details by reading appropriate smart card to minimize data entry</li> <li>▪ Server should maintain log of all current devices. Any access to the system must be recorded along with date, time, user id and IP address</li> <li>▪ Traffic officer should log in to the hand held device through the unique user id and pass word or smart card issued for the purpose</li> <li>▪ A unique Challan number should be generated through software for each challan</li> <li>▪ As soon as a vehicle registration number is entered, the handheld device should automatically check from the server if the vehicle is stolen, wanted in any criminal case or is in the list of suspicious vehicle</li> <li>▪ The most frequent traffic offences should be kept at the top in the drop down menu and offence details should be available if required by officer</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ Date, time and GPS coordinates of place of challan should be automatically populated in the relevant fields of software</li> <li>▪ Compounding amount must populate in the field automatically from master table</li> <li>▪ The successful MSI should develop the GUI and functionality as per requirements of the Jalandhar Traffic Police</li> <li>▪ The GUI should be Multi lingual i.e., English, Hindi and Punjabi</li> <li>▪ It should be possible to integrate payment gate way operator interface with the system for facilitation of payment</li> <li>▪ The Application Software should work in a web-based environment.</li> <li>▪ The application software should be user friendly, easy to operate</li> <li>▪ The software must provide comprehensive data back-up and restoration capability.</li> <li>▪ The system will function in web-based system where the hand-held device shall work as a node.</li> <li>▪ The application software should maintain the logs of user activities to facilitate the audit trail.</li> <li>▪ The system should have sufficient security features such as firewall, access control system, biometrics, password protection, audit trail, anti-virus etc.</li> <li>▪ Database server should be able to handle the activities of all the handheld devices at one time simultaneously with huge database size of prosecution, ownerships, driving license etc., without affecting the performance.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ The software should be able to generate various periodical reports, summaries, MIS reports, query reply etc... as per the requirements of Jalandhar Traffic Police.</li> <li>▪ Administrator should be able to modify the master tables as and when required and should have the capability to push the changes to hand-held devices.</li> <li>▪ All database tables, records etc. required for various dropdown menus etc. shall also be created by the vendor.</li> <li>▪ The application software is to be provided by the vendor to handle various processes of the prosecution required by the office of senior police officers, Courts etc.</li> </ul>
<b>9</b>	Hand Held Devices for e-challan system	<ul style="list-style-type: none"> <li>▪ Once the application is loaded on the hand-held device, there should be no possibilities to modify the application by the user. Reloading and modifying of application should be possible only by an administrator.</li> <li>▪ On switching on the hand-held device, the system must give access only after validation through user ID and password.</li> <li>▪ The communication between the server and hand-held device would be through GSM/GPRS/ 3G or better connectivity etc.</li> <li>▪ Every challan created must have a unique system generated identification number.</li> <li>▪ The HH application must be able to access information from the main Server and display upon request, pop-up tables/codes, vehicle and license details, all types of offences, compounding amount, challan types, vehicle details, court calendar etc. in order to minimize the typing by the prosecuting officer.</li> <li>▪ The hand held device should be lightweight and easy to hold.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ The HH device should be able to access data/ information on the basis of driving license number, vehicle registration number etc. from the main server data relating to previous offences.</li> <li>▪ The hand-held application software should also suggest date of challan, place of challan, name of the Court and court date etc. to further reduce typing by the officer. These fields should be design in consultation with Jalandhar Traffic Police.</li> <li>▪ When a challan is issue, the name and ID of the officer should be print on the Challan.</li> <li>▪ The HH device must be able to input and print multiple offences on the same Challan</li> <li>▪ The HHD software must validate Challan fields automatically before the Challan is printed. The system must ensure that certain fields are properly complete before allowing the Challan to be printed.</li> <li>▪ When downloading application software or pop-up tables or lists to the HH, or uploading challan records to the Server, synchronization of HH system must be automatic, in order to minimize human intervention</li> <li>▪ Uploading data to the Database Server should be automatic in consistent manner.</li> <li>▪ The application should provide features wherein when a driving license/ vehicle registration number is entered; it should be able to pull from the server all the details relating to the driving license holder/ vehicle owner including history of previous offences.</li> <li>▪ Software should capture the list of documents seized during prosecution and such list must be reflected on the printed court challan.</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<ul style="list-style-type: none"> <li>▪ The handheld application software shall allow the user to generate a summary report to facilitate evaluation of his daily work. The entire day report of the official be auto submitted to the administrator at the end of the day or closing hours of the official duty when HH is submitted at Office</li> <li>▪ Once the Challan is complete and saved, any further editing should not be possible unless so authorized by administrator.</li> <li>▪ Each hand-held device should be provided with original printed user manual and appropriate carry case for HH device with charger.</li> <li>▪ The application software should allow online payment through payment gateway</li> <li>▪ There should be automatic rejection of payment for the settlement of expired notices or challans. Partial payment of an offence must not be accepted by the system including previous violations fees.</li> <li>▪ The software should update DL/RC smart card with the booked offence.</li> </ul>
10	Public Address System	<ul style="list-style-type: none"> <li>▪ The Public Address System (PAS) should be capable of addressing citizens at specific locations from the JICCC.</li> <li>▪ The proposed system shall contain an IP-based announcing control connected to the JICCC.</li> <li>▪ Public Address System shall be used at intersections, public places, market places or those critical locations as identified by JSCL to make important announcements for the public. It shall be able to broadcast messages across all PAS or specific announcement could be made to a particular location supporting single zone / multi zone operations. The system shall also deliver pre-recorded</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<p>messages to the loud speakers attached to them from CD/DVD Players &amp; Pen drives for public announcements.</p> <ul style="list-style-type: none"> <li>▪ The system shall contain an IP-based amplifier and uses PoE / PoE+ power that could drive the speakers. The system shall also contain the control software that could be used to control/monitor all the components of the system that includes Controller, Calling Station &amp; keypad, Amplifier (Mixing &amp; Booster).</li> <li>▪ The 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 that will be mentioned in BID DOCUMENT.</li> <li>▪ PAS 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.</li> <li>▪ PAS master controller should facilitate multiple MIC inputs and audio inputs.</li> <li>▪ IP and PC based solution – easy to use and maintain</li> <li>▪ Remote configuration and administration</li> <li>▪ PoE/PoE+ or 12V power</li> <li>▪ 10/100Base-TX Ethernet</li> <li>▪ The system should not be an end of life / end of service product.</li> </ul>
11	Emergency call Box	<ul style="list-style-type: none"> <li>▪ The emergency box (or panic button) will enable citizens to establish a two-way audio (microphone and speaker) – video (video camera and a video screen) communication link with operation staff at JICCC (or other locations</li> </ul>

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Sl. No.	Functions	Minimum Specification
		<p>where control solutions is deployed) through a press of a button.</p> <ul style="list-style-type: none"> <li>▪ Emergency Call box to be strategically located, suitably sized and identified/clearly labelled for “Emergency”. Emergency button once pressed will send a call to the nearest police station.</li> <li>▪ The emergency feature must also be available within the mobile app which will enable the user to initiate a bidirectional audio – video call with operation staff at JICCC. In absence of connectivity, the application should send the current location and contact number of the citizen using emergency feature through text message to JICCC.</li> </ul>

### 7.5.7. Technical Specifications

#### ANPR LIU

Sl. No	Minimum Specification
1.	Shall have minimum Quad Core CPU (4 physical CPU cores)
2.	Shall have minimum 64-bit architecture
3.	Shall have minimum 8 GB RAM (DDR3-1600 or above)
4.	Shall have minimum 500 GB Hard Disk
5.	Shall have Dedicated Gigabit network port per camera (MTU 9000 / jumbo frames), +1 LAN port
6.	Shall have capability to connect 4 cameras per LPU

## **7.6. Variable Messaging System (VaMS)**

The purpose of Variable Message Displays is to provide public information to citizens related to traffic, environment, disasters, city information, route information etc.

Variable messaging displays will be used to display the useful information related to:

- Traffic congestion
- Accidents incidents
- Ongoing Roadwork zones
- Speed limits
- Key notices or messages from JICCC like information about any emergency or disaster
- Display the parking availability information, etc.

VaMS system is one of the important and effective tool to manage traffic in response to road incidents, special events and construction or maintenance activities on the road. When drivers are to be warned of an incident, advised to opt for an alternate route, guided to reach a specific location or clear a lane as a response to an incident, the message posted should be appropriate and precise. The messages and the procedure for displaying them should be such that the information is grasped by a driver whose primary focus is driving his vehicle while ensuring his and his co-passenger's safety.

The VaMS unit shall be able to communicate with the Jalandhar Integrated Command and Control Centre System (JICCC) using GSM Data/Wi-Fi/ Ethernet/SMS Channel. GSM data channel (GPRS) / Wi-Fi shall be used to send online messages and SMS channel shall be used to send configuration packets to configure the SIM. Ethernet port shall also be extended to ground level using necessary cables for local troubleshooting. Each unit shall be provided with a unique identification number and shall communicate with Jalandhar Integrated Command and Control Centre System (JICCC).

VaMS shall be managed and operated from the JICCC where information in the form of data messages shall be fed in a manner to be displayed on a specific VaMS installed at a particular location or across all locations. The VaMS boards shall be viewable from a distance of 100m and various angles on the road.

For installing VaMS Signboards, the MSI shall provide Gantry with spans, as required at various locations (single lane road, double lane road). Spans need to be specify depending on the number of

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lanes that need to be bridged. MSI shall consider additional space for lateral clearance as well as a vertical clearance height as per NHAI (National Highway Authority of India) guidelines.

Variable messaging System (VaMS) will be used by other applications like Intelligent Signalling, Environment Monitoring, etc. as mentioned in respective sections.

The sign age which appears on the road to be readable and visible, should be displayed for a certain time duration so that the road user reads it. The reading time is the time that driver actually takes to read a sign message. The exposure time is the length of time a driver is within the legible distance of the message. Exposure time of the message must be always greater than reading time.

Speed (Kmph)	Time (sec) to Travel 300m
50	21.6
70	15.4
90	12
100	10.8
120	9

It is however, recommended that the size and distance for clear legibility should be designed for at least 15 seconds for NH and 20 seconds for access-controlled expressways. Furthermore, the messages need to be displayed alternately in PUNJABI, HINDI, and 'ENGLISH', if possible pictorially as well. The board having the facility to display minimum of 2 lines of 12 or 15 English characters, can have English display in 1st line and other language in 2nd line, at the same time as well. When the VaMS displays a series of messages, 2-4 seconds per message is recommended. The blinking feature may be used on one or more of the messages. It should, however, not be used for more than one line of each message.

### 7.6.1. Scope of Services

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

- Installation of IP based VaMS boards at approximately 25 locations across the city. These VaMS boards shall have different characteristics depending upon the location and purpose of installation. VaMS board displays are to be controlled by Jalandhar Traffic Police or personnel from the JICCC.

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- Installation of Poles/Cantilevers/Gantry as required power connection, power backup, Installation and configuration of application and network connectivity.
- Details of Installation of Poles/Cantilevers/Gantry if required, Civil and Electrical works, earthing, etc. from Intelligent Signalling components etc.

### 7.6.2. Geographical Scope of Services

Sl. No	Locations
1	Bus stand
2	Central railway station
3	Cantonment railway station
4	Verka Milk Plant
5	Gulshan Hotel
6	PAP chowk
7	Dakoha Railway Crossing Chowk Point
8	Wadala Chowk
9	Municipal corporation
10	Guru Nanak Mission Chowk
11	Pholriwal Gate

**Note : Above is the tentative list of locations and detailed list of all 25 location will be finalized post system study/ feasibility report submitted by MSI**

### 7.6.3. Functional Requirements

Sr. No.	Minimum Specifications
1	<p><b>General</b></p> <p>The system should be capable to display warnings, traffic advice, route guidance and emergency messages to motorists from the JICCC in real time</p> <p>The system should also be capable to display warnings, traffic advice, route guidance and emergency messages to motorist by using local PC/Laptops.</p> <p>The VaMS should display text (multi lingual – Hindi &amp; English or any other local language) and graphic messages using Light Emitting Diode (LED) arrays.</p> <p>The System should able to display failure status of any LED at JICCC.</p>

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Sr. No.	Minimum Specifications
	The System should support Display characters in true type fonts and adjustable based on the Operating system requirement
	The VaMS workstation at the JICCC should communicate with the VaMS controller through the network. It should send out command data to the variable message sign controller and to confirm normal operation of the signboard. In return, the VaMS workstation should receive status data from the VaMS controller.
	VaMS controllers should continuously monitor the operation of the VaMS via the provided communication network.
	Operating status of the variable message sign should be checked periodically from JICCC.
	It shall be capable of setting an individual VaMS or group of VaMS's to display either one of the pre-set messages or symbols entered into the computer via the control computer keyboard or by another means.
	It shall be capable of being programmed to display an individual message to a VaMS or a group of VaMS's at a pre-set date and time.
	A sequence of a minimum of 10 messages/pictures/ pre-decided sign or group of signs shall be possible to assign for individual VaMS or group of VaMS's.
	It shall also store information about the time log of message displayed on each VaMS. The information stored shall contain the identification number of the VaMS, content of the message, date and time at which displayed message/picture starts and ends.
	The central control computer shall perform regular tests (pre-set basis) for each individual VaMS. Data communication shall be provided with sufficient security check to avoid unauthorized access
2	<p><b>Variable Message Sign board application</b></p> <p>Central Control Software allows controlling multiple VaMS (up to 20) from one console.</p>

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Sr. No.	Minimum Specifications
	Capable of programming to display all types of Message/ advertisement having alphanumeric character in English, Hindi, Punjabi and combination of text with pictograms signs.
	Capable of controlling and displaying messages on VMS boards as individual/group.
	Capable of controlling and displaying multiple font types with flexible size and picture sizes suitable as per the size of the VaMS.
	Capable of controlling brightness & contrast through software.
	Capable to continuously monitor the operation of the Variable Message sign board, implemented control commands and communicate information to the Traffic Monitoring Centre via communication network.
	Real time log facility – log file documenting the actual sequence of display to be available at central control system
	Multilevel event log with time & date stamp
	Access to system only after the authentication and acceptance of authentication based on hardware dongle with its log.
	Location of each VMS will be plotted on GIS Map with their functioning status which can be automatically updated.
	Report generation facility for individual/group/all VaMSs with date and time which includes summary of messages, dynamic changes, fault/repair report and system accessed logs, link breakage logs, down time reports or any other customized report.
	Configurable scheduler on date/day of week basis for transmitting pre-programmed message to any VaMS unit
	Various users should access the system using single sign on and should be role based. Different roles which could be defined (to be finalized at the stage of SRS) could be Administrator, Supervisor, Officer, Operator, etc.
	Apart from role based access, the system should also be able to define access based on location

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Sr. No.	Minimum Specifications
3	Rights to different modules / Sub-Modules / Functionalities should be role based and proper log report should be maintained by the system for such access
	Components of the architecture must provide redundancy and ensure that there are no single points of failure in the key project components. To take care of remote failure, the systems need to be configured to mask and recover with minimum outage.
	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.
	System shall use open standards and protocols to the extent possible
	Facility to export reports to excel and PDF formats.
3	<p><b>Remote Monitoring</b></p> <p>All VaMS shall be connected/configured to Traffic Monitoring Centre for remote monitoring through network for two-way communication between VaMS and control Room to check system failure, power failure &amp; link breakage.</p> <p>Remote Diagnostics to allow identifying reason of failure up to the level of failed individual LED.</p>

### 7.6.4. Technical Specifications

Sl. No.	Minimum Specification		
1	Dimensions	3.0 mtr length X 1.5 mtr height X 0.2 mtr depth. (3000mm x 1500mm X 200mm)	
2	Colour LED	Full Colour, class designation C2 as per IRC/EN 12966 standard	
3	Luminance Class/Ratio	L3 as per IRC/EN 12966 standards	
4	Luminance Control & auto Diming		

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	a	Should be automatically provide different luminance levels but shall also be controllable from the traffic centre using software
	b	Auto dimming capability to adjust to ambient light level (sensor based automatic control)
	c	Photoelectric sensor shall be positioned at the sign front and sign rear to measure ambient light. Capable of being continually exposed to direct sunlight without impairment of performance.
5		Contrast Ratio R3 as per IRC/EN 12966 standard
6		Beam Width B6+ as per IRC/EN12966 standards
7		Pixel Pitch 20mm or better
8		Picture Display
	a	At least 300mm as per IRC /EN 12966 standards
	b	Full Matrix: Number of lines & characters adjustable, active area: 2.88mX1.2m at least
	c	Synchronized Dot to Dot display.
	d	Capable of displaying real time, customized messages generated by JICCC.
	e	Special frontal design to avoid reflection.
	f	Display shall be UV resistant
9		Viewing Angle B6+ as per IRC/EN12966 standard- Viewing angle shall ensure message readability for motorists in all lanes of the approach road
10		Viewing Distance Suitable for readability from 150 Mtrs. or more at the character size of 240mm, from moving vehicles.
11	a	Self-Test
	b	VMS shall have self-test diagnostic feature to test for correct operation.
	c	Display driver boards shall test the status of all display cells in the sign even when diodes are not illuminated.
	d	All periodic self-test results shall be relayed to the JICCC in real time to update status of VaMS
12	a	Alarms
	b	Door Open sensor to Inform Control room during unauthorized access
	c	LED Pixel failure detection alarm
13		Flicker Refresh Frequency should not be less 90 Hz. No visible flicker to naked eye.

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14		Multiple Data Communication interface/Ports	RJ45 Ethernet, RS232, RS 485, FC port and any other suitable
15		Communication (connectivity)	Wired/GPRS based wireless technology with 3G upgradable to 4G capability.
16		Ambient Operating Temperature	The system should be capable of working in ambient temperature range of -5 oC to 55oC.
17		Humidity (RH)	Operating ambient humidity: 10% - 95% Rh or better.
18		Protection against Pollution/dust/water	Complete VMS should be of IP 65 protection level from front and IP54 from side and rear. As per EN60529 or equivalent Standard
19		Power	
	a	170-250V AC (more than 90% power factor) or DC as per equipment requirement.	
	b	Protection for overvoltage/ fluctuation/drop of the nominal voltage (50%) shall be incorporated.	
	c	The enclosure shall contain at least two 15 Amp VAC (industrial grade) outlet socket for maintenance purpose	
20		Power Back-up & its enclosure	UPS for 15 Mins power back-up with auto switching facility. The enclosure of UPS and battery should be pole mountable with IP 65 protected housing and lockable. Batteries with solar charging options can also be recommended as back up
21		Material for VaMS frame	at least 2mm aluminium or non-corrosive, water resistant or better
22		Mounting, Installation and finishes	
	a	Mounting structure shall use minimum 6 Mtrs. high hexagonal/octagonal MS Pole or suitable structure with 5.5 mtr. Minimum vertical clearance under the VaMS sign from the Road surface. MSI shall be responsible to carry out the site survey to assess site requirement including pole height/suitable structure for VaMS installation at various places in the city.	
	b	The mounting shall be capable of withstanding road side vibrations at site of installation.	
	c	It shall be provided with suitable walkway for maintenance access.	

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	d	The sides interior and rear of enclosures shall be provided in maintenance free natural aluminium finish. All enclosure shall be flat and wipe clean.	
	e	Rugged locking mechanism should be provided for the onsite enclosures and cabinets	
	f	For Structural safety, the successful bidder has to provide structural safety certificate from qualified structural engineers approved/ certified by Govt. Agency.	
23		Wind Load	WL9 as per EN12966 to withstand high wind speeds and its own load.
24	Cabling, connections and Labelling.		
	a	All cable conductors shall be of ISI marked for quality and safety. It shall be of copper insulated, securely fastened, grouped, wherever possible, using tie warps approximately every 10-20 cms or cable trays.	
	b	All connections shall be vibration-proof quick release connections except for power cables terminating in terminal blocks, which shall be screwed down.	
	c	All terminal block shall be made from self-extinguishing materials. Terminations shall be logically grouped by function and terminals carrying power shall be segregated from control signal terminals.	
	d	All cables shall be clearly labelled with indelible indication that can clearly be identified by maintenance personnel using “As built: drawings”.	
	e	Lightening arrester shall be installed for safety on each VMS.	
	f	The successful bidder has to provide safety certificate from qualified Electrical engineers approved/certified by Govt. Agency	
25		Local Storage in VaMS	Embedded VaMS controller should be capable to store at least 100 messages and symbols/pictograms to allow display to run in isolated mode on a predefined structure/ timings, in case of connectivity failure.

## 7.7. Helpdesk

### 7.7.1. Functioning of Helpdesk

Operational support for all the locations, through a suitable helpdesk system need to be design to ensure that the solution is functioning as intended and that all problems associated with operation are resolved satisfactorily. The MSI shall provide a web enabled helpdesk management

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system with SMS and email based alert system for the Helpdesk Call management and SLA reporting. MSI shall be required to setup a centralized helpdesk at the Jalandhar Integrated Command and Control Center (JICCC). The MSI shall be responsible for procurement, installation, commissioning and operations & maintenance of helpdesk including supply & installation of IT / Non IT infrastructure along with necessary application software required for the smooth functioning of the Central Helpdesk at both the location

MSI shall provision for the infrastructure necessary for managing the Help Desk including rent charges for Toll-free telephone line(s) at the Help Desk location. MSI shall provide multiple channels to log a complaint such as Toll-free lines, landlines, helpdesk tool, E-mail, direct walk-in etc. Outage of any component shall be calculate as a time between logging the call and closing the call.

A helpdesk is envisaged to be provide for the resolution of technical queries by internal users. Typical helpdesk activities (indicative) shall include, but not limited to:

1. Deployment of sufficient manpower to attend the helpdesk requests for extending technical support on hardware, network, application etc. to users
2. Deployment of web-based tool for the helpdesk
3. Provide Help Desk facility for agreed SLAs for reporting technical incidents / issues / problems with the system. Help desk facility shall be provided through Toll-free lines, landlines, helpdesk tool, E-mail, direct walk-in etc.
4. Implement a call logging system in line with the severity levels as per the SLAs. The Help desk shall log user calls related to system and assign an incident/ call ID number. Severity shall be assign to each call as per the SLAs.
5. Track each incident / call to resolution.
6. Escalate the calls, to the appropriate levels, if necessary as per the escalation matrix agreed upon with JSCL
7. Analyse the incident / call statistics and provide monthly reports including but not limited to:
  - i. Type of incidents / calls logged
  - ii. Incidents / calls resolved
  - iii. Incidents / calls open

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8. Helpdesk Solution shall further have the capability to upload frequently asked questions and solutions.

Helpdesk becomes the central collection point for service staff contact and control of the problem, change, and service management processes. This includes both incident management and service request management. This shall be the first level of support (L1).

It is also expected that a second level of centralized support (L2) shall also be maintain at the same location from where the various zones/wards can be serviced in case of problem escalation. If a problem is not resolve by telephone/help desk tool and the User declares the problem to be of an emergency nature, MSI shall dispatch a Field Service Staff member who shall provide On-site Support Service according to service levels given.

The Helpdesk shall act as a single point of contact for all users whether for service requests, incidents or problems. It shall encompass Helpdesk, Asset Management and Vendor Management. In addition, it shall offer a focused approach for delivering integrated Service Management and provide an interface for other functions in IT Services Continuity Management like Maintenance Contracts, Software Licenses etc.

MSI shall implement effective Helpdesk Management procedures to leverage the knowledge gained in providing faster and better solutions, create knowledge bases and prevent recurrence of problems.

### **7.7.2. Helpdesk Capacity**

MSI is required to provide a minimum 8-seater helpdesk at Jalandhar Integrated Command and Control Center (JICCC) during all operation hours that will be specified in the BID DOCUMENT. However, if the MSI believes that in order to meet the SLAs, additional capacity is required, the same may be provide by the MSI. It is also to be noted that, any supervisors required for the Helpdesk Operators shall be over and above the minimum operators mentioned.

### **7.7.3. Manpower requirement**

The MSI is required to provide defined number of Operators at Helpdesk for operating and managing the Helpdesk, which will be mention in BID DOCUMENT. The Operators shall perform various activities including:

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- a. Understanding the query/issue in the reported request. Query could be related to the following:
  - o Hardware including issues related to desktop/laptop, printer/multi-function device, local server, routers/switches
  - o Application including login and password issues, accessing a particular module, navigation assistance, report generation assistance
  - o Network including internet/intranet and end-user device connectivity
- b. Providing information / clarification on the spot in case of an informational query or providing necessary troubleshooting assistance in case of a logged issue
- c. In case of technical issues for which a resolution is not possible instantly, the operator shall submit the request into the system for escalation and further action by the MSI's team
- d. Process all service requests, dispatch them to field personnel who shall perform the follow up

### **Field Support Staff**

The MSI is required to provide Field Support Staff for undertaking all activities on field to complete a call logged by a User. MSI is expected to deploy enough number of Field Support Staff to ensure that SLAs which will be mentioned in BID DOCUMENT.

#### **7.7.4. Function Requirements of Help Desk Operations**

##### **Automated Call Distribution Software**

- ACD system (Hardware & Software) shall be provided in 1:1 Hot Standby configuration.
- The ACD system shall be able to handle call & IP Phone capacity defined.
- System should support skill base routing, multiple group support, priority handling and Queue status indicator. It is desirable that calls to certain trunk groups or to certain dialled numbers be assigned a higher priority than other calls and that calls which overflow from another split be queued ahead of other calls.
- System should support 50 (Fifty) call center agents on a single server

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- Single system should be able to administer 100 (hundred) agents
- Call overflow: The system should support call overflow routing e.g. if there is a queue in particular ACD group and another group is sitting idle, system should be able to transfer the calls to another group based on the settings defined by the administrator.
- Skill Assignment and Preference Levels: The proposed system must be able to assign individual skills to each call taker/agent (i.e. Bilingual, training or experience level, product knowledge, customer knowledge, etc.). Individually assigned skills must be able to be ranked and rated in terms of priority, proficiency or preference.
- Virtual Seating or Free Seating - The proposed system must support the concept of virtual seating. Call takers/agents can log-on from any "soft phone" instrument within the system. Call takers/agents on the proposed system will be logically defined, rather than requiring a "soft phone" extension and termination. Each Call taker/agent and supervisor on the system must have an individually assigned log-on identification number, which permits individual statistics to be collected by the ACD management information system. Multiple log-on events by the same individual during a work period at different terminals must be tracked individually as one "shift".
- The system should support assigning multiple skill sets (minimum 120) to an agent without degradation of the overall system capacity.
- Route calls to remote call centres based on agent skill availability.
- Prioritized call routing — It shall be possible to define Agent Preference options
- ACD System should be able to support integrated self-service applications.
- ACD System should be able to run defined workflow via HTTP request.
- In addition to the above, The ACD system should have the following features:
  - Expert Agent Selection (EAS)
  - Expert Agent Selection – Preference Handling Distribution (EAD-PHD)
  - Least Occupied Agent (LOA)
  - Reason Codes for AUX Work & Log-Off
  - Skill Level and Expert Agent Distribution
  - ISDN Network Call Redirection (NCR)
  - Service Observe of Logical Agent
  - Service Level Maximizer (SLM)

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- Forced Agent Logout from ACW
- ASA (Average Speed of Answer) Routing
- The offered voice system should have an integrated call center functionality, both IP and non-IP and It should also support both IP and non-IP agents simultaneously
- The system should support load balancing of calls among multiple ACDs.
- The offered system should redirect unanswered calls.
- Offered system should support to provide the capability to the supervisors for logout agents from their own voice terminal without having to go to the agent's desk & it could be possible from a remote location.
- The proposed system should support a multisite call center environment with multiple distinct sites as a single virtual call center operation. It should also have a capability to allocated call between sites based upon agent skills, agent availability, queue times, and other criteria.
- The offered ACD system should be able to collect request information, such as a zip code or account code, before the call is sent to an agent and then route the call based upon that information.
- Proposed system could use the estimated wait time or average speed of answer to make routing decisions.
- The offered system should predict the estimated wait time for various split/skills and pick the best destination for a call to avoid excessive wait times and subsequent overflow. It should support predictive wait time routing
- Call routing program have a capability to connect the caller to an Interactive Voice Response (IVR) system while the call remains in queue for an agent. The incoming call should not lose its place in queue when the call is routed to voice applications, audio text announcements, or other IVR applications.
- The system should promote agent fairness relative to equitable agent call distribution for multi-skilled agents. The system should be able to distribute calls to agents based on ACD work occupancy instead of idlest or longest current idle time.
- Both agents and supervisors should be notified via the telephone indicators when thresholds are reached for individuals and groups.
- The offered system should have a capability for agents to record personalized greetings that can be played to the caller prior to connection to the agent.

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- The offered system should support for service level call routing. Like for each call type in terms of “answer X% of this type of calls within Y seconds” and will your ACD routing algorithms use our specified X & Y service level factors to route and deliver specific calls accordingly to meet the specified objectives.

### **CTI - Computer Telephony Integration Software**

- The CTI shall be provided with 1:1 Hot Standby configuration to avoid any single point of failure.
- The CTI system shall be able to handle call & IP Phone capacity defined above.
- The CTI platform shall be able to provide the caller's CLI information. It shall be possible to send & populate agent's PC with CLI information.
- The offered CTI platform shall support a set of APIs.
- The CTI link shall be able to pass events and information of agent states and changes in agent states as well as incoming calls to the computer applications, e.g., if the customer calls from the same no. from which he had called earlier (registered/unregistered), the CTI platform shall be able to automatically fetch and display at least last 5 service requests details for that customer.
- The CTI shall maintain the accounting and authorization logs of the users accessing the components of the telephony system. The logs shall include information users who have logged-in into the system and the specific commands entered by them.
- It shall have web-based GUI console for administration, configuration & management of the system, Real-time information/alerts and reports regarding health status e.g. up/down status, performance & resource utilization statistics etc. of the system shall be available through this console.

### **Voice Recording System for Agent Calls - Softphone Software**

#### **Recording:**

- The call recording solution (Hardware & Software) shall be provided in hot standby configuration.
- The solution must be able to record IP phone communication via the LAN, without employing a passive or active IP sniffing on the network.

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- The recording solution must provide a single universal license that can support recording on all phones including analog phone, digital phone, IP phone, IP soft-phone.
- The solution must be able to record encrypted IP phone communication via the LAN.
- The solution should also be able to record IP, Digital & analog endpoints
- Should record inbound ACD calls and outbound dialler calls.
- Should be able to support Master-Slave configuration in case of large deployments
- support for Centralized or decentralized search and replay of calls
- "Tag" or classify calls with user-defined labels for simplified search and replay

### **Quality Recording:**

- The solution shall provide scalable screen recording.
- The solution should allow for voice only, data only, or voice and data recording based on specific event triggers.
- The solution should support selective recording based upon user-defined business rules
- The solution should have the capability to record based on a particular schedule (for example, record all calls on Tuesday from 9:00 - 11:00 AM for agent XYZ).
- The system should show the status of the agents; which agents are logged on.
- The solution should allow for the automatic refresh of the logged on agent display.
- The solution should be able to provide real-time agent monitoring.
- The solution should provide an optional desktop application to allow agents to initiate and /or terminate recording (Record on Demand)
- System should support Rules-based recording

### **Reporting:**

- Standard out-of-the-box reports generation should be possible.
- The system should be able to customize the reports
- The reporting system shall be part of an industry standard platform, or it should be a propriety product.

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- Reports should be scheduled for automatic delivery to email or a file directory.
- Both text and graph reports shall be offered.

### **Evaluation of Agents (scoring)**

- This should include adding questions, changing weightings and changing values.
- Evaluate multimedia calls and application use
- The solution should allow the user to create, without vendor customization, multiple grading templates using questions provided by the user.
- The solution should have the capability of inserting notes on a per-question basis and a summary note into the grading form.
- Easy to create evaluation forms
- Recording supported for wide range of contact center needs including inbound and outbound calls, phone, email and web chat
- The solution should produce scorecards with multiple Key Performance Indicators (KPIs).
- The solution should be able to show trends based on historical performance.
- Individual scorecards should give an overview of individual agent performance, supervisor group performance, manager's group's performance, overall contact center(s) performance and enterprise contact center performance.

### **Analytics:**

- It should be able to integrate other forms of metadata.
- The system should be able to be extended to include additional metadata.
- The data should be stored in an industry standard, non-proprietary format.
- It should support encrypted audio.

### **IP Phone - Softphone Software**

- The IP phones should be of the same make as that of IP PBX supplied by MSI.
- The IP Phone shall have an interactive and user-friendly alphanumeric display to make use of the key phone very simple.
- The IP Phones shall support connection of Headset.
- The IP Phone shall have LED/LCD Indicator for Call Waiting and Message Waiting.
- It shall be possible to set preferences such as Display Contrast and Ring Types.

### **Voice Broadcasting Software.**

This may be the integral part of CAD software or Master System Integrator (MSI) may purchase the separate tool as per the below mentioned requirement and later integrate with CAD solution

<b>Broadcasting (BOLOs)</b>	
<b>1</b>	BOLOs should be sent to: <ul style="list-style-type: none"><li>▪ Any CAD workstation/terminal</li><li>▪ Any personnel by name</li><li>▪ Groups of personnel by name, unit and/or terminal</li><li>▪ All units on a specified event</li><li>▪ Combinations of the above</li></ul>
<b>2</b>	Should have ability to associate a BOLO to an Event number
<b>3</b>	Should have association of the BOLO to an Event number results in the automatic population of the location information in the Broadcast dialog
<b>4</b>	Should have ability to associate a BOLO to a case number
<b>5</b>	BOLOs should be created without relating to an event
<b>6</b>	Should have ability to create a Broadcast (BOLO) in association with an event and place the event in a Held status in one function

### **Telephony System (IP PBX System and Gateway) - Answering Service Software**

- 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.
- The system software version offered should be the latest release as on the date of supply of EPABX as available globally.
- The call processing, Signalling & networking components of the offered system shall be based on open standards.
- The system architecture should allow for incremental application additions to the enterprise without modification to existing feature server software
- The PBX shall be provided in 1:1 Hot Standby mode to avoid any single point of failure. The PBX servers shall work in 1:1 Hot standby configuration in such a manner that if one server fails the second server is able to take the complete load of calls automatically (without any manual intervention) without dropping any existing calls (IP, TDM & PRI).

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- The PBX and gateway shall be rack mountable.
- The system shall allow outbound calling from the IP Phones.
- The system shall support local announcements and music on hold.
- The software shall provide GUI based interface for configuration and management of the system.
- The system shall maintain the accounting and authorization logs of the users accessing the components of the telephony system. The logs shall include information about users who have login into the system and the specific commands entered by them.
- It shall be possible to schedule tasks. The tasks could be one or more operations that the user can specify to run at a predetermined date and time.
- It shall provide reports about station alarms, trunk analysis, processor occupancy, system capacity etc.

### 7.7.5. General Requirements

Sl. No.	Minimum Specifications
1	The contact center solution should be able to route voice/ VOIP calls from centralized Interactive Voice Response System (IVRS) to respective call center (s) along with interaction history of the calling party.
2	The callers should be able to access the various services through state-of-art centralized integrated Interactive Voice Response System (IVRS). The information is envisaged to be available to the customer through telephone (IVRS) and call centers agents.
3	The IVRS should establish two way communication on the same channel with customers through recorded synthesized voice in English, Hindi and Punjabi Language or in combination of languages to give information, reply to queries and provide other
4	IVRS should be modular and scalable in nature for easy expansion without requiring any change in the software.
5	It should be possible to access IVRS through any of the access device such as Landline telephone, Mobile phone (GSM as well as CDMA) etc.

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Sl. No.	Minimum Specifications
6	IVRS should support various means of Alarm indications in case of system failures e.g. Functional error, missing voice message prompt, etc., and shall generate error Logs.
7	The system should have the ability to define business rules based upon which the system should quickly identify, classify and prioritize callers, and using sophisticated routing, to deliver interactions to the best qualified agent in the any of the connected local/remote call center, regardless of interaction channel
8	<p>The application should provide CTI (Computer-Telephony Integration) services such as:</p> <ul style="list-style-type: none"> <li>a) Automatic display (screen pop) of information concerning a user/customer on the call agent screen prior to taking the call based on ANI, DNIS or IVR data.</li> <li>b) Synchronized transfer of the data and the call to the call center agent.</li> <li>c) Transfer of data corresponding to any query raised by any IP agent regarding a query raised by a customer whose call is being attended by the call IP agent.</li> <li>d) Call routing facilities such as business rule based routing, skills-based routing etc.</li> </ul>
9	The application should support integration to leading CTI middleware vendors.
10	Should provide pre-integration with industry standard IVR servers and enhance routing & screen-pop by passing forward the information.
11	Should provide facilities for outbound calling list management, and software based predictive or preview dialing.
12	The application should allow service level plans to be varied by day, time of day, or a specific date.

### 7.7.6. Other requirements

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Sl. No.	Minimum Specifications
1	It should provide consistent user interface across multiple media types like fax, SMS, telephone, email, and web call back.
2	The executive's desktop should have a "soft-phone" – an application that enables standard telephony functions through a GUI.
3	It should provide the executives with a help-desk functionality to guide them to answer a specific query intelligently.
4	It should also provide an easy access to executives to previous similar query which was answered successfully.
5	It should also be possible to identify a request to be a similar request made earlier.
6	It should be possible for executives to mark a query as complex/typical and put it in to database for future reference by other agents.
7	It should be possible for executives to escalate the query.
8	System should be able to integrate with e-mail / SMS gateway so that appropriate messages can be sent to the relevant stakeholders after the interaction and any updates thereon.
9	Should intelligently and automatically responds to email inquiries or routes inquiries with skills based routing discipline to agents.

### 7.8. Geographic Information System (GIS)

One of the goals of the smart city initiative is to create a single citizen interface where all data and applications are available on a GIS platform. An initial effort was conducted by Municipal Corporation to create the GIS database. As part of smart city initiative, a full-fledged GIS infrastructure has to be established as part of JICCC and use the existing geodatabase with the following features:

- Use City level GIS platform, infrastructure & application as a foundation for Smart City solution, City Operation Center & Command & Control Center
- Collaboration of various city stakeholders & departments together and to have a connect and engagement via a common GIS window for all operations
- Use GIS as spatial planning and analysis for various operations within city
- Use GIS as a Decision support system to prioritize actions
- To have a location based services to citizens of cities for better transparency & quick actions

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- GIS based spatial and non-spatial queries for citizens and administrators and departmental stakeholders
- Provide administrators, citizens, tourists, businesses real time, and actionable information to aid their day-to-day decision-making

There shall be a separate RFP which will be floated to have a Project Management Unit for creating geodatabase for Jalandhar city,

The broad scope of RFP shall be:

- Identify the GIS layers with required attributes for day to day operations of each of the project component
- Collection of required GIS/CAD data from various line departments and conversion to GIS ready format
- Mapping of ICT related information for Smart city assets with detailed attribute details
- Provide all the required GIS data in standard format for Application Development
- To provide necessary API/Inputs to MSI to integrate various citywide applications
- Creation GIS data layers on GIS Map

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The existing details of GIS infrastructure is as follows:

TS Data Layers	Sec-1	Sec-2	Sec-3	Sec-4	Sec-5	Sec-6	Sec-7	Sec-8	Sec-9	Sec-10	Sec-11	Sec-12	Sec-13	Sec-14	Sec-15	Sec-16	Sec-17	Sec-18	Sec-19	Sec-20
Bank																				
Box																				
Bridges and Flyover																				
Bus Stand																				
Canal																				
Carriage Way																				
DGPS																				
<b>Dispensary</b>																				
Drainage																				
Dustbin																				
EB Poles																				
Electricity Poles																				
Electric Line																				
<b>Fire Brigade</b>																				
Footpath																				
Garbage Point																				
<b>Hospital</b>																				
Key Institutions																				
Land Marks																				
Manholes																				
Mobile Towers																				
OFC																				
OHSR																				
Open Plot																				
<b>Overhead Water Tank</b>																				
Parks																				
<b>Police Stations</b>																				
Post Office																				
Railway Line																				
Road Centreline																				
School/College																				
Sector Boundary																				
Street Light																				
Telephone Poles																				
Temple_Mosque																				
Tree																				
Toilet																				
<b>Traffic Signals</b>																				
Transformers																				
Vent Pipe																				
Water Tap																				
Zonal Office																				
<b>Legend</b>																				
Data/Layer Not Available																				
Available																				

## GIS database Creation

The PMU team will create standard data formats in coordination with stakeholders and will update the data layers as required to develop smart city specific GIS database. The PMU team will develop the GIS application for city using the data provided.

PMU team will be responsible to collect the required data from concerned departments. The PMU team is also responsible for data layer creation or mapping of ICT related assets and sensor systems (like locations of streetlight poles, CCTV cameras, utilities, Smart bus shelters, environment sensors etc.). If this requires field survey, it needs to be done by PMU team. The

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PMU team will regularly update the GIS data as per standard formats required for holistic operations of JICCC.

### 7.8.1. Functional requirement for GIS based City Analytics

Vertical	Minimum GIS Analysis & Capabilities required
Solid waste management	<p>The GIS system &amp; Platform should support effective planning of schedules to better plan and service collection requirements.</p> <p>GIS system should support to reduce unwanted trips by optimal route planning leading to greater per vehicle productivity with full compliance to planned schedules.</p> <p>GIS system should enable identification of solid waste disposal sites based on multiple criteria like slope, drainage, proximity to waterbodies, residential area etc. for efficient use of land and other natural resources within the city.</p> <p>GIS system should give information to public about the date, time and other information of garbage collection area wise.</p> <p>GIS system must suggest the location for proposed bins in the city by GIS analytics for effective management of waste based on various factors such as populations, nearby hospitals and schools, areas that require cleaning etc.</p> <p>Web GIS system should support GIS based dashboards to showcase the results and information in the form of pie charts, bar charts, histograms, threshold bars, query ,highlight and selections etc.</p>
Utility Water, Sewerage & storm water Network etc.	<p>GIS system should be capable of modelling a water distribution network, mapping the location of Point of Sale, Isolation Trace of affected network area &amp; customers, Illicit Discharge Trace, Service Qualification, Optimized network routes to maximize revenue by considering locations, suggest alternate routing options and determine the impact on revenue streams, etc. GIS system should support designs creation for network expansions, Integration with SCADA, ERP systems, billing</p>

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Vertical	Minimum GIS Analysis & Capabilities required
	<p>system, Metering system (smart meters), 3rd party Network Management systems for specific spatial analysis. The GIS system should be easily configurable to meet specific requirements like Network isolation Trace, Service Qualification etc. without having to build them from scratch, and with the assurance of following best practices, and capable of extending based on requirements. GIS system must have operational dashboards that dynamically linked to the water asset information's &amp; gives the entire status of O&amp;M.</p> <p>GIS system to perform the sewerage network tracing, Manhole inspection, Monitoring – preventive maintenance, field crew navigation applications, field survey application and reports for repairs etc.</p>
Environmental Sensors / Air Quality Monitoring	<p>GIS system should support to spatially map the air quality data, following statistical analysis to predict the values associated with spatial or spatiotemporal phenomena Primarily for environmental sensor reading analysis in order to decide if they pose a threat to environmental or human health and warrant remediation. GIS system should be capable of using proven deterministic methods of statistical Analysis to calculate unknown values of air quality: Inverse distance weighted, local polynomial, global polynomial, radial basis functions etc. The techniques should help to quantify the spatial autocorrelation among measured points and account for the spatial configuration of the sample points around the prediction location. GIS System should be capable to make a prediction— From the kriging weights for the measured values, calculate a prediction for the location with the unknown value. GIS system should be capable of accounting the error introduced by estimating the semivariogram model, by using many semivariogram models rather than a single semivariogram. It should be able to identify trends in the cluster of point densities to spatially locate the new, consecutive, intensifying, persistent, diminishing, sporadic, oscillating</p>

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Vertical	Minimum GIS Analysis & Capabilities required
	<p>and historical hot and cold spots based on “Getis-Ord Gi” statistic P-Value &amp; Z-Score for each feature in a dataset.</p> <p>GIS system based on the location analytics must find the areas that are causing the pollution like nearby industries and identifies the open green spaces where plantation can be improved for pollution reduction.</p>
<b>Provision for Property Tax and Land management</b>	<p>Property Tax /Land administration platform should seamlessly integrate with field operations and should securely connect to disparate systems to maintain the integrity of survey data. This GIS platform should support in creating and maintaining cadastral data and should streamline work processes and speeds the enrolment of new parcels including Tax Parcel editing including the tools, workflow, topology, error checking, version management, and historic rollback that make mapping and public records tasks quick and easy. It should be able to identify GIS tax data errors based on set of rules and behaviours that model how points, lines, and polygons share coincident geometry.</p> <p>Support field data collection to collect data against a map or form-based data and integration with Enterprise cadastral system and track tax payment status per plot.</p>
<b>Intelligent Traffic System, Routing &amp; ICT for City bus services</b>	<p>It should help to maintain inventory of assets (roads, buildings, bridges etc.) along with asset details and condition data. It should support assigning and editing network features such as barriers, turns and unidirectional flow and should provide Multipoint routing ability. A network dataset is capable of modelling a single mode of transportation, 3D and Multimodal network datasets. The GIS system should help to track the location on real-time, in scheduling and determining the optimum number of vehicles required on the road, and optimal routing tools for multiple vehicles to reduce fuel consumption and therefore create a</p>

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Vertical	Minimum GIS Analysis & Capabilities required
	<p>smaller carbon footprint. It should support to determine the best route assignment and order sequence.</p> <p>There should be analytics on the re-routing tools and the multimodal transportation system for moving point A to others by various communication methods like city bus, BRFTS, Metro etc. GIS system to highlight the passenger information system on the map that would be integrated with the PIS system of city bus. It should support to Store Coordinate Geometry Measurements to provide the results on a survey plan. It should support Linear referencing system to associate multiple sets of attributes to portions of linear features without requiring that underlying lines be segmented. System should support dynamic segmentation to compute the map locations of events stored and managed in an event table using a linear referencing measurement system and displaying them on a map. System should be able to identify the closest facility along the transportation network. System should be able to identify the suitable location based on maximising attendance, minimising impedance, maximum capacity or based on market share required to be covered.</p>
Smart parking system	<p>The system should have functionality to display the parking information on the map. System should be able to display real time parking lot availability on map. It should be able to identify trends in the cluster of point densities to spatially locate the new, consecutive, intensifying, persistent, diminishing, sporadic, oscillating and historical hot and cold spots. It should be able to analyse the trend of parking requirements in an area during time periods.</p>
Emergency Management Planning,	The Suite of applications should support preparation and response to emergency situations.

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Vertical	Minimum GIS Analysis & Capabilities required
Command centre control room operations	<p>1. To identify threats or current hazards, define the impact to people and places, Plan, execute and monitor response activities, Communicate essential information to public etc.</p> <p>2. Leverage configurable applications to rapidly deploy decision support tools to simplify the implementation of data and maps to accurately determine potential impacts by fusing incident data with critical infrastructure, population densities, and other community values using spatial analysis tools like Flood Planning, Citizen Service Request, Impact Summary Map etc. to Support decision makers with dynamic and actionable information.</p>
City Surveillance (Safety & Security Analysis)	<p>City GIS must map CCTV cameras &amp; integrate multiple sources of information, displays results on a map or satellite image, create a view shed area to visualize security camera coverage and plan the most efficient camera placement for security monitoring etc.</p> <p>It should support to analyse relationships between neighbourhood characteristics and incidents with respect to safety &amp; security. It should be able to analyse the trend and represent the number of incidents that occurred in that area during a specific period, show the change in an area's incident rate etc.</p> <p>The system should provide a consistent method to measure concentrations of events over time by identifying trends in the cluster of point densities. To spatially locate the new, consecutive, intensifying, persistent, diminishing, sporadic, oscillating and historical hot and cold spots to identify areas with chronic problems and indicates the direction in which a particular incident may be shifting.</p> <p>GIS system must be capable of calculating the service area based on time and roads that need to block (Nakabandi) for catching thief's/criminals.</p> <p>GIS system must calculate and suggest the sites where police petroleum or vans are required based on the incident data to minimize the incident</p>

Vertical	Minimum GIS Analysis & Capabilities required
	activities in the city. GIS System should be capable of maintaining data history, version management and conflict detection.

### 7.8.2. Integration of GIS Maps with Smart City Elements

MSI would analyse the integration of all mentioned Smart elements with Jalandhar GIS maps and provide operations that help achieve KPI's mentioned for each of the Smart elements. MSI should conduct analysis of integration points and provide a detailed report and get approval from JSCL before integration. It should also include the layers of the utility departments which are already existing with MCJ. MSI is responsible to work with the previous vendor to get the GIS Maps and integrate (Geo tagging, Geo fencing etc.) with Smart elements. JSCL will help MSI get the details from each line department and facilitate to get the required information on time. MSI shall develop operational procedures using GIS Map Interface.

GIS Map will be provided by JSCL on ArcGIS for integration. Following are the objectives from the GIS Integration.

1. GIS Map should be used as a common platform across all the solutions including Smart parking, Environmental, Sensors Monitoring, Intelligent Traffic Management, E-Governance, Utility Management system, Public Transport, Police Vehicles etc.
2. Appropriate geo referencing & geo tagging on the map should be done covering all relevant Smart elements in BID DOCUMENT and various POI's such as public amenities, bus stops, bus routes, bin locations, transfer stations, street poles etc.
3. The component mapping should be multi layered keeping in vision the requirements for next 20 years.
4. GIS data modal need to be designed in accordance with Smart City solutions and need to be scalable and robust in nature so that it can meet any future need of smart solution and integration with future smart solutions and modules of city.
5. Alert, Events, Statuses for each smart element including hardware and software should be displayed on GIS Map.
6. The related Smart elements like Variable messaging system (VaMS) should also be displayed in the same layer for the application. Ex: Traffic Management, Environmental monitoring.

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7. All government buildings and spaces should be geo tagged for the City of Jalandhar and shall be capable of data analytics based on GIS base map updates.
8. GIS data modal integrated should support domains, subtype, spatial rules and relationship, joins and spatial references etc.
9. GIS catalogue should be used to manage and maintain the GIS data modal. It must support database administration for user creation and management for GIS database.
10. City Level GIS Portal: GIS Web will include city portal for as a single window for accessing all the location based information. For more details, please refer e-governance section of DPR
11. Department specific search & query module should produce relevant output.
12. GIS maps must be integrated with GPS devices to locate real time position on GIS map & provide optimal route mapping.
13. SWM Assets mapping on GIS such as bins, transfer stations, landfill, garbage collection sites etc. Authority will provide SWM department related data.
14. There must be various analysis and work operations for Solid waste management from GIS application such as Geo fencing of waste bins, Geo fencing of vehicles, locate bins and bins location, signals, CCTV Surveillance cameras and provide planning & route optimization.

## 7.9. Disaster Management

MSI has to provide a separate module for Disaster Management solution. The Disaster Management module should be able to collect gather and analyse the critical data of city from various components. The system should be able to create a strategic view or big picture of probable disaster. The system should be intelligent enough to make decisions that protect life and property. The system should disseminate such decisions to all concerned agencies and individuals. The critical data elements may be decided in consultation with JSCL. The system should be able to use predictive analysis which can finally reduce response time and improve SLAs. Disaster Management module should be able to communicate or to be integrated with National Emergency Operation Centre (NEOC) of **National Disaster Response Force (NDRF)** based on defined SOPs. The Disaster Management system should be in compliance to applicable laws. The Disaster management module should have interoperability between cities, here it refers that disaster management module of any city should be able to cater the

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disaster management operation of any of the other cities as applicable. Standard Operating Procedures (SoP's) must adhere with the Governance structure of JSCL and Municipal Corporations, as in case of any incident or disaster decision making ability lies with JSCL.

### **7.10. Jalandhar Environmental Monitoring System (JEMS)**

Environmental pollution, particularly of the air, is nowadays a major problem that unknowingly affects lives in the cities. As clear focus of building [city] as one of the finest example of SMART city, JSCL believes it is important that citizens know of the air that they breathe. Citizens & visitors to City can enjoy unique experiences that keep them feeling good by knowing city's environment condition at different locations.

The Air quality should be monitored by a network comprising:

- Fixed monitoring stations
- Data processing
- Data transmission to a central system
- A central processing system

#### **7.10.1.KPIs for Environmental Monitoring System**

1. Provide better quality air to citizens of Jalandhar
2. Monitor environment pollution and have measures to control pollution
3. Environmental monitoring to be implemented in all major parts of the city especially in crowded places
4. Environmental monitoring should consist of measuring levels for Temperature, Humidity, Ambient Light, Sound, Pressure, CO, CO<sub>2</sub>, NO<sub>2</sub>, O<sub>2</sub>, SO<sub>2</sub> and compulsorily PM 2.5 and PM 10.
5. Integrate with other disaster management applications from other nodal organizations of environment
6. Additional monitoring will be done in crowded areas of Jalandhar
7. Environment monitoring sensors will be installed dump yards and solid waste management locations and crowded areas of Jalandhar

### **7.10.2.Scope of work**

As part of scope of work, MSI need to perform the below mentioned activities.

1. Install minimum of 5 environment sensors (as per the functional requirement) & display environment related information at various strategic locations through variable message system (VaMS)
2. The environment sensors shall be integrated with the central control system at JICCC to capture and display/ provide feed on Temperature, Humidity, Pollutants like SoX, NoX, CoX, etc., Noise Pollution, Electromagnetic Radiation, UV radiation etc. The data collected should be location-marked.
3. 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.
4. Then this information is relayed instantaneously to signage – large, clear, digital-display screens which let citizens know regarding the prevalent environmental conditions. The environmental monitoring data should be displayed by picking data from VMS application in real time.
5. Further environmental sensors recorded data shall be used by Mobile application developed as part of e-Governance to enable user for alarm management and notification of environmental details on real time basis.
6. Grievance Redressal of Citizen integration to e-Governance Mobile App where citizen can take the picture, upload the same with Geo Tagging. The complaint should be automatically forwarded to the respective staff, with escalation within specified timelines supported with multilingual text to speech, speech to text and speech to speech systems.

### **7.10.3.Components of Environmental Sensors**

1. Wireless Environment Sensor
  - Collect sensor data
  - Send recorded information to central system

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2. Central System
  - Receive information from environment sensors
  - Display the information on real-time basis
  - Send information to mobile phone application
  - Save information in database
3. Mobile Device of Driver
  - Connect to central web-server
  - Receive environment information from central system
  - Alarm management and safe environment mode features
4. Digital Display Unit
  - Shall receive information from the central application System and operate accordingly

### 7.10.4. Functional Requirements

1. Smart environment sensors should gather data about pollution, ambient conditions (temperature and humidity), levels of gases in the city (pollution) and any other events on an hourly and subsequently daily basis. User should be able to set the schedules as per requirements. It is for information of citizens and administration to further take appropriate actions during the daily course / cause of any event.
2. The environment sensors should be having the following capabilities:
  - They should be ruggedized enough to be deployed in open air areas, on streets and parks
  - They should be able to read and report at least the following parameters: Temperature, Humidity, Ambient Light, Sound, Pressure, CO, CO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>, SO<sub>2</sub> and compulsorily PM 2.5 and PM 10 Noise and UV
3. The analysers must function properly in all conditions without any defect between 0 to 55 degrees C ambient temperatures, 0 ambient dust levels. The data capture rate should not be less than 90%
4. The manufacturer of the Equipment should assure technical support for the equipment for the duration as indicated in the scope

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5. Smart environment sensors will inform and enable citizens and administrators to keep a check on their endeavours which impact environment and enable the city to take remedial action if required. These environmental sensors can also be connected via 3G or 4G wireless network or Wi-Fi networks. It is not mandatory to connect all sensors via MPLS fibre network.
6. 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. It is preferred if the platform also includes intelligent analytical engines that makes information meaningful to all stakeholders and helps ease decision making.
7. Integration of environmental monitoring system with Variable messaging system (VaMS) to be displayed wherever possible (need to be finalized post detailed survey of locations).
8. The sensor management platform should allow the configuration of the sensor to the network and also location details etc.
9. The sensors should be able to be managed and calibrated remotely. This includes sensors being updated with calibration parameters, software upgrades. Sensors must also provide updates and detect faults with self-diagnosis functionality.
10. Apart from information provision, the sensors must ensure data is transmitted securely and have security measures from sensors to the software platform. It must also ensure tamper alerts are provided in cases of vandalism, security breaches, etc.
11. Any sensor failure should alarm and generate an event that should be linked with Incident Management system automatically and should be capable to schedule the automation of sending the failure report to the vendor
12. The sensors provided should be 99% accurate and should be of industry standards
13. Apart from information provision, the sensors must ensure data is transmitted securely and have security measures from sensors to the software platform. It must also ensure tamper alerts are provided in cases of vandalism, security breaches, etc.

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14. Calibration system should be provided for the calibration of the air quality analyzers, data acquisition system.
15. The data collected should also be available on permitted mobile devices as necessary
16. Real time or averaged data can be viewed quickly and easily client interface on the central computer
17. It should have a feature for viewing instantaneous and historical data in the form of tables and graphs either locally or from a remote client
18. Generation of reports for pollution load, wind etc. should be available
19. Alarm annunciation of analyser/sensor in abnormal conditions in the control center so that appropriate action can be taken by authorities
20. The environmental sensors should be visible as a layer in GIS Maps

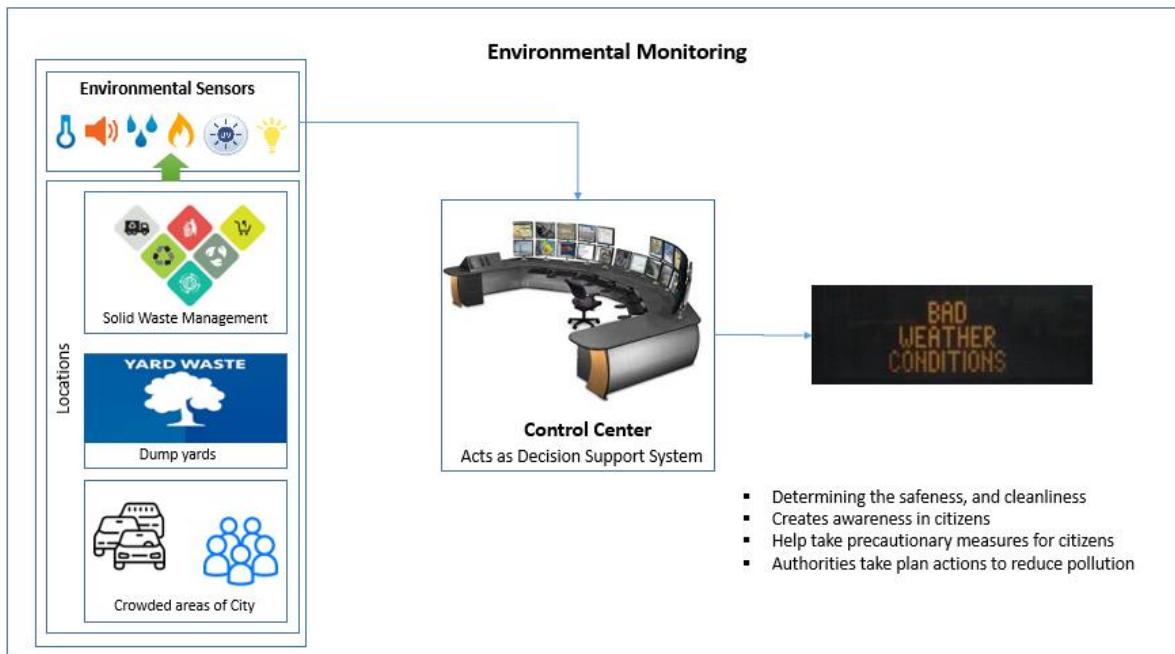


Figure: Illustrative diagram of Environment Monitoring

### 7.10.5. Geographical Scope

Sl. No	Locations
1	Bus stand
2	Model Town
3	Cantonment railway station
4	BMC Chowk
5	Guru Nanak Mission Chowk

### 7.10.6. Technical Specifications

Sl. No.	Parameter	Minimum Specification
1	Measurement elements	Temperature, Humidity, Ambient Light, Sound, CO, NO <sub>2</sub> , O <sub>3</sub> , SO <sub>2</sub> , PM2.5, PM 10
2	Measurement component Measurement range	O <sub>3</sub> : 0 – 390 ppb
		SO <sub>2</sub> : 0 – 630 ppb
		CO : 0 – 31 ppm
		CO <sub>2</sub> : 0 to 10% / 0 to 20%
		O <sub>2</sub> : 0 to 10% / 0 to 25% (2 ranges each, maximum range ratio 1: 25 except O <sub>2</sub> ) * Optionally, N <sub>2</sub> O and CH <sub>4</sub> can be measured
		PM 2.5: 0 to 250 micro gms / cu.m
		PM 10: 0 to 450 micro gms / cu.m
		Light: up to 10,000 Lux
		UV: Proportion of UV Present in μW/Lumen & Total amount in μW/M <sup>2</sup>
3	Temperature, Pressure and Humidity Sensor	Noise: up to 100 dB (A)
		Real-time Temperature Range: outdoor 0°C ~ 50°C
		Real-time Air Humidity Level Display
		Real-Time Pressure Display (in Bars or millibars)
4	Connectivity	Wi-Fi, Ethernet or GSM (3G)
		Sensors must have provision to interchange between Wi-Fi or GSM systems easily
5	Software and Data backup	Backup measurement data for up-to 5 days in case of network failure or system maintenance cycles

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6	Mechanical Enclosure	Single enclosure with all components inside or simplified mounting
7	Data validity and stabilization	Sensors must ensure data of sensors is valid and not require stabilization times in case of power outages less than 5 hours.
8	Product origin and certification	Must also qualify a minimum international standards on product certification such as CE, FCC and PTCRB
9	Rain Water measurement	in mm
10	Repeatability	±0.5% FS
11	Zero Drift	±1.0% FS max./week ( $\pm 2.0\%$ FS/week max. if range is less than 200ppm) ±2.0% FS max./month for O2 meter
12	Respond Speed	120 seconds max. for 90% response from the analyses inlet

### 7.11. E-Governance

As part of e-governance services of Punjab the government is planning to come up with a Mobile App and web services to enhance the existing G2C services all over the state. To achieve the same, following are the applications components that are being developed by PMIDC for all Municipal Corporation of Punjab.

1. Building Plan Management
2. Water & Sewage
  - New Connection
  - Disconnection
  - Billing
3. **Property Tax**- Assessment & Collection
4. **Fire**- License and NOCs
5. Trade Licenses
6. Compliances and Grievances for all utilities
7. Verification services

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8. Birth & Death Certificate
9. State & ULB dashboards
10. Employee Payroll and Financial Accounts

As part of this project, we intend the MSI to integrate the following component related to the other components of smart city solution with PMIDC common mobile application and web page.

- Solid Waste Management application & Smart Parking application: - This will be integrated after considering the feasibility and adaptability of this feature in the common mobile application of PMIDC.
- Integration of Jalandhar GIS map with PMIDC for location based complains and information related to Police (Static Information) & GIS navigation.
- Location based complains and redressal using Jalandhar GIS map
- Location based Variable messaging system (VaMS) status
- Environmental monitoring information system

### **7.12. Integration with NERS (Mohali, Punjab)**

#### **National Emergency Response System (NERS) with Smart City solution**

Vision of Government of India is to have a single Emergency number across the State for all emergency services. State government has nominated an agency as the PSAP (Public Safety Answering Point) to implement “112” NERS in the state. The Emergency services will report to centralized call center and then further action is performed by respective department and designated nodal agencies. This would ultimately lead to better service delivery, satisfaction of citizens and transparency in department processes.

An integrated Centralized Emergency 112 call center with command and control room will enable call takers, dispatchers and other staff working in the control room environment to be able to efficiently access all communication and information resources required to manage operational incidents effectively. Seamless interaction among various Control Rooms of nodal departments (Police, Health & Fire) shall take the lead position depending on the type of emergency. For example: in case of report

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of fire at some farmer's field during summer, the Fire Emergency Control Room will take the lead by all the call will land on Centralized Emergency 112 call center.

Under Jalandhar smart city– Emergency operations, a provision has made to Integrate IoT elements of JICCC and NERS for a holistic view of emergency operations.

Some of the IoT elements (Vehicle tracking units) shall be installed in PCR vans of Jalandhar by JSCL and are tracked and managed at JICCC. Few of the VTU's shall be installed by NERS in some of the vehicles like Ambulance, Fire and PCR vans. As part of BID DOCUMENT, MSI shall study the feasibility of integration of IoT elements of NERS project into JICCC and IoT elements installed by JSCL shall be integrated into NERS project at Mohali.

As part of NERS projects, there shall be four dispatchers located at JICCC for managing emergency situations at Jalandhar. The number of dispatchers can grow to ten in next 4 years. Provision for seating of these dispatchers to be part of planning as part of JICCC. The hardware and software required for the dispatchers shall be procured by NERS. MSI shall perform a detailed study of integration with NERS and get approval from Authority before integration of the components of Emergency Response System.

### **Scope of work:**

Sl. No	Minimum Specifications
1	To facilitate a common live view in case of an incident, the IoT data shall be Geo-tagged and Geo-referenced on Jalandhar GIS Map and integrate with common operations platform of JICCC). The MDT and VTU's installed by NERS project shall be integrated with JICCC.
2	During an incident when a call is received by NERS, the location of the incident displayed in NERS control center will simultaneously be displayed at JICCC. This information shall help dispatchers to take relevant action near the premises of the incident using common operations platform.
3	Write integrated SOPs as required for JICCC
4	To establish connectivity between two locations, a dedicated channel/ any other wireless technology can be implemented between NERS & JICCC; the cost

Sl. No	Minimum Specifications
	incurred for setting up the connectivity should be considered as part of BID DOCUMENT.
<b>5</b>	There shall be seamless integration between the components of NERS and JICCC for managing emergency operations
<b>6</b>	The data gathered for an incident including location & activities performed during emergency operations should be recorded for further analysis.
<b>7</b>	MIS reports for emergency response calls shall be made available at JICCC

#### 7.12.1. Technical Specifications

### 7.13. Edge Analytics (Optional)

#### Edge Analytics with continuous learning

Following use cases should be implemented by MSI using edge analytics. All the cameras provided shall work with edge analytics software and the device located at field location. AI implementation for the use cases shall be done by AI OEM only. MSI shall need to do the detailed analysis and submit a report for implementation of AI with continuous learning and get the approval from JSCL before procurement of the equipment's and software.

These use cases are to be implemented using Artificial Intelligence through various cameras, sensors implemented in the field without dependency on any type of camera, sensors (Field device agnostic) with continuous learning capabilities, following use cases are to be part of implementation but not limited to:

#### Surveillance:

- Multi object classification and facial recognition
- Lost human, pet, vehicle recognition
- Gunshot & other arms recognition
- Graffiti and Vandalism detection
- Detection and Recognize the pattern of demonstration and conflicts in crowd

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- Detection and classification of human, animal and vehicle
- Safety: Detection and classification based on:
  - Behavioural Biometry: Identification through multiple behaviour
  - Parking violation
  - Speeding vehicle
  - Accident detection
  - Loitering detection
  - Person climbing barricade
  - Person collapsing
- 'Vehicle of interest' tracking by colour, speed, number plate
- Unwanted/ banned vehicle detection
- Wrong way or illegal turn detection

and other use cases mentioned in section video analytics as applicable.

### **Environmental Monitoring:**

- Environmental condition detection
- Air quality detection
- Collecting ambient information (CO<sub>2</sub>, noise level, temperature, and humidity) leading to decision-making to estimate levels of crowd density

#### **7.13.1. Advantages of Edge Analytics**

- If the sheer amount of data overloads the network infrastructure connecting the gateways to the backend infrastructure, e.g. in the case of video cameras providing a stream of high-resolution images.
- If very fast response times are required for local actuations and the network introduces significant delays.
- If the raw data is not supposed to be stored, e.g. due to privacy information, and only processed results may be provided.
- If the frontend is provided by a different stakeholder who does not want to/is not allowed to provide the raw data.

**Examples:**

- Deploying logic on edge gateways that enable local actuation in reaction to a stimulus e.g. when unusual, potentially suspicious activity is sensed in dark areas, deploy an app on a gateway (Using cloud) with logic to switch on street lights;
- Deploying on-demand special purpose apps (From cloud) and analytical capabilities on edge devices, enabling collection of more detailed data as the situation unfolds, e.g. deploy a car plate recognition app on a gateway to help police locate a suspect's car through cameras in a car park.
- Orchestrating high speed network links to communicate back to a control room for better quality data about the situation, such as high-resolution video streams, CCTV, etc.

# Chapter 8: Indicative Bill of Material and Costing



# Chapter 9: Project Implementation Time lines and Deliverables



## 8. Project Implementation Timelines and Deliverables

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The implementation timelines for the project components are as given below.

S No.	Phase	Timeline
1	Issuance of Letter of Intent	A
2	Submission of Performance Bank Guarantee	A + 30 days
3	Signing of Contract with MSI	A + 30 days = T
4	Completion of Project Inception Phase incl. Mobilization of Team	T + 1 month
5	Completion of Requirement Phase, including Feasibility Study and Site Survey	T + 3 months
6	Completion of Design Phase & Report	T + 5 months
7	Installation of HW/Infrastructure, SW Phase & Report	T + 9 months
8	Completion of Integration	T + 10 months
9	UAT, FAT, STQC, etc.	T + 11 months
10	Go-Live (G)	T + 12 months = G
11	Operation and Maintenance	G + 4 years

## 9. Project Deliverables

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Sl. No	Key Activities	Deliverables
1	Project Kick Off	1. Project Plan
2	Deployment of manpower	2. Risk Management & Mitigation Plan
3	Assess the requirement of IT Infrastructure and Non IT Infrastructure	1. Functional Requirement Specification document 2. System Requirement Specification document

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4	Assessment of Business processes (From an assessment perspective for JICCC)	3. Other technical documents 4. Requirements Traceability Matrix 5. Site Survey Report 6. Engineering Drawings for Command Center 7. Layout drawings for Smart Components to be deployed
5	Assessment of requirement of Software requirements	
6	Assess the Integration requirement	
7	Assess the connectivity requirement all locations (including Building)	
8	Assessment of network requirement	
9	Assessment of training requirement	
10	Formulation of Solution Architecture	1. Location wise Bill of Quantity in detail 2. HLD documents
11	Creation of Detail Drawing	3. LLD documents (which include ER diagrams, database designs, GUI design, data definitions, etc.)
12	Detailed Design of Smart City Solutions	4. Application Architecture documents. 5. Technical Architecture documents. 6. Network Architecture documents.
13	Development of test cases (Unit, System Integration and User Acceptance)	7. Test Plans 8. SoP's for the command center 9. Change Management Plan
14	Preparation of final bill of quantity and material	
15	SoP preparation for command center based on extensive consultation with all stakeholders	
16	Helpdesk setup	1. IT and Non IT Infrastructure Installation Report
17	Physical Infrastructure setup	2. Completion of UAT and closure of observations report
18	Procurement of equipment, edge devices, COTS software (if any), Licenses	3. Training Completion report
19	IT and Non IT Infrastructure Installation	4. Application deployment and configuration report
20	Development, Testing and Production environment setup	5. Software License documents 6. Hardware warranty documents

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

# Annexure: General Requirements



## Annexure: General Requirements

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The general requirement for successful execution of Smart city is mentioned under this section. During initial phase of project, MSI is required to draft / prepare and then finalize the detailed architecture for the overall ICT systems for the Smart City features, by incorporating findings of site surveys. The Solution envisaged by the MSI should be able to provide real time Jalandhar Integrated Command and Control Center (JICCC).

All the components & Sub-Components of the Overall Smart City Solution and the respective Technical Architecture should:

- At least comply with the published e-Governance standards, frameworks, policies and guidelines available on <http://egovstandards.gov.in> (updated from time-to-time);
- Be of leading industry standards
- Comply with the Cyber Security Model Framework for Smart Cities issued by MoHUA

It is the responsibility of MSI to provide the Infrastructure Fault Management System, which perform the following functions:

### a) Infrastructure Fault Analysis

1. The proposed solution must automatically discover manageable elements connected to the network and map the connectivity between them. The Network Fault Management consoles must provide the topology map view from a single central console.
2. The proposed system must support multiple types of discovery including IP range discovery, Seed router based discovery & Trap-Based Discovery
3. The system should provide discovery & inventory of heterogeneous physical network devices like Layer-2 & Layer-3 switches, Routers and other IP devices and do mapping of LAN & WAN connectivity with granular visibility up to individual ports level.

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4. The system must be able to support mapping and modelling of the infrastructure grouped by network connectivity, physical location of equipment and user groups or departments
5. The system should support maps grouped by network topology, geographic locations of the equipment's and user group/departments. These should help in understanding physical Network, virtual Network services and the relationships between them.
6. The system must provide visualization tools to display network topology and device to device connectivity. The system must also be able to document connectivity changes that were discovered since the last update.
7. The proposed solution must provide a detailed asset report, organized by vendor name and device, listing all ports for all devices. When a report is run the administrator must have an option of specifying the number of consecutive days the port must be —unused|| in order for it to be considered —available.
8. The proposed solution should provide out of the box root cause analysis with multiple root cause algorithms inbuilt for root cause analysis.
9. It should have a strong event correlation engine which can correlate the events on the basis of event pairing, event sequencing etc.
10. The system must be able to “filter-out” symptom alarms and deduce the root cause of failure in the network automatically.
11. The proposed solution must support an architecture that can be extended to support multiple virtualization platforms and technologies

### **b) Configuration Management for Critical Network Devices**

1. The system should be able to clearly identify configuration changes as root cause of network problems
2. The proposed fault management solution must be able to perform real-time or scheduled capture of device configurations
3. The proposed fault management solution must be able to store historical device configurations captured in the database and thereby enable comparison of current device configuration against a previously captured configuration as well as

compare the current configuration against any user-defined standard baseline configuration policy.

**c) Advanced IP Services Management for technologies like QoS and Multicast**

1. The proposed solution should be able to support response time agents to perform network performance tests to help identify network performance bottlenecks.
2. The proposed solution should be able to monitor QoS parameters configured to provide traffic classification and prioritization for reliable VoIP transport. The proposed solution should discover and model configured QoS classes, policies and behaviours.
3. The proposed solution should provide the ability to discover, map & monitor multicast sources & participating routers wherein the system should be able to visualize the distribution tree in the topology map.

**d) Infrastructure-based SLA Management and Integration Requirements**

1. The proposed service management system should provide a detailed service dashboard view indicating the health of each of the departments / offices in the organization and the health of the services they rely on as well as the SLAs.
2. The system must be capable of managing IT resources in terms of the business services they support, specify and monitor service obligations, and associate users/Departments/ Organizations with the services they rely on and related Service/Operational Level Agreements.
3. Root cause analysis of infrastructure alarms must be applied to the managed Business Services in determining service outages. SLA violation alarms must be generated to notify whenever an agreement is violated or is in danger of being violated.
4. The system must provide the capability to designate planned maintenance periods for services and take into consideration maintenance periods defined at the IT resources level. In addition, the capability to exempt any service outage from impacting an SLA must be available.

5. The proposed NMS should provide unified workflow between the fault and performance management systems including bi-directional and context-sensitive navigation
  6. The system must support seamless bi-directional integration to helpdesk or trouble ticketing system
  7. The proposed network fault management system should integrate with the helpdesk system by updating the Asset with CI information to support viewing history or open issues in helpdesk on the particular managed asset and associate an SLA to the ticket in the helpdesk.
- **Manageability Review:** - The agency shall verify the manageability of the system and its supporting infrastructure deployed using the Enterprise Management System (EMS) proposed by the MSI. The manageability requirements such as remote monitoring, administration, configuration, inventory management, fault identification etc. shall have to be tested out.
  - **SLA Reporting System:** - MSI shall design, implement/customize the Enterprise Management System (EMS) and shall develop any additional tools required to monitor the performance indicators listed under SLA. The Acceptance Testing & Certification agency shall verify the accuracy and completeness of the information captured by the SLA monitoring system implemented by the MSI and shall certify the same. The EMS deployed for system, based on SLAs, shall be configured to calculate the monthly transaction-based payout by JSCL to MSI. The MSI may provide an end to end Service Level Management System for the Data center and Network Infrastructure
    1. Provide end-to-end, comprehensive, modular and integrated management of IT infrastructure components to maximize the availability of IT services and SLA performance.
    2. The management system needs to aggregate events and performance information from the domain managers and tie them to service definitions. This capability is critical for the administrators to have a complete view of the performance and availability of various application services being managed.

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3. The proposed tools should automatically document problems and interruptions for various IT services offered and integrate with the service level management system for reporting on service level agreements (SLAs).
4. The system must be capable of managing IT resources in terms of the business services they support, specify and monitor service obligations, and associate users/Departments/ Organizations with the services they rely on and related Service/Operational Level Agreements.
5. Provide a detailed service dashboard view indicating the health of each of the departments / offices in the organization and the health of the services they rely on as well as the SLAs.
6. Provide a high level view for executives and other users of the system using a real time business services Dashboard.
7. Provide an outage summary that gives a high level health indication for each service as well as the details and root cause of any outage.
8. Support for a User Definition Facility to define person(s) or organization(s) that uses the business Services or is a party to a service level agreement contract with a service provider or both. The facility must enable the association of Users with Services and SLAs.
9. The Service Level Agreements (SLAs) definition facility must support defining a set of one or more service Guarantees that specify the Service obligations stipulated in an SLA contract for a particular time period (weekly, monthly, and so on). Guarantees supported must include one that monitors service availability (including Mean Time to Repair (MTTR), Mean Time between Failure (MTBF), and Maximum Outage Time thresholds) and the other that monitors service transaction response time.
10. SLA violation alarms must be generated to notify whenever an agreement is violated or is in danger of being violated.
11. Provide the capability to designate planned maintenance periods for services and take into consideration maintenance periods defined at the IT resources level. In addition, the capability to exempt any service outage from impacting an SLA must be available.

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12. A historical reporting facility that will allow for the generation of on-demand and scheduled reports of Business Service related metrics with capabilities for customization of the report presentation.

A list of SLAs that needs to be measured using the proposed monitoring tools is given below. These SLAs must be represented using appropriate customizable reports to ensure overall service delivery.

Monitoring system should be capable of sending alerts through SMS, email alarm etc.

### **1. Service Level Category: Network Infrastructure**

#### **Network Specific SLAs**

- Uptime SLA
- MTBF (Mean Time Between Failures) & MTTR (Mean Time to Repair)
- Latency & Response Time (DNS / DHCP / SMTP etc.)
- Traffic-based SLAs

### **2. Service Level Category: Data Centre IT Infrastructure**

#### **System Specific SLAs**

- System Availability
- System Response Time
- Utilization based SLAs (CPU / Memory etc.)

### **3. Application Specific SLAs**

#### **End-User Based SLAs**

- End-to-End Response Time for End-User Web Pages to Load
- Avg. Response Time, Errors Per Interval, Response per Interval
- SLAs from Critical Processes (e.g. Submit Button Click, Upload Action in Portal)

### **4. Transaction Based SLAs**

- SLAs for Business Process involving with multiple steps / pages
- Completion Time SLA for Critical Business Processes

### **5. Application Deep-Dive SLAs**

- Application Component-Wise SLA within the DC

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- SLA for DB Query to Complete
  - Web Services Call etc.
  - 3rd Party interaction SLAs between Applications
- 6. Project Documentation:** - The Agency shall review the project documents developed by MSI including requirements, design, source code, installation, training and administration manuals, version control etc. Any issues/gaps identified by the Agency, in any of the above areas, shall be addressed to the complete satisfaction of JSCL.
- 7. Data Quality:** - The Agency shall perform the Data Quality Assessment for the Data digitized/ migrated (If required) by MSI to the system. The errors/gaps identified during the Data Quality Assessment shall be addressed by MSI before moving the data into production environment, which is a key mile stone for Go-live of the solution.

# Annexure: Technical Requirements



## Annexure: Technical Requirements

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While designing the solution architecture, the MSI need to submit the detailed Technical Architecture for all the components along with the detailed description of each of the Smart City ICT Component, their Sub-Components. The Solution should factor in and 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 Jalandhar City. The system should also support vertical and horizontal scalability so that depending on changing requirements from time to time, the system may be scaled upwards. There must not be any system imposed restrictions on the upward scalability in number of cameras, data center 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 200 concurrent internal users and 1000 mobile users. The Applications proposed for various vertical solutions shall be capable of handling 100% 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 there 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 MSI shall make the provision for high availability for all the services of the system. Redundancy has to be considered at the core / data center components level

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- **Security** - The architecture must adopt an end-to-end security model that protects data and the infrastructure from malicious attacks, theft, natural disasters etc. MSI 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 Appropriate insurance cover must be provided to all the equipment supplied under this project.

Field equipment installed through this project would become an important public asset. During the project period, the MSI 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

All the system(s) implemented for the Jalandhar Smart City Project should be highly secure, with adequate security & protection of the sensitive data relating to the Jalandhar City and its residents. Few such overarching security considerations are briefly described below; the MSI is expected to submit the most appropriate Security Features for the overall ICT Solution:

1. The Generic architecture of smart city generally consists of four layers - a sensing layer, a communication layer, a data layer and an application layer, and these four layers are overseen by the smart city security system. Architecture of information Technology Systems deployed in Smart City need to be open, interoperable and scalable
2. The message exchange between various applications in the smart city should be fully encrypted and authenticated. Any application outside the Data Centre (DC) should talk to the applications hosted in the data center through only predefined APIs.
3. Convergence of multiple infrastructures into one Central platform for ease of management in a Smart City is mandatory. Applications hosted in the central data center should support multi-tenancy with adequate authentication and Role based access control mechanism for each tenant pertaining to their respective line department infrastructure

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4. The smart city architecture should be capable of managing heterogeneous data, which would be continuously communicated through numerous devices following different protocols. In order to ensure that the flow of data between devices does not run into latency issues, appropriate protocols need to be deployed so as to minimize latency. The following communication protocols could be used for the different layers for data flow.
  - **Between applications and back end systems:** HTTP, SQL, FTP, SNMP, SOAP, XML, SSH, SMTP
  - **Between back end systems and field devices:** Message Queue Telemetry Transport (MQTT), xMPP, RESTful HTTP, Constrained Application Protocol (CoAP), SNMP, IPv4/6, BACnet, LoNworks, Low Power Wide Area Network (LoRa), Fixed, 4G/5G, Wi-Fi, WiMax, 2G/3G from field devices: ZigBee, oLP, ETSI LTN, IPv4/6, LowPAN, ModBus, Wi-Fi, 802.15.4, enocean, RFID, NFC, Bluetooth, Dash7, Fixed, ISM & short-range bands.
5. Data Layer (termed as City Digital platform/ fabric) should be capable of communicating with various types of sensors/ devices and their management platforms/applications for single/multiple services irrespective of software and application they support. Data exchange between various sensors and their management applications must strictly happen through this layer, thus making it one true source of data abstraction, normalization, correlation and enable further analysis on the same. Adequate security checks and mechanisms as described in later points to be deployed to protect data layer from data confidentiality breach and unauthorized access.
6. The entire information Technology (IT) infrastructure deployed as part of Smart city will follow standards like - ISO 27001, ISO 22301, ISO 37120, ISO 3712, ISO 27017, ISO 27018, BSI PAS 180, BSI PAS 181, BSI PAS 182, for Wi-Fi access - PEAP (Protected Extensible Authentication Protocol), 3rd Generation Partnership Project (3GPP), etc. or preferably MSI should engage with TPA at the requirement formulation stage for STQC/Cert-in. Cost of the certification will be borne by MSI.

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7. Application Program Interfaces (APIs) should be published and the IT systems be running on standard protocols like JSON / XML or REST etc.
8. From a network security perspective all information that flows on the network should be encrypted to ensure safety and privacy of confidential data. The devices at each endpoint of the network should be authenticated (using mechanisms based on attributes one of which could use passwords). The authentication system so used on these endpoint devices should ensure that only authorized users are sending data over the network, and there is no rogue data that is sent to the control systems to generate false alarms or sabotage the systems
9. All sensors deployed as part of IT and IT based systems in the Smart cities should talk only to the identified Jalandhar Smart City network, and do not hook on to the rogue networks' The guidelines to secure Wi-Fi networks as published by Department of Telecom must be followed
10. Wireless layer of the Smart City Network should be segmented for public and utility networks by using Virtual Private Networks (VPN's) or separate networks in the wired core, so that any traffic from the internet users is not routed into the sensor networks and vice-versa.
11. All traffic from the sensors in the Smart city to the application servers should be encrypted Secure Socket Layer (SSL), PKI and authenticated prior to sending any information. The data at rest and in transit must be encrypted
12. Authentication of sensors in the Smart city should happen at the time of provisioning the sensors, and adding them into the system, and should be based on physical characteristics of the sensors like MAC ID, Device ID etc.
13. Sensors deployed in solutions to set up Smart city should be hardened devices with the ability to be upgraded remotely for firmware through encrypted image files.

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14. As various sensors use multiple protocols to communicate with the underlying network with varied security capability, the system should allow provisioning necessary authentication and encryption at the gateway or the nearest data aggregation level if the sensor is not able to do the same.
15. The Sensors or edge device deployed in Smart city should not have any physical interface for administration. Monitoring of systems and networks should be undertaken remotely.
16. All the sensors in the Smart city should connect to an identified network for Jalandhar Smart City.
17. The data center should be segmented into multiple zones with each zone having a dedicated functionality e.g. all sensors for one operational domain can connect to the data center in one zone, and the internet facing side of the data center should be in another zone
18. The internet facing part of the data center should have a Demilitarized zone where all the customer application servers would be located that are customer facing. Only these servers can access the data from the actual utility application servers on predefined ports
19. The customer application servers should be accessed only by the web server that is hosted in a different zone of the data center.
20. The following should be implemented in the data center - firewalls, intrusion detection & Intrusion prevention systems, Web Application Firewalls, Behavioural analysis systems for anomaly detection, Correlation engine, Denial of Service prevention device, Advanced Persistent Threat notification mechanism, Federated identity and access management system, etc.

■ **Web Proxy Solution:**

Offered solution should be hardened Web Proxy, Caching, Web based Reputation filtering, URL filtering, Antivirus and Anti-malware appliance. All these functionalities should be preferably in a single appliance. Provided operating system should be secured from vulnerabilities and hardened for web proxy and caching functionality.

■ **NGIPS:**

Solution should include Next Generation Intrusion Prevention System (NGIPS) to provide Advanced Threat Protection solution with future enhancements and protocols. Solution should be for both passive (i.e., monitoring) and inline (i.e., blocking) modes. Detection should be capable of detecting and preventing a wide variety of threats (e.g., malware, network probes/reconnaissance, VoIP attacks, buffer overflows, P2P attacks, zero-day threats, etc.). Solution should also be able to detect threats, including at a minimum exploit-based signatures, vulnerability-based rules, protocol anomaly detection, and behavioural anomaly detection techniques.

21. All "applications' and "apps" will undergo static and dynamic security testing before deployment and be tested with respect to security on regular basis at least once in a year'
  - a. All applications and "Apps" deployed as part of Smart city be hosted in India'
  - b. The said architecture Provide:
    - Automatic and secure updates of software and firmware etc.
    - All systems and devices should provide auditing and logging capabilities'
    - Ensure vendor compliance to remove any backdoors, undocumented and hard cored accounts.
    - End-to End solution should be provided with annual end-to-end service availability of 99.999 percent. The end to end service

agreement should be in place for minimum period of five years from the date of operation. Appropriate teams may be set up to monitor cyber incidents and mitigation of same

22. All the information on incidents be shared regularly with Indian Computer Emergency Response Team (CERT-India) and NCIIPC (National Critical Information Infrastructure Protection Centre) and take help to mitigate and recover from the incidents.
23. 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
24. The security services used to protect the solution shall include: Identification, Authentication, Access Control, Administration and Audit and support for industry standard protocols
25. The solution shall support advanced user authentication mechanisms including digital certificates and biometric authentication
26. Security design should provide for a well-designed identity management system, security of physical and digital assets, data and network security, backup, recovery and disaster recovery system
27. 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
28. The overarching requirement is the need to comply with ISO 27001 standards of security
29. 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 Public Key Infrastructure (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 MSI 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

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Standards. The MSI 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:

- 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
- be of leading industry standards

All the personnel working on the Project and having access to the Servers / Data Center should be on direct payroll or possess valid authorization letter of the MSI/OEM/Consortium Partner. The MSI would not be allowed to sub-contract work, except for the following activities:

- Any Passive Networking or Site Preparation/Civil/Electrical work(s) during implementation and O & M period
- Viewing Manpower at the JICCC / viewing centers & 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 timely completion of the work & the quality of the work done shall lie with the MSI. The MSI shall be held responsible for any delay/error/non-compliance/ penalties/ negligence 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 the JSCL before any such resource mobilization.

- **GIS Integration** - MSI shall undertake a detailed assessment for an integration of all the Smart City ICT components with the Geographical Information System (GIS) and any additional layers required for CCTC surveillance by police. MSI is required to carry out the seamless integration to ensure ease of use of GIS in the Dashboards in Jalandhar Integrated Command and Control Center (JICCC). If this may require any field surveys, it needs to be carried out by the MSI. Any such data readily available with the JSCL, shall be shared with MSI. However, the MSI is to check the availability

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of such data and its suitability for achieving the project outcomes. MSI is required to update GIS maps from time to time.

- **SMS Gateway Integration** - MSI shall carry out SMS Gateway Integration with the Smart Jalandhar City System and develop necessary applications to send mass SMS to groups/individuals, wherever required. Any external/third party SMS gateway can be used, but this needs to be specified in the Technical Bid proposal, and approved during Bid evaluation. In addition, wherever feasible, it is envisaged that the MSI proposes to leverage the existing State Solutions, such as NIC Gateways for this purpose.
- **Application Architecture** - The Applications designed and developed for the Departments concerned must follow the Industry Best Practice(s) and Industry Standard(s). In order to achieve the high level of stability and robustness of the application, the System Development Life Cycle (SLDC) 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. 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 JSCL 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.

MSI shall design and develop the Smart Jalandhar City System as per the study that would be done by the MSI.

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

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- c. The user of citizen services should be given a choice to interact with the system in local languages including English, Hindi and Punjabi. The application should pave the provision for uniform user experience across the multi lingual functionality covering following aspects:
- Front end Web Portal in English and local language
  - E-forms (Labels & Data entry in local languages). Data entry should be provided preferably using the Enhanced In-script standard (based on Unicode version 6.0 or later) keyboard layout with option for floating keyboard
  - Storage of entered data in local language using UNICODE (version 6.0 or later) encoding standard
  - Retrieval & display in local language across all user interfaces, forms and reports with all browsers compliant with Unicode version 6.0 and above
  - Facility for bilingual printing (English and the local language)
- d. The application(s) should comply with World Wide Web Consortium (W3C) Web Content Accessibility Guidelines (WCAG) 2.0 Level AA/Other time to time issued Govt. Of India/Govt. of Punjab guidelines for making web content accessible to differently-abled person.
- e. Application should have a generic workflow engine for citizen centric services. This generic workflow engine will allow easy creation of workflow for new services. At the minimum, the workflow engine should have the following features:
- Feature to use the master data for auto-populating the forms and dropdowns
  - Creation of application form, by “drag & drop” feature using Meta Data Standards
    - a) Defining the workflow for the approval of the form
    - b) First in First out
    - c) Defining a Citizen Charter/Delivery of service in a time bound manner
  - Creation of the “output” of the service, i.e. Certificate, Order etc.

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- Automatic reports
  - i. of compliance to citizen charter on delivery of services
  - ii. delay reports
- f. The application should have a module for Management of Digital Signature including issuance, renewal and suspension of Digital Signatures based on the administrative decisions taken by the Govt. of India / Govt. of Punjab. MSI shall ensure using Digital signatures/e-authentication to authenticate approvals of service requests, etc.
- g. e-Transactions & SLA Monitoring Tools
  - i. The MSI should be able to measure and monitor the performance of the deployed infrastructure and all SLAs. More importantly, it should be possible to monitor in REALTIME, the number of citizens touched through e-Services each day, month and year, through appropriate tools and MIS reports.
  - ii. The Infrastructure Management and Monitoring System shall be used by MSI to monitor the infrastructure (Both IT and Non-IT) hosted at the Data center and DR site.
  - iii. For monitoring of uptime and performance of IT and non IT infrastructure deployed, the MSI shall have to provision for monitoring and measurement tools, licenses, etc. required for this purpose.
- h. The Smart Jalandhar City Application should have roadmap/capability to integrate with all the key ICT / E-Governance initiatives of the Government of Punjab (GoP) and Govt. of India (GoI), such as Portal Services, Citizen Contact Centres, and Certifying Authorities, etc., as and when required by JSCL.
  - i. Complete 'Mobile Enablement' of the 'Smart Jalandhar City System.

## Annexure: Use cases

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### Sample Uses cases:

1. **Name of Use Case:** Abandoned objects identified and alarm generated on the video wall to run a SOP to send service request to police personnel.

Use Case: 1

**Purpose:** Alert police regarding abandoned objects at a location identified by surveillance and video analytics application.

**Goals:** Alert nearest field officer and mobile surveillance team about the unattended object location and take create awareness through PAS system.

**Actors:** Surveillance operator, video analytics expert and police.

**Smart Applications:** Video Management Server, Analytics, IoT Platform, Helpdesk/Incident management.

**Description:** An alert be displayed on the GIS Map and a beep can be heard by the result of video analytics of the identified abandoned objects at the surveillance location. Surveillance operator will execute the Standard Operating Procedure to send first action teams (Field Officers and mobile surveillance team) to the location with the details like images and reports of the incident. .

**Pre-conditions:** Video surveillance cameras installed for live video feeds, Video management server is configured to identify abandoned objects and generate alert.

**Post-conditions:** A service request is track and closed with all the incident details.

**Trigger:** Video Management application generates an alert for the abandoned object as configured.

**Constraints:** Correct identification of abandoned objects.

#### Main Flow:

- Surveillance cameras continuously monitor and run the configuration to identify the abandoned objects in its vicinity
- If an abandoned object is identified an alert is generated
- The alert is display on the control center dashboard with required details like location etc.
- The alert is used to activate other cameras to record activities at the same location

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- When an object is identified by video analytics, video management server will identify the time line and record the video feed at the command center for the time
- The alert can also be sent to other cameras in the vicinity for additional video feeds around the incident
- Surveillance operator and analytics expert run through the video feed and identify the suspect
- The SOP is run by surveillance operator to create a service assignment to the police station
- All the images and videos are sent along with the details to the police as part of the SOP
- All the details including photo of the culprit will be multi cast across the mobile surveillance vehicles and other police officials
- Incident is tracked and updated to closure

## 2. Name of Use Case: Controlling Multiple Cameras using PTZ joystick

Use Case: 2

**Purpose:** Controlling multiple cameras using PTZ joy stick

**Goals:** Use PTZ joy stick to zoom tilt and focus on person or incident

**Actors:** CCTV Surveillance Operator, Surveillance officer at SP office

**Smart Applications:** Video wall Manager, Video Management Server, PTZ joy stick

**Description:** Live video streaming is available on the video wall from PTZ cameras

The users can monitor:

- Live video streaming of locations across the city suing PTZ cameras
- PTZ cameras to zoom and tilt to focus on locations of incidents that help recognize the suspect.

**Pre-conditions:** PTZ cameras are streaming live videos to data center, Video wall displays all the videos received from surveillance cameras.

**Post-conditions:** Identify any incident and save the recording for further process, send a team for rescue operations as required

**Trigger:** A person or incident is identified and there is need to follow and identify the person or details

**Constraints:** Availability of real time streaming of data

**Main flow:**

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- CCTV Surveillance Operator continuously monitor live videos for any mishaps
  - If there is an incident, operator uses PTZ cameras to zoom and try to identify the miscreants
  - Operator will switch between PTZ cameras using joy stick and zoom in, zoom out and tilt to focus on the person or incident
  - Take snapshot if someone found guilty
  - Save the videos required for further reference
  - Send relevant teams to the location for relief
  - Raise an incident for tracking
  - Search incidents and provide evidences as required
3. **Name of Use Case: Motion tracking using surveillance cameras to record video feeds and take snapshots of the moving objects and send notifications**

Use Case: 3

**Purpose:** Motion Tracking using surveillance cameras (PTZ) (setting up a tour of pre-sets)

**Goals:** Track objects in motion and auto focus the object in motion in a specific area of camera vision during specified hours and record videos and take snapshots. The camera will receive and send alerts to take specific actions like sound alarm or alerts are used to use other cameras to record videos and take snapshots

**Actors:** CCTV Surveillance Operator, Surveillance officer at SP office

**Smart Applications:** Video Management Server, video analytics

**Description:** The network camera is configured through VMS to find objects in motion and auto focus to record videos and take snapshots. The VMS is configured to send alerts to command control center which can be used to trigger events to send alerts to other cameras to record video and take snap shots of the object and send notifications

**Pre-conditions:** Network cameras attached to Video Management Server is configure to detect objects in motion and follow them

**Post-conditions:** Identify incident in the command control center and run relevant SOP or computer aided dispatch to take control of the situations

**Trigger:** Objects in motion identified by network camera to send alerts

**Constraints:** Camera cannot figure out if two objects are crossing on focused motion area specified

**Main flow:**

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- VMS attached to specific network camera is configured to detect objects in motion with specific sensitivity at a specific area of camera vision
- The VMS can be scheduled to run the program at specific intervals
- The VMS runs the program continuously to detect the objects in motion
- When an object is seen moving it will send alert to VMS server which can be used to take various actions like record video, take snapshots and send alerts
- The videos and snapshots are saved for further reference to incidents
- Command control officer can use PAS system to make announce to control the situation
- Command control officer can use SOP to dispatch relevant team to the location as necessary

### 4. Name of Use Case: Making way to Emergency vehicles/Ambulances

Use Case: 4

**Purpose:** Emergency Scenario – Ambulance to be moved quickly to the hospital

**Goals:** Dispatch notifications to emergency Response Team for rescue with a single operation (SOP) to provide timely help to move the patient from the location to a nearest relevant hospital

**Actors:** Citizens, Traffic Police, Nodal officer, Ambulance driver

**Smart Applications:** Smart City Control Center Integration platform, Mobile App for Ambulance driver, Intelligent Traffic Management Application, GIS locations of Emergency Vehicles.

**Description:** The citizens or any personal can call Command control center for help using phone, App Emergency box. This use case help polices personal with the route information of ambulance from the point of dispatch to the patient and hospital. Traffic police will control the traffic signals based on the destined route to move patient to the hospital and log incident data in the command control center.

- ICMCC helpdesk receives alert.
- Supervisor will run the SOP to information Ambulance and contact driver.
- The accumulated consumption of the current day, week, month or year, and the corresponding cost

**Pre-conditions:** Availability of Ambulance, Location of Ambulance, Location of hospitals on GIS Map, Operator aware of type of mishap to dispatch to relevant hospital or as per patient

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attendant request, Police personals deployed at each location in the city and their contact information, Communication channel, Command control traffic controller.

**Post-conditions:** Information to relatives or care takers, FIR for mishaps, update incident details in incident management application, Death information & certificate

**Trigger:** Police, Citizens or relatives call Command control center for help.

**Constraints:** Availability of real time data of traffic, police and available hospital details, details of health issues

### Main Flow:

- Incident details received from the location to control center
- Help desk analyses the situation and figure out SOP
- Operator to follow SOP defined as per trigger and co-ordinate with ambulance, Traffic police, City police through SOP
- Incident data is created automatically and/or manually regarding the emergency situation while running the SOP
- Dispatch an Ambulance, Police, display information on VMS regarding emergency to citizens and request to make way for Ambulance
- All the respective team's co-ordinate and help ambulance pick the patient
- Emergency operator analyses & share faster route for the ambulance to reach to the patient and back to the hospital
- Change switching cycles of traffic signals
- Incident is updated with all relevant details

## 5. Name of Use Case: Allow operators to collaborate on information and videos for case building

Use Case: 5

**Purpose:** Collaboration using Network based video walls (AV-over-IP) in JICCC and creating cases.

**Goals:** Multiple operators on command control center should be able to simultaneous share and monitor the videos and collaborate.

**Actors:** Integrated Command Control Operators.

**Smart Applications:** Network based video wall controller.

**Description:** The video wall provided the following functionalities to the command control operators and supervisors:

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- Monitor networks, video streams, alarm systems, and other critical content on a dynamic central display.
- Set role based permissions to users by supervisors (Ex: view only, modify, No delete).
- Create a shared platform where operators can collaborate to accelerate incident response.
- Share critical information with teams and stakeholders across the network using Navigation and viewing panes.
- Search and review videos and audio and share with peers the recorded information using queries.
- Case building by collecting information and review cases.

**Pre-conditions:** Video feeds are received from surveillance cameras across the city and displayed on video wall; Operators are able to share the videos with other nodal operators in the command control center.

**Post-conditions:** Case building, case reviews, case collaboration.

**Trigger:** Incident or case identified by surveillance operator.

**Constraints:** Real time videos feeds are available.

### Main Flow:

- Video feeds are received in command control center and surveillance operator notices an incident.
- Operator shares the information on the video wall high resolution to collaborate with peers.
- Peers review the videos on the common platform to discuss and collaborate.
- Surveillance operator creates a case using case builder.
- If already a case exists, the surveillance operator can query and search the videos or audios using navigation and displayed in viewing pane.

## 6. Name of Use Case: Emergency Response System

Use Case: 6

**Purpose:** Emergency response system

**Goals:** Use Emergency Response System to mobilize the respective line departments based on the emergency situation and use the system to analyse the closed incidents for governance improvements.

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**Actors:** Helpdesk, Dispatcher, Supervisor and line departments (Police, Disaster, Fire, Health and Municipal corporation point of contacts)

**Smart Applications:** Helpdesk, Incident Management, control center platform SOPs

**Description:** Emergency response system is designed to help citizens in situations related to health, floods, fire emergencies etc. with a single point of contact to get timely assistance from line departments. The teams involved could be from Health Department, Fire Department, Police Control Room and Municipal Corporation. The related SOPs are designed and integrated into control center platform with details of contact persons from each line department and a well-established communication channels. Different SOPs are used based on predefined process or as per supervisor instructions.

According to the pre-configured flow of SOP, communication is sent to respective line departments for necessary action.

**Pre-conditions:** Multiple SOPs are preconfigured for different incidents like medical emergency, accidents, terrorist, eve-teasing, floods, fire, earthquakes, bomb threat, public disturbances etc.

**Post-conditions:** Incident is tracked to closure and used for analysis

**Trigger:** Citizens or people calling emergency number

**Constraints:** All the processes are identified and configured in command control SOPs

### Main Flow:

- A citizen or any person calls emergency response number
- A helpdesk or first point of contact personnel receives the call and analyzes the situation
- Helpdesk shall also use tools like GPS location and inform nearby rescue teams based on the location
- Helpdesk personal shall approach supervisor in case of any issues in analyzing the situation
- An incident is created with all the relevant information and tracked
- Helpdesk operator and/or dispatcher identify the relevant SOP and execute
- According to the SOPs pre-configured steps are executed and all the relevant departments and personnel are informed automatically with the required data for the situation
- During the process of operation, helpdesk and supervisors are alert and act as point of contact to help citizen and line departments involved in incident
- Incident is tracked and updated periodically till closure
- All the relevant information is shared with the governance committee for further analysis and action plan to improve civil services.

## **7. Name of Use Case: Public Announcement System**

Use Case: 7

**Purpose:** Public announcement system (PAS)

**Goals:** Use public announcement system to make important and relevant announcements

**Actors:** Helpdesk and Line department personnel

**Smart Applications:** Helpdesk, Incident Management, control center platform and PAS system

**Description:** Public address system can be used to address the people in case of situations like public disturbances at a location. This PAS system can be used in conjunction with the surveillance cameras installed at the locations. The IP based PAS systems can also be used to broadcast general and emergency messages for public awareness.

**Pre-conditions:** An incident is identified through any communication channel and helpdesk is informed

**Post-conditions:** Incident is tracked to closure

**Trigger:** Receive incident information from citizen or any agency

**Constraints:** The connectivity to the public announcement system is available

**Main Flow:**

- A citizen or any person calls emergency response number and informs the helpdesk regarding a public disturbance
- Helpdesk executes a relevant SOP to dispatch relevant teams to the location using GIS Map
- A commanding personnel or supervisor shall use video surveillance and use PAS system to address and control the mob during such kind of services
- He shall use the installed surveillance cameras for situational analysis and proofing

## **8. Name of Use Case: Environmental Monitoring System**

Use Case: 8

**Purpose:** Environmental Monitoring System

**Goals:** Use environmental monitoring sensors to identify the pollution levels across the city and perform analytics to identify the trend on pollution levels

**Actors:** Utility Operator

**Smart Applications:** Environmental monitoring system and control center platform

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**Description:** The environmental monitoring solutions are installed across the city and data is collected for hazardous gases like SoX, NoX, CoX. The data collected over a period of time is used for analysis. The outcome of data analytics in the form of reports shall provide the trend in increasing/decreasing pollution levels across the city. This data shall be shared with pollution control board to take corrective measures to control the pollutants. The pollution board shall look at development of standards and guidelines for industry specific emissions and effluents standards, Training, Pollution control technology, Pollution control enforcement, Mass awareness and publications etc...

**Pre-conditions:** Environmental sensors are installed and configured to send data to command control center

**Post-conditions:** The relevant reports shall be sent automatically to pollution control board with all the data using SOP and shall continue to monitor the pollution levels to check if precautionary measures taken by pollution board are effective

**Trigger:** Always

**Constraints:** Data received through sensors is accurate and at specified intervals

**Main Flow:**

- Sensors monitor the pollutants in air and send data to command control center at specific intervals
- The data collected over a period of time to study the trends of increasing pollutants across the city
- The pollution levels are also displayed on variable message boards
- An SOP is executed to send across the reports to pollution control board
- Pollution control board take initiatives to control the pollution levels
- Utility manager continues to monitor the parameters and checks whether the pollution is under control after measures taken by the pollution board

## 9. Name of Use Case: Variable Message Displays

Use Case: 9

**Purpose:** Variable message board

**Goals:** Citizen related information collected at command control center shall be displayed on variable message sign boards across the city for consumption

**Actors:** Utility operators, police

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**Smart Applications:** Variable messaging system and control center platform

**Description:** The variable message boards are used to display information for public. The information may be related to Traffic, pollution, climate, municipal information or city police information. The information can be scheduled or dynamic information received from various channels. The information sent to variable message sign boards can be unicast or broadcast. The information displayed shall of following nature:

1. Promotional messages about services provided by a road authority during non-critical hours, such as carpooling efforts, travellers' information stations and 5-1-1 lines
2. Crashes, including vehicle spin-out or rollover
3. Road Works
4. Incidents affecting normal traffic flow in a lane or on shoulders
5. Non-recurring congestion, often a residual effect of cleared crash
6. Closures of an entire road
7. Vehicle fires
8. Short-term maintenance or construction lasting less than three days
9. Variable speed limits
10. Car park occupancy levels
11. Any municipal corporation promotions
12. Pollution levels
13. Temperature and humidity
14. Climate forecasts

**Pre-conditions:** Variable message sign boards are installed and configured

**Post-conditions:** Citizens shall utilize the information

**Trigger:** Any dynamic information received as listed above

Constraints: Variable message signs are connected to command control center

### Main Flow:

- Utility operators or police use variable messaging system send information to variable message boards
- The information can also be sent to variable message boards dynamically through specific applications
- Operator shall schedule a message to be displayed at specific intervals or configure to display dynamic information on regular basis

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- The information is broadcasted to all variable message sign boards or unicasted to specific variable message sign board

A list of other use cases is provided below:

Sl. No	Type	Description
A	<b>Video Wall</b>	
1		Live streams displayed on video wall
2		User navigation between cameras
3		On demand video
4		Trigger based automatic switching screens
B	<b>ICMCC</b>	
1		Single Dashboard of Operations
2		Maintaining versioning for SOPs
3		Creating and Editing of SOPs
4		Logging changes to SOPs
5		Manual, Automated, If else, Notification activity
6		Key performance indicators for various departments with drill down in red green and yellow
7		Alert Management
8		Event capture
9		Event filtering
10		Incident Management
11		Statistical reporting of trends
C	<b>Helpdesk</b>	
1		Receive calls through various communication channels
2		Execute SOPs based on events
3		Update citizens regarding open incidents
4		Get feedback from citizens
5		Update SOPs based on usage and/or change requirements
D	<b>Surveillance</b>	
1		User rights Management
2		Sharing display with remote operators with the Video Wall
3		Motion & Time based search across cameras

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Sl. No	Type	Description
4		Live videos on Mobile for police authorities
5		Incidents - Manual, Automated & Scheduled Name and time-stamp for every action buzz
6		Loitering detection using PTZ cameras
7		Tracking
8		Computer Aided dispatch for emergency situations
9		Finding Emergency team location on GIS Maps
10		Data collection & Analysis, Statistical reporting of trends for all incidents
11		Service assignment through CC to specific officers
12		Information Transfer (Reports, images, ...) from user to user and devices
13		Multicast Transmission of images from the Control Center to the police vehicles or users
14		Real-time transmission of images from another vehicle
15		Change detection (abandoned objects)
16		Recurrent permanence or passage of a person in a specific place
17		Monitoring of isolated places
18		Social network for civilization
19		Face recognition in big critical events
20		Security breach situation
21		Terrorist acts
22		Hazardous materials/gas spill
23		Earth quake
24		Bomb threat
25		Derailment
26		Passenger evacuations outside city
27		Passenger evacuations, stations
28		Forced door
29		Slip and fall
30		Fire – Any facility

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Sl. No	Type	Description
31		Fire – Industry
32		Intrusion
33		Asset damage
34		Medical emergency
35		Public disturbance
36		Special event
37		Theft
38		Overall cases - Dashboard
39		Arrests under Crime – Women - - Dashboard
40		FIRs Registration - Dashboard
41		Entry & Exit patrol - Dashboards
42		Panchnama
43		Incident proofing
44		Crime Map
<b>E Other</b>		
1		Integration with existing applications
2		Notifications – Website and App, VMS
3		Emergency team data
<b>F Traffic</b>		
1		Collecting traffic information
2		Red Light Violations – Overview Camera - Image of vehicle
3		Detection of multiple red light violations
4		ANPR Camera - number plate, text conversion of number plate after OCR, Date, Time and Location
5		Traffic management & Analysis
6		Signal monitoring and control
7		Evidence collection
8		Automated challan generation
9		Manual Challan & Dispatch

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Sl. No	Type	Description
10		Verification of vehicle related documents like Registration Certificate, Insurance Certificate, Pollution Certificate etc. by issuing a single E-Certificate/QR Code/Unique Code SMS
11		Stolen vehicle identification
G	<b>Efficiency</b>	
1		Traffic data analysis
2		ATCS to Improve traffic scenario based on time – Chain control
3		Increase Signal Efficiency
4		Managed & Co-ordinated movement of vehicles for various situations
H	<b>Citizen services</b>	
1		User friendly traffic information
2		Parking space availability
3		e-challans
4		m-parivahan/Vahan – Driving licenses, registration certificates, driving license
5		On-line payment for e-challans
6		Provide safety for pedestrians
7		Right of way to Ambulances
8		Grievances
I	<b>VMS</b>	
1		Notifications & Advertisements
J	<b>Environmental Monitoring</b>	
1		Extreme weather
2		Pollution monitoring
3		Notifications – Website and App, VMS

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Sl. No	Type	Description
K	<b>GIS Map &amp; Property Tax Updating</b>	
1		Geo tagging of all properties to be available on GIS Map - Property details (type of property, address, number of floors, usage, etc.), Ownership details (property owner, property occupant, rent), Construction Details (area, year, additional area), Assigning property ID if applicable and Updating of database
2		Mobile App & website update for property tax
3		Check Property Tax details with outstanding amount information
4		Make online payments
5		Search property, road, ward
6		Add property, road, ward – Subject officer
7		Update tax rates and Calculate tax
8		Get monthly pending payment report
9		Ward based reports for property tax – GIS Map
10		Notifications – Website and App