Volume 2 Request for Proposal (RFP)
For
"Selection of System Integrator for setting up of a Command and Control Centre With Centralized Information dashboard and automated Check posts for the office of the Commissioner of Geology and Mining"
Government of Gujarat

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1 Scope of services of the project

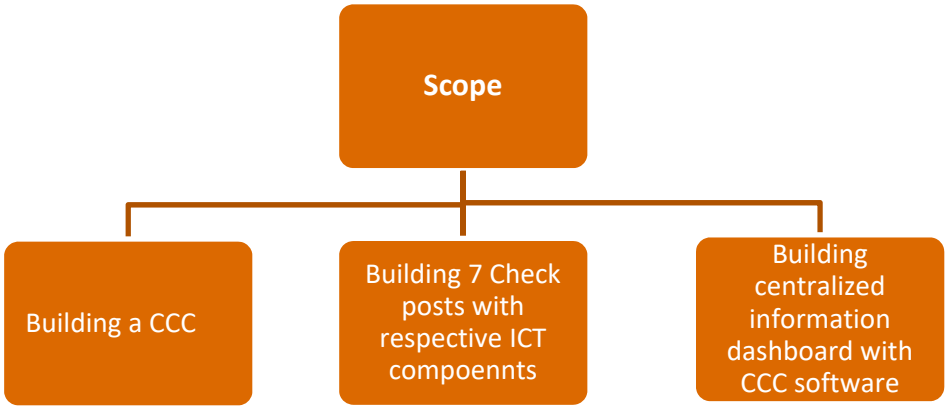
This is an EPC based tender, wherein bidder is solely responsible for design, engineering, planning, supply. Installation, commissioning and O&M for the period of 3years from the date of Go-Live. Office of CGM (Tenderer) has tried to define detailed scope of work under each head/component of the project, however if bidder observes that any component is missed inadvertently and it is a necessary component for successful operations of the project then in that case successful bidder has to consider the same in its proposal and tenderer is not liable for payment of any additional cost for such item beyond the quoted price of the tender. Detailed scope of work is as mentioned below:

1.1 Components & Services Overview

The SI shall be responsible for the successful designing, supplying, building/development, implementation, commissioning and operations & maintenance of:

a) Command and Control Centre along with DC (to be housed at Gandhinagar, Gujarat) and DR (on cloud)
b) Build a centralized information dashboard– A dashboard which integrates various IT applications of the office of the CGM. These IT applications would be integrated to CCC using CCC software's SDK or using APIs, Web services etc. The major aim is to command and control various parameters of CGM's current and future IT applications along with other field ICT infrastructure data from the check posts through the CCC software (dashboard). The CCC users should be able to draw analytics, configure alerts, do incident management, sending automated SMS's on violations and drawing correlations etc. from the CCC dashboard/Software.
c) Build & commission automated check posts at 7 locations along with its respective ICT infrastructure which includes smart elements/sensors and other state of the art civil construction and non-IT infrastructure at respective check posts.
d) Operate and maintain the project infrastructure at CCC and check posts for a period of 5 years.

Following are the major components of the project.



The scope also includes SI to operate and maintain the operations of check posts and CCC for a period of 5 years and then handover the operations to the office of the CGM staff. For the same SI has to provide capacity building support to CGM authorities as per the scope of services described below.

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

1. **Design, Supply, Develop/Implement, Installation, Commissioning and Maintenance of CCC, Check posts, Centralized information dashboard, DC, DR and Field Equipment** which includes, but not limited to the following components:

    a. Command and Control Centre (CCC Infrastructure)

    b. Building 7 check posts with respective edge devices, sensors and necessary ICT, civil and non IT infrastructure

    c. CCC Operational Facility (Client Side Infrastructure) at CCC room and DC Room infra

    d. Build a centralized information dashboard - By integrating CCC software with other office of the CGM's IT applications using CCC software's SDK/web services/ API's

    e. DC hardware and equipment's to be hosted at CCC.

    f. DR (on cloud) Infrastructure – SI has to provide sizes and specifications

    g. ICT Components -Field devices (such as CCTV Cameras, ANPR Solution (cameras and LPU's), E-weighbridges, Parking sensors, Smart Lights, RFID Readers, Various Sensors, and Displays etc. at Check posts as indicated in Scope of Work

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

3. **Provisioning Hardware and Software Infrastructure** which includes design, supply, installation, commissioning, and O&M of IT Infrastructure at Command and Control Centre (CCC) and check post locations.

    a. Basic Site preparation services (as required)

    b. IT Infrastructure including server, storage, network equipment, other required hardware, application portfolio, licenses required at DC and DR etc.

    c. Command and Control Centre infrastructure including operator console, workstations, joystick controller etc.

    d. Establishment of LAN and WAN connectivity, electrical cabling along with required materials at Command and Control Centre, check post locations limited to scope of infrastructure procured for the project

e. E-weighbridges, RFID readers (with required accessories, mountings),

f. Smart Lights, Surveillance cameras, ANPR cameras, Smart LED lights, junction boxes etc. for Check posts

g. All the cabling,

SI is also required to identify, assess and provide precise hosting requirements of hardware and software Infrastructure for DC, DR, Check post (if any) & CCC as mentioned above

4. **Capacity Building** for CGM which includes preparation of operational manuals, training documents and capacity building support, including:

   a. Training of the CGM authorities and operators on operationalization of the system

   b. Support during execution of acceptance testing

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

   d. Preparation of revised KPIs for performance monitoring of various CGM and check post utilities monitored through the system envisaged to be implemented

   e. Developing standard operating procedures for operations management and other services to be rendered by CCC, Check posts, centralized information dashboard application

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

   g. Support during the handover process to office of the CGM staff after 5 years of O&M.

5. **Operate, Maintain, Transfer & Warranty –**This includes SI to operate and maintain CCC, DC, DR & check posts operations along with their respective software, hardware and other IT, Non -IT infrastructure installed as part of project for a period of 5 years. This should include onsite comprehensive warranty with support of hardware/parts/equipment for 5 years post Go-Live. The SI would be required to transfer the operations and maintenance of CCC & check posts to office of the CGM staff upon completion of O&M period of 5 years. It must be noted that the SI's quarterly payments are linked with the SLA's during the O&M (post Go-live) phase. Hence, SI is required to depute a dedicated team of professionals to manage the project and ensure adherence to the required SLAs. This SI should provide the structure design, stability and strength of the civil infrastructure by a registered structural certifying body for every civil infrastructure being constructed for the project (this includes the poles design as well).

1.2 Feasibility study for finalization of detailed technical architecture and project plan Assessment, and Scoping:

After signing of contract or issuance of LOI, the systems integrator needs to deploy local team (based out of Office of CGM, Gandhinagar) proposed for the project and ensure that a Project Feasibility Report is submitted to Office of the CGM which should cover following aspects:

1.2.1 Feasibility report for the study for CCC

a. Conduct site surveys to identify need for site preparation activities

b. Detailed plan to provision CCC infrastructure which includes Video wall, workstations, Servers, AC's, racks, and raise flooring etc.

c. Plan to provision electricity, networking, and cabling etc.

d. Functional requirement specifications (FRS) – which includes approved (from the office of the CGM stakeholders) detailed business & software/IT requirements for the CCC operations along with their respective SOP's. The FRS should be accompanied with requirement traceability matrix

e. Access, identify and organize data from surveillance and other field devices which needs to be integrated with CCC

f. Details of the site clearance activities which needs to be performed and its reinstallation plans

g. Define various alerts, analytics, incident types and correlations which CCC software needs to be established

h. Provide finalized detailed layout planning of the entire infrastructure (interiors) of the CCC as mentioned in the scope.

i. Assess and identify the precise equipment sizing requirements for all the CCC, DC, and DR.

j. Security and scalability plan for the CCC as the number of systems for the office of the CGM increases.

1.2.2 Feasibility report for the study to create centralized information dashboard

a. Provide a detailed plan of CCC software's integration with various sub systems and creating a centralized integrated dashboard with bidirectional (push and pull) flow of information.

b. Assess existing IT systems (AS-IS study) to identify the key parameters and KPI's , to show on CCC software's dashboard to correlate and analyse data, configure incident, violation types and alerts along with their respective SOP's.

c. Functional requirement specifications (FRS) along with requirement traceability matrix -providing detailed business requirements to create a centralized information dashboard application which integrates following systems with CCC software to provide various parameters for analytics, correlation and alerts

    a. VTMS

    b. GIS

    c. Gujmine & Geomine Mobile applications

    d. ERP

    e. ILMS

    f. ANPR, VMS, RFID Readers, E-weighbridge, Smart LED lights, and Parking applications, Boom Barrier systems etc.

    g. CCC Software

d. Mention the key parameters from all these applications should be available on CCC software for analytics and drawing correlations. Some of these applications which are being developed or would be developed should be provisioned for future integrations.

e. Provision for the API's / Web services to integrate existing COTS or bespoke systems with CCC software. SI would be given access to the systems until database level to understand the existing systems to create API/ web services, if required.

f. Security and scalability plan for the centralized information dashboard as the number of systems for the office of the CGM increases.

g. Details about various MIS reporting requirements by different stakeholders and provision the same in the integrated dashboard application.

1.2.3 Feasibility report for the study for connectivity

a. Conduct feasibility study for finalization of detailed network architecture.

b. Mention the possibility of connecting all the 7 check post locations using MPLS with DC location.

c. Mention the best suitable last mile connectivity options for all the 7 check post locations.

d. Provide the details about nearest PoP availability from all the check post.

e. Do bandwidth sizing for every check post and DC locations. 40 Mbps at check post locations. This should be considered as an approximate bandwidth figures. However, the SI has to do the sizing and provision for the bandwidth accordingly.

f. Network architecture should provision redundant connectivity from different service providers.

1.2.4 Project management, risk, resources and other parameters

a. Names of the Project Team members, their roles and responsibilities

b. Approach and methodology to be adopted to implement the Project (which should be in line with what has been proposed during bidding stage, but may have value additions / learning in the interest of the project).

c. Risks the SI anticipates and the plans and provide their mitigation plan

d. Detailed project plan specifying dependencies between various project activities / sub-activities and their timelines

e. Solution architecture showcasing the detailed architecture of the application components and their integration

f. Provide plan for information security and network security other

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

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

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

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

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

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

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

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

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

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

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

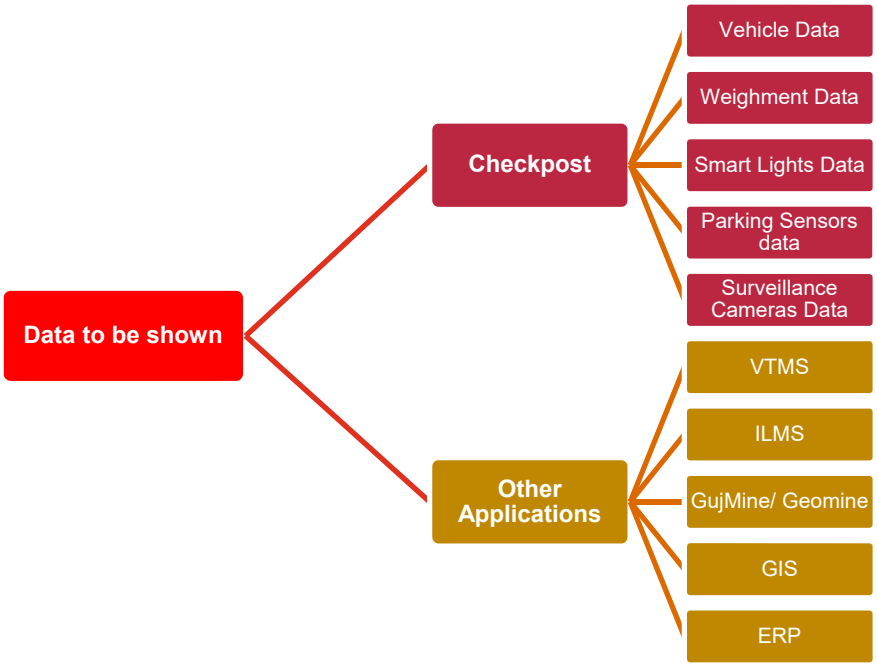
6. **Open Standards** - System should use open standards and protocols to the extent possible without compromising on the security

7. **Convergence** - CGM has already initiated many projects which have state of the art infrastructure at field locations deployed under them. The CCC Infrastructure should be made scalable for future convergence needs. Office of the CGM has envisaged to create a state of the art infrastructure and services, hence it is imperative that all infrastructure created under the project shall be leveraged for maximum utilization. Hence

the System Integrator is required to ensure that such infrastructure will allow for accommodation of equipment's being procured under other projects. Building a centralized information dashboard application

This centralized information dashboard aims at integrating various current, proposed and future IT systems of the office of the CGM. The centralized information dashboard shall be built using CCC's SDK / web services/ API's and provide data from all the various sub systems for analysis, correlation, alerts, and incident management activities to produce actionable insights to the staff of the office of the CGM based on their access rights.

The various information that may be accessed from the system but not limited to be below mentioned applications



Please refer to functional requirements (section 2) of this document for further details about the integrated dashboard application

1.3 Design, Supply, Installation & Commissioning, Maintenance of the Field Equipment

The Scope includes Supply, Installation, commissioning, maintenance and Customization (as required) of various field/check posts systems which include CCTV Surveillance Cameras, ANPR Cameras, parking sensors, RFID readers, Boom Barrier E-weighbridges, Smart LED lights, Signage's and other ICT infrastructure required for successful operation of the check posts in accordance with mentioned scope. All the field equipment along with their respective client software are also required to be able to work in offline mode i.e. in an event when connectivity fails between check post and DC the data/information should not be lost and should be synced back with the central system once the connectivity reinstates.

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

1. The implementation methodology and approach must be based on the global best practices in-order to meet the defined Service Levels during the operation.
2. Best efforts have been made to define major functionalities for each sub- systems of CCC & Check post project. However, System Integrator should not limit its offerings to the functionalities proposed in this RFP and is suggested to propose any functionality over and above what has already been given in this tender.
3. The SI shall design the field level/Check posts' equipment architecture to ensure maximum optimization of network equipment, poles, cantilever, and mounting infrastructures, power supply equipment including, electric meters and junction boxes.
4. Finally approved/accepted solution for each component of CCC system & Check post infrastructure shall be accompanied with "System Configuration" document and the same should be referenced for installation of CCC systems and check post infrastructure as per the scope of this project.
5. The system integrator shall be required to submit a detailed installation report post installation of all the equipment at approved locations. The report shall be utilized during the acceptance testing period of the project to verify the actual quantity of the equipment supplied and commissioned under the project.
6. Office of the CGM would provide necessary permissions to host required field sensors and devices at check post locations, since the check post land belongs to the office of the CGM. All other required permissions shall be obtained by the SI, however Office of the CGM will assist the SI whenever required.
7. All the payments required for ROW permissions and other permissions shall be borne by the SI

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

1.3.1 Surveillance System (CCTV Cameras)

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

1. The SI shall install Surveillance Cameras (Fixed, ANPR and PTZ) for monitoring and management purposes at specified locations at the check posts and at CCC.
2. The SI shall undertake due diligence for selection and placement of surveillance cameras to ensure the optimized coverage of the vehicle movement and peripheral check post locations. The surveillance camera at the entry should provide visibility of the vehicle entering the check post along with the queue of the vehicles at the check posts in the approach area and beyond. The camera mounted on the top of the E-weighbridge should be linked with the weighbridge sensors/controllers to take the bucket image of the material which vehicle is carrying.
3. The SI shall design, supply, and install the surveillance cameras as defined in the RFP, all wiring connections for the system shall be installed by the SI. The SI shall supply all of the necessary equipment for the camera operations including camera housings and mountings, camera poles, switches, cabling, and shall make the final connections to the junction box.
4. The SI shall be responsible for providing all the necessary IT infrastructure for monitoring, recording, storage & retrieval of the video streams at CCC or any other location as specified in the RFP. The cameras should function equally well in day and at night producing high quality images and streams.
5. For more details on technical and functional specifications of Surveillance Cameras, SI should refer to Section 2 and Annexure A for Functional and Technical specifications respectively.

1.3.2 ANPR Cameras

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

1. The SI shall install the ANPR Cameras at all the 7 check post locations across the state. This system shall automatically capture the license number plate of the vehicle at these check posts. The Accuracy of ANPR system should be more than 90% in case of standard English Alphanumeric Font and High Security Registration plates and 70% for non-standard English Alphanumeric Fonts. In an unlikely event, where the number plate could not be read, there should be provision of manual keying of vehicle number in the ANPR software.
2. The SI shall design, supply, and install the ANPR camera system as defined in the RFPs, all camera accessories such as external IR Illuminators, camera housing and mounting shall be installed by the SI. The housing and mountings of the cameras should be rugged as they would be exposed to weather conditions 24*7. The SI shall supply all of the necessary equipment for the camera and local processing system, including but not limited to: computers, local storage, and ancillary camera equipment, camera poles, junction box, warning signs, signage etc. and shall make the final connections to the camera.
3. The SI shall be responsible for providing all the necessary IT infrastructure for detection, analysis, storage & retrieval of the number plate information at CCC or any other location as specified in the RFP.

1.3.3 E-Weighbridge

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

1. The SI shall design, supply, install, commission and O&M and also any other equipment required for successful commissioning of the system for the E-weighbridge's operations including weighbridge's mounting, client server based monitoring software, switches, controller, cabling, and shall make the final connections to the junction box.
2. The E-weighbridge should be based on hollow structure technology, such that the load cells and other parts of the E-weighbridge should not get malfunctioned
3. The E-weighbridge should be able to weigh 16 wheeler trucks and maximum weight up to 100 tones
4. The E-weighbridge monitoring and controlling software should be based on client server technology. E-weighbridge at every check post should have a client software to manage E-weighbridge operations and to connect with RFID readers, ANPR camera, Fixed camera's, Boom-Barrier and RTO API's via a controller
5. The weighbridge software should have provision of carrying out re-transaction of a vehicle, in case a vehicle, after leaving the weighbridge goes bad or take more than 10 minutes (configurable) to leave the check post. In such cases, the weighbridge software should be able to provide both the previous and current transaction details. In case of connectivity failure, the SI should provision local functioning of all the check post operations and syncing once the connectivity is reinstated.

1.3.4 RFID Readers

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

1. The System Integrator shall supply, install, commission and O&M RFID readers along with necessary wiring and cabling near the E-weighbridge and at exit point of every check post
2. The SI shall supply and be responsible for all of the necessary equipment for the RFID reader's operations including reader's software based on client-server technology, its casing and mounting, pole, switches, cabling, and shall make the final connections to the junction box.
3. The entire RFID ecosystem is conceived to be a pilot project for one RFID tag installed on 1000 vehicles to start with. Depending the performance and efficacy of the pilot project, these tags might increase to 1,25,000

tags in future. The bidders shall consider the pilot of one RFID tag for 1000 vehicles and their corresponding check post readers as mentioned in the scope for providing commercial bid.

4. The RFID tags would be predominantly responsible for vehicle and vehicle owner's identification
5. RFID reader at every check post should have a client software to manage its operations .These RFID reader's client application would talk to E-weighbridge controller and send vehicle identification data to its server application hosted at Central location.
6. RFID readers would be deployed at every check post near the weighbridge and at the exit. Since the vehicle would be at a stationery position on the weighbridge, there are very high chances of RFID reader detecting the RFID tag on the vehicle and uniquely identify the vehicle. At the exit the RFID reader would be able to allow exit of the vehicle.
7. These RFID vehicle data would also be available locally at all the check posts for vehicle detection.

1.3.5 Parking Sensors

1. The System Integrator shall supply, install, commission and O&M underground parking sensors along with necessary wiring, loops and connections at parking slots as envisaged at every check post. Every check post is expected to have around 20 parking slots.
2. The SI shall be responsible for supply of all the required equipment for the parking sensor's operations including sensor, sensor casing, switches, cabling, and client server based monitoring software and shall make the final connections to the junction box.
3. These parking sensors would primarily send the parking slot's occupancy data to their parent application at central location. That is, the parking sensors should send a trigger while a vehicle moves in and out of the parking slot
4. The parking sensors would have a client application deployed at every check post, using which the check post authorities can allocate/ deallocate a particular parking slot to a seized vehicle and send the trigger to its server application.
5. Boom Barrier should open up if the vehicle is wilfully released from a parking slot following necessary operating procedures

1.3.6 Smart LED lights

1. The System Integrator shall supply, install, commission and O&M smart LED lights along with necessary wiring and connections at every check post
2. The SI shall supply and be responsible for all of the necessary equipment for smart light's operations including casing, switches, mountings, poles, cabling, managing software and shall make the final connections to the junction box.
3. These smart LED lights should be able to provide triggers to its server application at CCC as the smart LED light goes bad (not working). These lights should be able to be controlled through the check post as well as from the CCC.

1.3.7 Boom-Barrier

1. Boom-Barrier should be placed at the exit Point of (one per lane) the check post to ensure that vehicles entering the check post should not escape without following necessary procedures. Boom Barrier should have loop detector.
2. Boom barrier at all the check posts should be able to be remotely openable from CCC.

3. These Boom-Barrier would be linked with the controller of the weighbridge, RFID reader at the exit and would automatically open up, if all the data pertaining to the vehicle is found genuine during the weighing operations.

For more details on technical and functional specifications of above components, SI should refer to functional requirements (section 2 of this document) and technical specifications (annexure A) respectively.

1.4 Design, Supply, Installation and Commissioning, Maintenance of IT Infrastructure at CCC, DC & Check posts

1. It is proposed that the SI shall provide the list of IT hardware, infrastructure (storage, compute) required at the CCC, DC (located at Gandhinagar) for successful operations of the systems. SI should also propose a reference DC architecture such that redundancy is provided for all the key components to ensure that there is **no single point of failure and the key components remains highly available.** It will be SI's responsibility to:
    a. Provision 250 Mbps (approx. 40 Mbps/checkpost) MPLS redundant bandwidth (from different providers) at DC location.
    b. Provide a detailed list of hardware and Infrastructure equipment required at CCC room.
    The G-SWAN connectivity between State data centre (SDC) and DC shall be provided to the bidder by the office of the CGM.
2. The SI has to ensure that the respective district offices of the office of the CGM views CCC dashboard for the following on a web browser/Mobile app:
    a. Video feeds from check posts CCTV cameras
    b. Real time weighment data of the E-weighbridge which exceeds the weight mentioned in royalty pass
    c. Individual and average time in and time out of vehicles at the check posts
    d. Unsolicited movements of any vehicles based on the data from parking sensors deployed at the respective parking slot of the check post.
3. Design, equipment list and specifications of the Data Centre should be provided by SI as per Telecommunications Infrastructure Standard (TIA-942) for Data Centres
4. The SI shall provide system integration services to customize and integrate the applications procured through the project and other existing CGM applications. All the applications proposed by the SI should have open APIs and should be able to integrate and share the data with other third party systems already available or coming up in the near future
5. As part of preparing the final bill of material for the data centre, the successful SI will be required to list all passive & active components required in the data centre.
6. The bill of material proposed by the successful SI will be approved by the office of the CGM

Data Centre, CCC, check posts are as under:

Data Centre & CCC

a. Servers (inclusive of OS) - Application Servers, Database Server, Video Recording Server, Video Management Server, Enterprise Backup Server, Domain Controller, and Failover Servers for application etc.
b. Application & System Software (with necessary customization) – CCC Application, Video Management System application, Video Analytics, Parking management application, application, RFID server application, E-weighbridge application, Smart light applications, EMS, NMS etc.
c. RDBMS (if required)

d. Video Wall system (including Integration of Video Panels to make one Single Integrated video-wall).
e. Anti-virus Software
f. EMS (including NMS) software
g. Primary and Secondary Storage Solution including storage management
h. Backup Solution
i. Switches
j. KVM Switches
k. UTM Firewall , IPS/IDS, Load Balancer
l. Racks (for Servers, Networking and Storage)
m. Operator Workstations
n. Other DC Non-IT infrastructure, such as UPS, AC (Cooling), Fire Suppression, VEDSA, Rodent Control, Building Management System, DG Sets etc.
o. Raise flooring for CCC Area
p. All required Passive / Structured cabling Components
q. Electrical Cabling for all IT and supplied components
r. Necessary Illumination Devices in DC area
s. Indoor Surveillance Cameras in CCC Area
t. RFID tags
u. Operator Workstations Furniture and other furniture
v. AC and access controls
w. Any other Servers required to the cater to the scope of work mentioned in RFP

Check post are as under

a. Workstations with server OS
b. RDBMS (if required)
c. Anti-virus Software
d. Switches
e. Servers, LPU's
f. Racks (for Servers, Networking and Storage)
g. Other Non-IT infrastructure, such as UPS, AC (Cooling)Fire Suppression, VEDSA, Rodent Control etc.
h. All required Passive / Structured cabling Components
i. Electrical Cabling for all IT and supplied components
j. Necessary Illumination Devices in Check post buildings
k. Indoor Surveillance Cameras at check post administration area
l. Any other hardware(servers & networking) required to the cater to the scope of work mentioned in RFP
m. E-weighbridges with traffic lights and other required equipment
n. Smart LED lights
o. ANPR Cameras
p. PTZ Cameras
q. Fixed Cameras
r. RFID readers
s. Parking sensors
t. Boom-barrier
u. Recording server
v. Local Storage (If required)

7. The above are only indicative requirements of IT & Non-IT Infrastructure requirements at DC, CCC and Check posts. The exact quantity and requirement shall be proposed as part of the technical proposal of the SI.
8. The SI shall prepare the overall DR hosting-on cloud & their operational plan for this project. The plan shall comprise of deployment of all the DR equipment required under the project. The implementation roll-out plan for hosting of the DR shall be approved by the office of the CGM. The detailed plan shall be also comprise of the scalability, expandability and security of the DR infrastructure under this project.
9. DG Set shall be sized and provisioned by office SI for CCC, Check posts which shall cater to emergency power requirement.
10. The system integrator shall be required to submit a detailed installation report post installation of all the equipment at approved locations. The report shall be utilized during the acceptance testing period of the project to verify the actual quantity of the equipment supplied and commissioned under the project.
11. In case the connectivity of the check post goes down, all the ICT equipment of the check post should functional locally and should be able to sync all the data back to the server once the connectivity reinstates

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

1. Network & Backbone Connectivity is an important component of the project and needs very careful attention in assessment, planning and implementation. It is important not only to ensure that the required connectivity is provisioned within the required timelines but also ensure that it is reliable, secure, and redundant and supports the required SLA parameters of Latency, Jitter, Packet Loss and Performance.
2. It is proposed that the SI shall provision MPLS connectivity for all the 7 check post locations along with CCC and DC locations with necessary CPE equipment. For last mile connectivity SI should work out the best connectivity options based on the check post locations after doing the bandwidth sizing required at each check post location. SI should provide cost benefit analysis for connectivity options. For an initial approximation, 40 Mbps per check post should be assumed as bandwidth required. Between DC and CCC locations SI should assume 1 Gbps dedicated redundant point to point bandwidth. At SI should provision for 250 Mbps redundant bandwidth. However, the SI has to do the actual bandwidth sizing and provision for it accordingly. 80% of all the required/mentioned bandwidth should be available at any given point of time
3. SI should provision for redundant connectivity options such that check post is always connected with DC in case one network goes down. It is required for the last mile and MPLS connectivity to be provided by more than one vendor.
4. The SI shall design the overall network for the project, in order to meet the requirements as defined and within the service level agreement. The SI must get the approval of the network architecture from the office of the CGM before commissioning and installation.
5. The SI should provide a detailed network architecture of the overall system, incorporating findings of site survey exercise. The network so envisaged should be able to provide real time video data streams to the Data Centre. Which in turn would be viewed at CCC and to district office (on web/app etc.). All the components of the technical network architecture should be of industry best standard and assist SI in ensuring that all the connectivity SLAs are adhered to during the operational phase.
6. The SI is also responsible for providing network for below connectivity requirements:
    a. MPLS connecting 7 check posts locations and DC
    b. Internet connectivity at CCC room, DC at Gandhinagar.
7. The SI shall prepare the overall network connectivity plan for this project. The plan shall comprise of deployment of network equipment at the check posts to be connected over network (including CPE), any

clearances required from other government departments for setting up of the entire network. The network architecture proposed should be scalable and in adherence to network security standards. It is necessary that all OFC (if used) cabling and proposed last mile connectivity should be underground. Last Mile to be defined as "the access link from the service provider's PoP – (as per Telco Standards) to the field device".

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

Sr.	CCC Project component	Consideration
1	Surveillance (CCTV) Cameras	Minimum 4 Mbps per Fixed Camera Minimum 5 Mbps per PTZ Camera
2	ANPR System	Video footage of incident (t-5 seconds to t+5 seconds, where is time of incident) at required high resolution Minimum 2 Images of the overweight vehicle along with Number plate
3	Parking Sensors	Minimum 1 MB for each location
4	E-weighbridge, RFID readers, Smart lights etc.	Minimum 1 Mb for each location

9. As mentioned, the actual bandwidth requirement to cater the above mentioned bandwidth parameters and to meet SLAs would be calculated by the SI and the same shall be clearly proposed in the technical proposal with detail calculations. Office of the CGM also requires the SI to meet the parameters of video feed quality, security & performance and thus SI's should factor the same while designing the solution. Office of the CGM reserves its right to ask the Systems Integrator to increase the bandwidth if the provided bandwidth is not sufficient to give the functionality of the system mentioned in the RFP and adhere to the SLAs.
10. In case the telecommunication guidelines of Government of India require the purchaser to place purchase order to the service provider for bandwidth, Office of the CGM shall do so. However, Systems Integrator shall sign a contract with Telecom Service Provider(s) and ensure the performance. Office of the CGM shall make payments to the Systems Integrator.
11. The system integrator shall be required to submit a detailed installation report post installation of all the equipment at approved locations. The report shall be utilized during the acceptance testing period of the project to verify the actual quantity of the equipment supplied and commissioned under the project.

1.6 DR Site on third party (On Cloud) site

1. The DR for this project system shall be hosted on cloud.
2. For commercial bid purposes DR site can be selected by the SI, from site of any Cloud Service provider (CSP) empanelled by MEITY (Ministry of Electronics and Information Technology). List of CSP can be found on http://meity.gov.in.
3. The Selected site for DR would be in Tier III DC facility, which is ISO 20K and ISO 27K certified. The DR site would not be within 50 km of DC and should be in a different seismic zone.
4. The following services shall be provisioned and told to office of the CGM for the DR Site
    a. Virtualised environment (VM Machines)

b. Storage
c. Networking
d. Security
e. Internet Bandwidth
f. Hosting Space
g. Power & Cooling
h. Secured Data Centre Environment

5. The design rule of No-Single-Point-of-Failure shall not apply to DR components.
6. The SI shall bear the charges for hosting data centre services at the DR Site.
7. The SI need to do the sizing of VM Environment and other Infrastructure resources required at facilities based on its capacity planning and sizing for the entire duration of the contract.
8. DR should be 100% capacity in terms of compute power of the Smart DC compute power. Storage requirement for DR shall be proposed by the vendor as per the requirements mentioned in the tender. RPO and RTO shall be designed and configured as per following requirements:

Sr.	Project Compute Infrastructure	RPO	RTO
1	CCC Project (DC Infrastructure being commissioned through this project)	4 Hours	1 hour

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

1.7 Civil and NON –IT components scope

1.7.1 Scope of Work for Construction of Automated Check Posts at Seven Locations

The SI should ensure the successful implementation of the proposed automated check posts and related Infrastructure at seven locations, along with integration of the check posts with the smart features/sensors/elements of the check post and the CCC, as mentioned details and **exhaustive specifications / items mentioned in Annexure B**. The implementation should be as per the scope of services described below.

Any functionality not expressly stated in this document but required to meet the needs of the CGM to ensure successful operations of the system shall essentially be under the scope of the SI and for that no extra charges shall be admissible. SI shall implement and integrate the systems and components as described in various sections of the RFP documents.

The SI's scope of work for the civil Construction of the Automated Check Posts includes construction of buildings, sheds, service roads, parking, signage, special systems etc. (as specified Volume 2-Checkpost Scope). The scope of work is detailed as below (See Annexure B for detailed specifications) but shall not be limited to the following broad areas:

a. Site Preparation & Investigation:

Before commencing with construction of the check posts, the SI shall conduct site preparation process including a preliminary site visit at all the seven locations at its own cost.

Site Clearance: The SI shall conduct site clearance by clearing the site by removing trees, shrubs or any and old underground infrastructure or other obstacles that might affect the construction process. The SI shall also level and grade the site, before commencing with construction.

Site Survey The SI shall carry out surveys and investigations after the award of contract, to complete the data required for implementation of the project.

Site Testing: SI must conduct necessary soil tests before commencing any structural task on the soil.

Site Investigation: The SI must perform Geotechnical Site Investigations of the project site to evaluate the conditions of the site for the purpose of designing and constructing the project structure.

b. Design, detailed engineering of the check post infrastructure and other associated infrastructure:

Based on the site survey and investigations, the SI shall prepare Site Plan designs including detailed designs, service layouts and other drawings. Design and Drawings shall be developed in conformity with the specifications and standards set forth in **Annexure B Specifications and Standards.**

In respect to the SI's obligations with respect to project engineering for the check posts, the following shall apply:

- The SI shall prepare and submit an engineering schedule, with reasonable promptness and in such sequence as is it promotes check post completion, to the office of CGM. Based on the schedule of items as mentioned in the engineering schedule, the SI is shall submit three copies of each of the drawings and designs, to the office of CGM for review and finalization.
- The drawings, design and engineering items submitted for review to the office of CGM shall be in conformity with the scope of the project, the specifications and standards and applicable law.
- Within 30 days of the receipt of the drawings, the office of CGM shall review and convey its observations to the SI with particular reference to their conformity or otherwise with the scope of the project and the standards and specifications. The SI shall not be obliged to await the observations of the office of CGM on the drawings submitted beyond the said period of 30 days and may begin or continue work at its own discretion and risk.
- If the aforesaid observations of the office of CGM indicate that the drawings are not in conformity with the scope of the project or the specifications and standards, such drawings shall be revised by the SI in conformity with the provisions of this Agreement and resubmitted for review. The office of CGM shall give its observations, if any, within 10 (ten) days of receipt of the revised Drawings. In the event the SI fails to revise and resubmit such drawings to for review as aforesaid, the office of CGM may withhold the payment for the affected works in accordance with the provisions of section 6 of volume 1 of the RFP. If the SI disputes any decision, direction or determination of the office of CGM hereunder, the Dispute shall be resolved in accordance with the Dispute Resolution Procedure (section 7.19 of volume 1);
- No review and/or observation of the office of the CGM and/or its failure to review and/or convey its observations on any Drawings shall relieve the SI of its obligations and liabilities under this Agreement in any manner nor shall the office of CGM be liable for the same in any manner; and if errors, omissions, ambiguities, inconsistencies, inadequacies or other Defects are found in the Drawings, they and the construction works shall be corrected at the SI's cost, notwithstanding any review under this section;
- The SI shall be responsible for delays in submitting the Drawing as set forth in engineering schedule, submitted by SI, caused by reason of delays in surveys and field investigations, and shall not be entitled to seek any relief in that regard from the office of CGM; and

- The SI warrants that its designers, including any third parties engaged by it, shall have the required experience and capability in accordance with Good Industry Practice and it shall indemnify the Office of CGM against any damage, expense, liability, loss or claim, which the office of CGM might incur, sustain or be subject to arising from any breach of the SI's design responsibility and/or warranty set out in this Clause.

Within 90 days of the project completion date, the SI shall furnish the office of CGM a complete set of As- Build drawings (Hard and soft copy) reflecting the complete check post and other related facilities as actually designed, engineered and constructed, including an as-built survey illustrating the layout of the check post and setback lines of the buildings and structures forming part of check post**.**

c. Civil/structural works for check post structure and other related infrastructure.

The SI shall construct the automated check posts and other related infrastructure as specified in **Check post scope** and in conformity with the specifications and standards set forth in **Annexure B Specifications and Standards**. The SI shall be responsible for integrating the check post infrastructure with other scope of the project including interface with the smart systems/IT to be installed in the check post and the CCC and shall rectify any error in the alignment of the various components.

d. Finishing work for check post (both internal and external)

The Finishing work of check post area, administrative block, common areas, corridors and common toilets for the automated check post under this Contract's Scope are to be executed. The finishing work of external façade is also included in the Scope of work of project.

The SI's scope includes plastering at all block work/brick work. All exposed columns/beams/slabs will be finalised in rendered concrete. Flooring for all the components of the check post must be carried out. Further details are given in the Technical Specifications of work attached in Annexure B Specifications and Standards. The SI is advised to understand in detail the Scope of work and nothing extra shall be payable on account of SI's wrong understanding of Scope of work in this regard.

Glazing on External Façade & Door-Windows etc. of wooden /aluminium/M.S./Zinc or as specified in the specifications etc. for all areas of the check posts are included within the Scope of this package.

1.7.2 Scope of work for utility installation, testing and commissioning at check post including

The Plumbing/Sanitary Design & Schematic/Line drawings are included in the Scope of work of the SI. The detailed fabrication & shop drawings, as required for execution at site are to be prepared by the SI and submitted for approved to the office of CGM before proceeding with execution

The preparation of Sanitary/Plumbing fabrication & shop drawings expressly (but not limited to) includes the following:

- Integration of detailed shop drawings with Civil/Structural details prepared by SI for check post structures and obtaining approval of the office of CGM.
- Preparation of fabrication & shop drawings on a software like AutoCAD, etc. of each and every part of building having a sanitary/plumbing aspect within Scope of work on suitable scale (3 no. of sets of each drawings).

The Execution of Plumbing/Sanitary work for buildings /spaces as per Scope of the work read with Technical Specifications and Drawings. The Sleeves, Cut out Drainage arrangement, embedment, cancelled piping, water arrangement, overhead tanks etc. and connecting the service to the main line of are expressly included (but not limited to) in the scope of work.

a. Internal Electrical work

The internal Electrical design & schematic/line drawing are included in the scope of work of SI. The detailed fabrication and shop drawings, as required for execution at site are to be prepared by the SI in B.I.M. (Building Information Modelling) format and got approved from the office of CGM before proceeding the work.

The Layout design (Scheme of Electrical arrangements of Electrical works for buildings/other check post areas and shop drawings in B.I.M. (Building Information Modelling) format of each and every aspect of the project, required for execution integrated with Civil /Structural/Architectural Drawings for each component and obtaining approval of the office of CGM. Preparation of Drawing on a software like B.I.M. format etc. of each and every part of the check post having an Internal Electrical aspect within Scope of work on suitable scale (3 no. of sets of each drawings).

The Execution of Internal Electrical work for all aspects of the check post as per Scope of work read with Technical Specifications and Drawings. The following items are expressly included (but not limited to) in Internal Electrical execution:

- Each floor/ area slab/ wall concealed electrical copper wiring/ cabling/ conduiting (steel/PVC/GI) network including fan boxes, plastic conduits, wires/cables etc or as specified in the specifications;
- Various type of direct dimmable (on TCP/IP) LED Lighting fixture, sensors, fans, exhaust fans;
- Switch boards, switches, plugs, fans, exhaust fans, regulators, UPS, etc.;
- Distribution boards, Circuit breaker, MCB, RCCB, MCCB, Junction boxes, meters, Electrical Panels (Low Voltage/Medium Voltage/High Voltage), Earthing etc.;
- L.T., M.V., Cables laying including customised cable tray for multiple services installation in basements, supporting accessories, fittings & fixtures etc.,
- Diesel Generator sets with start-stop switches, alternator, fuel-tank, exhaust system, acoustic & weather proof enclosure etc.
- Insulation of all equipment/ fittings etc. and commissioning the same

All Electrical systems to have IP500/ipV6 connectivity (preferred wireless) directly to IBMS for all their crucial parameters and operation.

b. External Development & Landscaping including internal roads & pavements, smart lights, water supply, sewerage facility, drainage network, rain water harvesting well etc.

- **Landscape -** Landscape over open land area including all horticulture operation, earth filling, grassing, tree plantation etc. as per Drawing and Technical Specification
- **External Services –**
    - Installation, testing and commissioning of rain water harvesting system, water supply system, sewerage system and drainage system as per Drawing and Technical Specification.
    - Providing and laying/fixing cabling from the main receiving station, rising main, meter, electrical panel, sensors /devices assembly, outstation junction box, for pole mounted field sensors /devices the cables shall be routed down the inside of the pole and through underground duct to the outstation cabinet etc. as per Drawing and Technical Specification. Cabling must be carried out per relevant BIS standards. All cabling shall be documented in a cable plan by the SI. All cables shall be clearly labelled with indelible indications that can clearly be identified by maintenance personnel.
    - The SI shall comply with lightning-protection and anti –interference measures for system structure, equipment type selection, equipment earthing, power, signal cables laying. The SI shall describe the planned lightning-protection and anti –interference measures in the feasibility report. Corresponding lightning arrester shall be erected for the entrance cables of power line, video line,

data transmission cables. All crates shall have firm, durable shell. Shell shall have dustproof, antifouling, waterproof function & should capable to bear certain mechanical external force. Signal separation of low and high frequency; equipment's protective field shall be connected with its own public equal power bodies; small size/equipment signal lightning arrester shall be erected before the earthling. The Internal Surge Protection Device for Data Line Protection shall be selected as per zone of protection described in IEC 62305, 61643-11/12/21, 60364-4/5. Data line protection shall be used for security system, server data path and other communication equipment. Data line protection shall be installed as per zone defined in IEC 62305.Type 1 device shall be installed between zone 0B and zone 1. Type 2 devices shall be installed before the equipment in zone 2 and 3.

- Smart LED lights, land scape light, all signage as per Drawing and Technical Specification.
  Multi-purpose poles in open area for integrated or independent installation as appropriate for cameras (PTZ, Fixed Box/ Bullet Cameras, and ANPR), Smart LED lights, active network components, controller, generators and UPS at all check post locations, as per the specifications given in the RFP.
- The Junction Box needs to be appropriately sized in-order to accommodate the systems envisaged at the check posts and considering the future scalability, and the SI should design the Junction box for 1.5 to 2 times the actual size the SI requires for utilization under the CCC project.
- The Junction Box for UPS with Battery bank can be separate or common junction box. Solar Panels can also be considered as alternate source for power. The Junction Box for UPS with Battery bank can be separate or common junction box. Solar Panels can also be considered as alternate source for power.
- Generators at all the check post locations shall be protected by shed and at a safe location.
- All Electrical systems to have IP500/ipV6 connectivity (preferred wireless) directly to IBMS for all their crucial parameters and operation

- All Electrical systems to have IP500/ipV6 connectivity (preferred wireless) directly to IBMS for all their crucial parameters and operation
- **Roads and Boundary wall**
  - Construction of Internal Roads, Pathways, open parking space etc. including connecting with the external road network as per Drawing and Technical Specification.
  - Construction of Boundary wall, Gate, M S Grills, Boom Barrier etc. as per Drawing and Technical Specification.
  - Construction of Service ducts for electrical water supply etc. as per Drawing and Technical Specification.
  - Service Connection/tapping of the water supply, sewerage, drainage, electricity to the main/municipal system or as appropriate.
- **Covered Inspection Shed**
  - Construction of the covered inspection shed all related components as per Drawing and Technical Specification.

1.7.3 Scope of Work for installation, testing and commissioning of equipment/systems at check posts

The SI shall be responsible for successful installation, testing and commissioning of following ICT equipment at the check posts, as per Drawing and Technical Specification. (Refer to section 1.3 – **Design, supply, installation & commissioning, maintenance of field equipment**)

- E-weighbridge

- Parking Sensors
- RFID Readers
- CCTV Cameras
- Boom-Barrier
- Traffic light for the weighbridge
- Smart LED Lights

Any other installation or mounting as required at the check post during the course of project execution.

1.8 Special conditions

1.8.1 The site

- The site for work for which the check post should be constructed shall be made available by the office of the CGM. The complete land (for construction of ICP) shall be handed over to the SI after the contract is signed. However, SI should satisfy themselves before biding about the accessibility of the site. Any access road to be constructed for carriage of men/ machinery/ material etc. to the site shall be sole responsibility of the SI and nothing extra shall be payable on this account.
- Prior to starting the site clearance exercise, the SI shall carry out survey of field locations as specified in this section, for buildings, structures, land allocated for check posts, fences, trees, existing installations, etc. The office of the CGM shall be fully informed of the results of the survey and the amount and extent of the demolition and site clearance shall then be agreed with the office of the CGM.
- The right of access to the site shall be available with authorised representatives to the office of CGM and its employees and agents for inspection, viewing and exercise of their rights and performance of their obligations as under the agreement.

1.8.2 Design

- The SI shall design and provide all necessary specifications for the Works in accordance with the site plans and contract agreement's requirements. Any design detail, plan, drawing, specifications, notes, annotations, and information required shall be provided in such sufficient format, details, extent, size and scale and within such time as may be required to ensure effective execution of Works and/or as otherwise required by the office of CGM.
- The SI holds himself, and his designers as having the experience and capability necessary for the design. The SI undertakes that the designers shall be available to attend discussions with the Engineer at all reasonable times during the Contract Period.

1.8.3 As-Built Drawings and Documents

- The SI shall prepare, and keep up-to-date, a complete set of "as-built" records of the execution of the Works, showing the exact "as-built" locations, sizes and details of the Works as executed, with cross references to relevant specifications and data sheets. Three copies shall be submitted to the office of CGM prior to the commencement of the Tests on Completion. In addition, the SI shall prepare and submit to the Engineer "as-built drawings" of the Works, showing all Works as executed. The drawings shall be prepared as the Works proceed, and shall be submitted to the office of the CGM for inspection. The SI shall obtain the consent of the office of CGM as to their size, the referencing system, and other pertinent details.

- Prior to the issue of any Completion Certificate, the SI shall submit to the office of CGM three copies of the relevant "as-built drawings" (hard and soft copies), and any further Construction and/or Manufacture Documents. The Works shall not be considered to be completed until such documents have been submitted to the office of the CGM.

1.8.4 Specifications and Standards

- The SI shall comply with the specifications and standards that are enclosed as a part of this agreement. However, it is to be noted that the specifications provided are the minimum requirements and SI has to comply with the best practices/standards. The SI shall provide copy of all relevant codes and standard to employer.

1.8.5 Electricity, power, water and other services.

- The SI shall make arrangements of water supply, power supply, lodging facility for its team at sites, as necessary, during the execution of the assignment, at its own cost. Any other out-of-pocket expenses are to be borne by the SI other than explicitly mentioned in the agreement.

1.8.6 SI's care of the works

- The SI shall bear full risk in and take full responsibility for the care of the works, and of the materials, goods and equipment for incorporation therein, from the appointment date until the date of completion certificate.
- Upon completion of the works, the SI shall remove from the site all the said constructional plan and his unused material.
- The SI shall confine his operations to the Site, and to any additional area which may be provided to the SI and agreed by the office of CGM as working areas. The SI shall take all necessary precautions to keep his personnel and equipment within the Site and such additional areas, and to keep and prohibit them from encroaching on adjacent land.
- The design, the construction, the execution and the completed Works (including remedying of defects therein) shall comply with the specifications, technical standards, building construction, safety and environmental regulations and other standards specified in the agreement to the Works or defined by the applicable laws and regulations.
- The SI shall construct the automated check posts in accordance to the Project completion date set forth as per the request order. In the event the SI fails to achieve the scheduled completion date within a period of 30 days from the date set forth as per the contract conditions/ request order, unless such failure has occurred due to Force Majure or for reasons solely attributable to the office of CGM, it shall pay the office of CGM of a sum calculated at the rate of 0.05% (zero point zero five percent) of the contract Price for delay of each day reckoned from the specified date and until the project work is completed and shall be recovered from Earnest money deposit/Bid Security.

1.8.7 Safety of works

The SI shall throughout the execution of the Works including the carrying out of any testing, commissioning (including Integrated Testing and Commissioning), or remedying of any defect:

- take full responsibility for the adequacy, stability, safety and security of the Works, Plants and Equipment, Temporary Works, operations on Site and methods of installation, construction and transportation;

- have full regard for the safety of all persons on or in the vicinity of the Site (including without limitation persons to whom access to the Site has been allowed by the SI), comply with all relevant safety regulations, including provision of safety gear, and in so far as the SI is in occupation or otherwise is using areas of the Site, keep the Site and the Works in an orderly state appropriate to the avoidance of injury to all persons and shall keep the office of CGM indemnified against all injuries to such persons.
- provide and maintain all lights, guards, fences and warning signs and watchmen when and where necessary or required by the office of CGM or by laws or by any relevant authority for the protection of the Works and for the safety and convenience of the public and all persons on or in the vicinity of the Site; and
- where any work would otherwise be carried out in darkness, ensure that all parts of the Site where work is being carried out are so lighted as to ensure the safety of all persons on or in the vicinity of the Site and of such work.

SI is required to take note of all the necessary provisions with respect to Safety, Health and Environment and the SI's Price shall be inclusive of all the necessary costs to meet the prescribed safety standards. In the case, the SI fails in the above, the office of CGM may provide the necessary arrangements and recover the costs from the SI.

1.8.8 Existing Utilities and shifting of obstructing utilities

- The SI shall, in accordance with Applicable Laws and with assistance of the office of CGM, cause shifting of any utility (including electric lines, water pipes and telephone cables or other services) to an appropriate location or alignment, if such utility or obstruction adversely affects the execution of Works of the Project in accordance with this Agreement. The actual cost of such shifting, as approved and communicated by the entity owning the utility, shall be paid by the SI and reimbursed by the office of CGM to the SI.

1.8.9 Road signs

- All existing road signs which are likely to be effected by the works are to be carefully taken down and stored. Signs to be re-commissioned shall be cleaned, provided with new fixings where necessary and the posts re-painted in accordance with applicable municipality/ State or NHAI rules. Road signs, street name plate, etc. damaged by the SI during their operation shall be repaired or replaced by SI at no additional cost. SI should put necessary signage mentioning "Approaching Mining check post" before 500 & 200 meters of check posts.

1.8.10 Utilities as a part of project scope

- **Electrical works and power supply:** The SI shall directly interact with electricity boards for provision of mains power supply at all desired locations like CCC project field solutions and for all the check post locations. The SI shall be responsible for payment of the electricity bill including connection charges, new meter charge, recurring charges etc. to the respective electricity board directly. SI shall have to submit the challan of bill payment to the office of the CGM for reimbursement of the same. ROP charges paid by SI shall not be reimbursable. Last mile connectivity for the power shall be the responsibility of the SI
- **Water works and water supply:** The SI is responsible for provisioning of water supply at the check posts. The water supply can be a connection line take from the water works department or digging a bore well with proper approvals and clearances. SI has to choose the most optimum way of provisioning of water provisioning at respective check posts based on the check post location. The SI shall directly interact with water works departments for provision of water supply at all desired locations for check posts and for all the check post locations. The SI shall be responsible to submit the water bill including connection charge, new

meter charge, recurring charges etc. to the respective water works department directly. SI shall have to submit the challan of bill submission to the office of the CGM. Office of the CGM will reimburse the amount submitted to the SI after verification in next billing cycle.

1.8.11 Excavated Material

- Unless otherwise specified, the SI shall not sell or remove, except for the purpose of this Contract, sand, stone, clay, ballast, earth, rock or other materials obtained from the work Site and these shall be the property of the office of CGM and will be disposed of only in the manner instructed the office of CGM.

1.8.12 Staff and Labour

- The SI shall make his own arrangements for the engagement of staff and labour at his own cost.
- **Rates of wages and conditions of Labour -** Full compliance of statutory requirements apart, the SI shall pay rates of wages and observe conditions of labour not less favourable than those established for the trade or the industry where the work is carried out.

The SI shall make himself aware of all labour regulations and their impact on the cost and build up the same in the Contract Price. During the Contract Period no extra amount in this regard shall be payable to the SI, for whatsoever reason including any revision of rates payable to the labour due to revision of rates payable in Minimum Wages Act.

Labour provided by the SI, either directly or through sub-contractors, for the exclusive use of the Employer or the Engineer, shall, for the purpose of this Sub-Clause, be deemed to be employed by the SI.

In the event of default being made in the payment of any money in respect of wages of any person employed by the SI or any of its sub-contractors of any tier in and for carrying out of this Contract and if a claim therefore is filed in the office of the Labour Authorities and proof thereof is furnished to the satisfaction of the Labour Authorities, the Employer may, failing payment of the said money by the SI, make payment of such claim on behalf of the SI to the said Labour Authorities and any sums so paid shall be recoverable by the Employer from the SI.

1.8.13 Labour Laws

- In dealing with labour and employees, the SI and his sub-contractors shall comply fully with all laws and statutory regulations pertaining to engagement, payment and upkeep of the labours in India.
- The SI shall provide and maintain at his own expense, all necessary accommodation and welfare facilities as per prevailing labour & welfare laws for his (and his Sub- contractor's) staff and labour.

1.9 Material Specifications

The selected bidder should refer **Annexure B Specifications and Standards** of the below mentioned Non-IT components. It is essential that Fire Proof material be used as far as possible and Certification from Fire Department be taken for CCC before Go-Live.

Special Specifications

- Covered Inspection Shed, Weigh Bridge, Diesel Generator Set, etc.

Civil and Architectural work

- Furniture and Fixture, Partitions, Painting, PVC Conduit, Wiring, Cable Work, Earthing, Fire Alarm System, Aspirating Smoke Detector System, Water leak detection System, Access Control System, Rodent Repellent, Fire Suppression System, Operator console- work space, Covered shed area, etc.

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

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

2 Functional requirements

2.1 Command and Control Centre (CCC) Solution

2.1.1 Objectives

The key objectives from the CCC solution are

- To monitor, analyse and control the state-wide mineral movements at central control location
- To provide analytics inputs for raids and illegal mining activities & real-time directions for critical incident responses
- To provide integrated view of all existing IT applications of CGM to effectively monitor entire business processes and design provisioning for future applications
- To control operations of various field level devices including sensors, RFID system, boom-barrier at Check posts.

The Command and Control Centre would be located at CGM office, Gandhinagar. The CCC is expected to provide an integrated view of all the 7 check-posts along with all the pertinent ICT interventions like automatic weighbridges, surveillance cameras, RFID sensors, parking sensors, ANPR details etc. Key focus area is to be a decision support, surveillance engine for CGM administrators in their day to day operations as well as during emergency situations.

Centralized information dashboard

The Command and Control Centre displays a centralized information dashboard with KPI monitoring along with various departments level dashboards by analysing data and streams coming from a wide variety of systems. This data is expected to be analysed and correlated with data coming from other office of the CGM's IT systems to identify abnormal events, patterns and exceptions and alert the concerned authorities for further action. Any disruption in SOP's of any check post service or processes will be reported as an incident, which must be resolved as per SLAs. Further, any department's personnel can raise incidents through the system.

CCC would be a web based system and would have the capability to provide Geo-Spatial displays along with intelligent incident response mechanism. CCC shall facilitate the viewing and controlling mechanism for the selected or all the check posts in a fully automated environment for optimized monitoring, regulation and enforcement of services. The check posts data shall be accessible by operators and concerned authorized entities with necessary authentication credentials.

Expectations from CCC

1. The vision of the CCC is to have an integrated view of all the field level equipment's at 7 check posts and monitor their operations remotely. CCC would serve as the focal point to serve as a decision support engine for office of the CGM administrators in day to day operations as well as during exigency situations.
2. CCC shall be a fully integrated, web-based solution that provides seamless incident – response management, collaboration and geo-spatial display.
3. CCC shall facilitate the viewing and controlling mechanism for the selected field locations in a fully automated environment for optimized monitoring, regulation and enforcement of services. The CCC shall be accessible by operators and concerned authorized entities with necessary authentication credentials.

4. Various smart elements are able to use the data and intelligence gathered from operations of other elements so that exceptions are identified and dealt in a well-defined manner and the office of the CGM's surveillance team is kept informed about the exceptions at the check posts.

2.2 Solution Architecture of CCC and other field devices (IT Infrastructure)

The overall architecture of the components envisaged under the "CCC & Check post ICT Infrastructure" is as given below.

2.2.1 Sensor and actuator layer

The sensor layer will help the office of the CGM administration gather information about the ambient check post conditions or capture information from the edge level devises like cameras, parking sensors, E-weigh bridges, RFID readers etc. Components under this layer will be under the scope of the SI selected through this process.

2.2.2 Network Layer

The secured network layer will serve as the backbone for the project and provide connectivity to gather data from sensors and communicate messages to display devices and actuators. The network layer will be scalable such that additional sensors, actuators, display devices can be seamlessly added.

2.2.3 Data Centre Layer

The data centre layer will house centralized computing power required to store, process and analyse the data to decipher actionable information. This layer includes servers, storage, ancillary network equipment elements, security devices and corresponding management tools. Similar to the network layer, it will be scalable to cater to the increasing computing and storage needs in future. Provisioning of this layer will under the scope of the selected vendor.

2.2.4 Smart Application and Integration Layer

The smart applications layer will contain data aggregation and management systems (rules engines, alerting systems, diagnostics systems, control systems, messaging system, events handling system), and reporting / dashboard system to provide actionable information to CGM administrators. It will be an evolving layer with applications added and integrated as and when new applications are developed at CGM. 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 other government and non-government agencies. Provisioning of this layer will be under the scope of the selected vendor

2.2.5 Service delivery and consumption Layer

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

2.2.6 Control Units & Command and Control Centre Layer

The CCC and control units will enable administrators to get a holistic view of check post conditions. Such control units will take shape of either an exhaustive command centre or control applications which can be viewed over a web browser or available in form of a mobile application. The implementation vendor will have to develop a Command and Control Centre (CCC) at CGM Office Gandhinagar.

2.2.7 Security Layer

Various sensors, actuators and other field, display devices will be connected through a network, security of the entire system becomes of paramount significance and the system integrator will have to provide:

- **Infrastructure security**- including policies for identity and information security policies
- **Identity and Access Management** – including user authentication, authorisation, SSL & Digital Signatures
- **Application security** - including Hosting of Government Websites and other Cloud based services, Adoption of Technical Standards for Interoperability Framework and other standards published by GoI for various eGovernance applications
- End device security, including physical security of all end devices at CCC.

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

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

2.3 Functional and Technical Specification for CCC Software

Function	Description	Bidder Compliance
1. Solution & Platform	Must comply with the industry open standards based Commercial-of-the-shelf (COTS) products. Highly scalable (without any licensing restrictions of databases, servers, cores, users etc.), must have load balancing and certified by OEM. Must have API's and SDK's available to integrate or be integrated to CGM's other applications either bespoke developed or COTS product. The solution should adhere to industry standards for interoperability, data representation & exchange, aggregation, virtualization and flexibility. Platform must support IT Infrastructure Library (ITIL) standards for standard operations plan and resource management. Platform must be compatible to geo spatial Standards like GML & KML etc.	
2. Integrations	Should be able to integrate different types of edge devices, services, deployed solutions (either Bespoke or COTS). The data from these edge devices should be normalized and be available via API to various other application developers as and when required. The software should be able to command, control, exchange data to and from these edge devices and services	
3. Incident management	The software should support comprehensive incident management services for multiple type of incidents with both segregated and/or overlapping management and response teams, including support for incorporation of	

	resource database for mobilizing the resources for response. The software should also support real time event status reporting manually or automatically by various sensors, edge devices and their linkage with standard operating procedure automatically without human intervention. The software should support Geospatial rendering of event and incident information by plotting of area of impact using polynomial lines to divide the area into multiple zones on the GIS maps. The system must support. Ability of the software to capture vital information such as location, name, status, time of the incident and be modifiable in real time by multiple authors with role associated permissions (read, write). Incidents should be captured in standard formats which includes user defined forms along with standard incident management command forms to facilitate incident correlation and reporting. The Command and Control Centre software should have a section for posting, updating and disseminating plans, procedures, checklists and other related information. The software must identify and track status of critical infrastructure / resources and provide a status overview of facilities and systems. The software should provide detailed reports and summary views to multiple users based on their roles.	
4. Application Integrations	The software should be capable of integrating either existing or future office of the CGM applications and push, pull pertinent data from these systems and provide it on CCC's dashboard for analysis, correlations and drawing actionable intelligence. The CCC software should be able to associate incident management capabilities with other integrated IT applications and be able to correlate messages, incidents and trigger existing SOP's or start a new SOP. The CCC software should be able to correlate surveillance feeds with incident data and produce relevant feeds. The CCC software should have API's or SDK's available to integrate various systems irrespective of their technology stack and whether, these system are bespoke solutions or CTOS products.	
5. Customizable Centralized information Dashboard	The software should provide user specific, personized centralized information dashboard for their respective needs and show various performance indicators, edge devices statues on an easy to navigate configurable & customizable GUI. The dashboard should be able show, push and pull key parameters and pertinent information on demand from all the other integrated IT applications, field devices and other applications. The dashboard must be able to show inputs from various sources be it a screen, pc or any other external devices. The CCC should enable end-users to dynamically filter the data in their dashboard based on region, dates, product, brands, etc. and capability to drill down to the details. The dashboard should allow use of GIS tool which allows easy map editing for wide area monitoring (Google map, Bing map, ESRI Arc GIS map, etc.).	

6. Device Status, Obstruction Detection and Availability Notification	The CCC software should provide icon based user interface on the GIS map as well as tabular view to report available and non-functional device. The CCC software should provide user interface to publish messages to multiple devices at the same time	
7. Processing, correlating Events and directives control	The CCC should be able to relate two or more events coming from different subsystems, sensors, edge devices (incoming sensors) based on time, place, and custom attribute and provide correlation notifications to the operators on dashboard based on predefined business and operational rules in the configurable and customizable rule engine. The correlation should happened in real time and should not need any compilation. Events could be a single system occurrence or complex events that are correlated from multiple systems. Events could be ad hoc, real-time, or predicted and could range in severity from informational to critical. The directives control should depend on severity of event and directives be designed/modified based on SOP. The directives could be issue automatically via rules, or it could be created by the operations team manually. At the Command & Control Centre, the event should be displayed on an operations dashboard and analysed to determine a proper directive.	
8. SOP Management-	CCC software should provide ability to write, invoice limitless configurable and customizable standard operating procedures through graphical, easy to use tooling interface. Standard Operating Procedures should be established, approved sets of actions considered to be the best practices for responding to a situation or carrying out an operation. The users should be able to edit SOP's including add, edit, delete activities and should be able to add comments or stop SOP prior completing. There should be provision for automatically logging the actions, changes, and commentary for the SOP and its activities, so that an electronic record is available for after-action review. The activity types supported should be manual activity, automation activity (an activity which initiates and tracks a particular WO and select a predefined WO from the list), if then else activity (conditional activity that allows branching based on specific criteria. Either enter or select values for Then and Else), notification activity (an activity that displays a notification window that contains an email template for the activity owner to complete, and then sends an email notification) and SOP activity (activity that launches another standard operating procedure)	
9. Monitor major performance Indicator	The CCC software should provide ability to record, edit and monitor various performance indicators for various processes and policies and show their respective status using various colour codes, for example Green –if all ok, RED- critical , Yellow –caution etc.	

10. Reporting Requirements	The CCC software 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. The solution should generate customized reports based on the area, sensor type, integrated applications or periodic or any other customer reports as per choice of the administrators. The software should provide historical reports, event data & activity log. The reports can be exported to pdf or html formats.	
11. Collaboration and communication	The CCC should provide various tools for users to communicate & collaborate in real time. The CCC software should 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. The CCC software should provide 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. The software should provide dispatch consoles which can be integrated with various communication channels supporting rich media formats for incidents which enables dispatchers the power to consolidate incident and instantly share the information to responder team. It should assess the common operating picture, identify & dispatch mobile resources available nearby the incident location. Augment resources from multiple agencies for coordinated response.	
12. Alarms, Alerts and mass notifications	The CCC software should provide role based, single-sign- on, secure alarm work flow monitoring to users for creating, administering the alert content and disseminating it to end users. Provision of alerting external broadcasting organizations like Cellular etc., as web-service. The CCC software should have an ability to handle multiple alarms from multiple workstations and display alarm condition through visual display and audible tone. The software should provide complete reporting of alarms which include incident, severity, time/date, description, location, edge devices, video snapshots, response instructions, audit trail of alarms. These reports should be able to get exported including jpeg, pdf, html, txt formats. The software should have an ability to match keywords or text from the alarming subsystem's incident description to raise an alarm using criteria including exact match, exact NOT match, contains match, wildcard match and regularly expression match (such as forced door alarm, denied access, door open too long, etc.). The software should have an ability to optionally match alarming subsystem's incident status, incident severity, and sensor type. Further the CCC software must have an ability to apply any alarm policy to one or more monitoring area(s) or zone(s) or to one or more sensors without having to reapplying the policy multiple times. The CCC software 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. The software should display highest priority alarm and associated data / video in the queue as default, regardless of the arrival sequence. The alarm module of the software should have the ability to assign specific actions for each alarm, to activate or deactivate alarms as required, to create exceptions, to batch-wise rules and process them, to Check and rectify logical errors and contradictory rules, to schedule execution of rules, to suspend or terminate the application of rule and archived deactivated rules. The software should provide users the ability to view historical alarms details along with the ability to sort alarms according to date/time, severity, type, and sensor ID or location even after the alarm has been acknowledged or closed. Users should be able to send mass or specific notifications to multiple authorities including district authorities (on mobile) that a new intelligence has been gathered through open source/ other IT applications of CGM using SMS, Voice (PSTN/Cellular), Email etc.	
13. Security, Access control, Authentication and Authorization	The CCC should provide very high and stringent levels of security for servers, internet, web contents, databases based on authorization and authentication of user groups based on their roles, access levels and permissions. The software should support multi dimension access control such that with users have ability to accesses multiple sites/domains using single-sign-on (should be able to support LDAP).	
14. Rules Engine	The CCC software should provide an environment to design, develop and deploy dynamic business rule and even applications. The software should have at-least two complementary decision management strategies: business rules and event rules.	
15. Analysis Tools	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. The software should allow to take proactive decisions that help minimize risks and damages, the solution should provide Analytical and Simulation systems as part of the Decision Support System. The solution should help simulate what if scenarios. It should help visualize assets/resources at risk due to the pending/ongoing incident, should render impacted region on a GIS/3D map. The solution should help build the list of assets, their properties, location and their interdependence through an easy to use Graphical User Interface. When in What if Analysis mode the solution should highlight not only the primary asset impacted but also highlight the linked assets which will be impacted. The user should be able to run the What-if Analysis mode for	

	multiple types of emergency events such as Bomb Blast, Weather events, Accidents etc.	
16. Graphs & Charts	The system should provide a facility to see incidents and actions (tasks) added to the CCA in a tabular list form as well as Gantt chart format filtered by day, week, month, year or any specific date range. The system should provide a facility to see incidents, actions and interdependencies between actions in a clear visual graphical manner. The system should be able to filter the information based on Incident information, Resources information, Agency type, Tasks and criticality of incident/event.	
17. Video Display	The CCC software should all the users to view live or recorded video from resizable and movable windows (matrix) and perform video controls for video systems from workstations. Shall allow to take still image from live or recoded video, play, fast-forward, rewind, pause, export (for a specified time) and specify time to play recorded video. The CCC software shall have the capability to move PTZ cameras and allow user to view video in matrix and multiple video formats (1x1, 2x2, 3x3, 4x4 etc.). The CCC software should further enable operator to specify video windows to be displayed in matrix and have matrix settings to be saved per user. The software shall enable video snapshot to be taken and saved from any window pane in the matrix view. The software shall rotate bot live and recorded video “virtual” video guard tour and shall rotate through multiple video views based on predefined video camera sequence and duration. Further the software should allow the users to pause the rotation of video and resume the video rotation again and the times between new video to be adjusted. The software should allow alarms to be generated from any video pane and shall user to only view and control video for which they have been assigned permissions by the administrator	
18. Task management	The system should be able to create, assign, track and report on the lifecycle of tasks during a particular incident. The task should further be allowed to be decomposed into sub-tasks. The progress of the task and sub tasks should be available on the dashboard. The system should be able to organise the visual representation of tasks into prioritized list, filtered list, as well as colour coded representation for ease of understanding. Every tasks and sub tasks should have an ID, target completion date, creation date and time stamp, status of the tasks. System should provide capability to define status of tasks during its lifecycle. All these attributes should be colour coded these status definitions could be mapped to other task attributes such as the task type. These tasks should be searchable by entering keywords. The system shall allow the tasks to be filtered on the real-time dashboard. This filtering should allow an operator to filter for all tasks of a particular state or a combination of state; and by the time remaining until (or time elapsed since) the target completion time. The system should allow multiple individual	

	workstations to select specific agencies of interest on each workstation simultaneously. The system should allow the office of the CGM to display all agencies' tasks simultaneously as well. The tasks should be displayed on a real-time timeline. The criticality of tasks should be dynamically changed depending on the performance of the incident response.	
19. GIS Display	The software shall allow the users to view the environment through geospatial or fixed composite computer-generated (JPEG, BMP, AutoCAD, etc.) map. Users should be able to vie sensors and related information on the map. Users should be able to georeferenced these field devices/ sensors on map such that they have a real world coordinate. The software should visually display a alarm sensors, camera sensor with related camera orientation, camera range and camera field of view angle. The software should visually differentiate sensor alarm severities on map through different colour and icon identifiers. The software should immediately view alarm details (including description, video, etc.) and investigate the alarm from the map further the software choose camera and other sensors from map to view live video and the data. The software should also allow user to choose camera to play, zoom in /out pause, stop, fast-forward, rewind, and play recorded video from present time and take live video image snapshot and save to file from any camera. The software should allow user to choose camera from map to move PTZ cameras. The software should allow user to jump from one map to the next with a single click of a mouse with map links. The software should allow map information "layers" to be displayed/hidden on items such as – Sensor names, Sensor range (e.g. camera – orientation, range, field of view angle) with Locations and zones, Perimeter ranges and Resource tracks	
20. Situational Awareness	The CCC software should be able to combine data from various sources and present it as different views tailored to different operator's needs and should automatically update the information based on alarms and incidents that are presented to it via the business rules engine. The polling and CCA database refresh cycle shall be configurable to match the status of the situation (whether there is an emergency or crisis or just monitoring only). Common Operational Picture should comprise of a comprehensive view of the incident or a group of related incidents as on a specific date and time which should include but not be limited Tasks assignment and their status, Agencies involved, Resources deployed, Incident status across relevant parameters of the incident e.g. vehicles affected by a checkpost shut-down, Timeline view of the situation	

2.3.1 Mobile App/browser based info for Field Staff

The CCC Solution shall provide view/limited control options to the field level /district authorities based on their access rights. This access can be provided by a mobile app and by browser based access.

Besides viewing surveillance data based on their respective rights, these authorities should be able to manage and close any task/issues. There would not be more than 100 field staff using this app. The app should have facility to upload a geo-tagged & time-stamped photograph and remarks text, from mobile device.

2.3.2 Integration Required

1. The CCC will aggregate various data feeds from sensors and systems and further process information out of these data feeds to provide interface /dashboards for generating alert and notifications in real time.
2. The CCC would also equip office of the CGM administration to respond quickly and effectively to emergency or disaster situation through Standard Operating Procedures (SOPs) and step-by-step instructions. The CCC shall support and strengthen coordination in response to incidents/emergencies/crisis situations.
3. The system shall provide reporting & audit trail functionalities to track all the information and monitor operator interactions with the system and to impart necessary training to the users

2.3.3 Other Requirements

1. The CCC will be the nodal point of availability of all online data and information related to various current and future elements/applications and will be connected to other office of the CGM network of services through an integration layer.
2. The CCC will be established with all electrical, mechanical, furniture, hardware, software and network infrastructure including switches and routers and will be maintained by the successful bidder throughout the mentioned period. It must be noted that DC is housed in CCC, Gandhinagar.
3. The controls and displays should be mounted in ergonomically designed consoles to keep operator fatigue to a minimum and efficiency high.
4. Security: In no circumstances this data accumulated and processed by CCC should be compromised. Hence provisions will be made to keep all the data stored in this platform highly secured with required Security framework implementation. The platform will be hosted in DC at Gandhinagar. Further the platform will provide an open standards based integration Bus with API Management, providing full API lifecycle management with governance and security.
5. The CCC shall be able to remotely open boom barrier al all the checkposts and control various other field level devices.

2.4 Centralized Information Dashboard on CCC Software

2.4.1 Objectives

To plan, strategize, monitor, control office of the CGM's key business processes and equip the administrative staff with meaningful data, it is must for the CCC software to integrate with the CGM's ecosystem of various distributed systems (mentioned in the table below). These applications are operating in silos, CCC software is expected to be integrated and to have data interchange (push and pull) with them. Currently in the mining and minerals management, the Government (Gujarat State & Central) has developed/ planned following applications to carry out standalone functions:

Applications	Purpose	Status	Type	Technology

1. ILMS	Integrated lease management system- Used to manage the royalty, penalty and lease data	Developed and operational	Bespoke	Microsoft suite (.Net & MsSql)
2. VTMS	Registration of mineral transport vehicles and their location tracking	Tender rolled out- to be developed	COTS	NA
3. Geomine, Gujmine	Mobile app for people to raise complaints of illegal mining, for office of the CGM staff to login their attendance and survey/ raid reports	Developed and operational	COTS	Android and Php- Mysql
4. GIS Application	A single source of visualization of all the leases, mines on maps, engaged leases, vehicle movements and other CGM assets	Tender being prepared	COTS	NA
5. ERP	Manage and execute day to day operations of the office of the CGM	Under Development	COTS	Oracle

Following are the details of the systems which are currently being used or in advanced stage of development.

1. **ILMS (Integrated Lease Management System: Currently referred as ILMS at CGM)**

As per office of the CGM's vision, ILMS is considered as MAGIC (Mineral Administration and Governance using ICT) Application for CGM mainly developed (in year 2011) with an objective to enable the Department of Geology and Mining to regulate the mining activities through electronic mode. Prior to ILMS, each activity was managed and processed manually at the offices and in field. The primary aim of the project is to replace traditional manual processes by a web-based application which is faster and more efficient. It covers services such as

- **E-Royalty pass**: e-Royalty Pass System (ATR – All Time Royalty Pass) provides web-based interface for leaseholders to issue royalty passes having a unique barcode/QR code id on SSP.
- **E-Delivery Challan**: e-Delivery Challan enables the lease holder and stockiest to directly sell the mineral to the stockiest and end users.
- **E-Payment**: This facilitates the end user to pay respective payment of royalty and penalty through RTGS / NEFT / Online internet Banking.
- **E-Return system**: The leaseholders can submit their returns online through e-Return. This is the balance quantity of minerals declaration every month after exploration and dispatch.
- **E-Demand register**: Demand Register has been developed as a provision of online/offline information transaction recording framework, to maintain leaseholder's account details of production, dispatch and collection, interest, sale value etc. as per rules of Gujarat minor mineral concession rules (GMMCR) 2010. This function is available for District officials and still under revision/ revamping
- **Online Lease/ Permit application**: Online Lease Application enables applicants/industries to apply for any kind of new lease as per standard forms prescribed in GMMCR / MCDR rules through online portal of Geology & Mining.

2. **GeoMine and CGM Gujarat (GujMine)**

With the increased penetration of mobiles devices and adoption of mobile applications over computer based IT systems, CGM has developed (in year 2015) GeoMine and CGM Gujarat android based mobile applications with the objective to offer key business functions on mobile platforms in the year 2015.

1) GeoMine: It is an application for CGM staff with following functions –
    a. GPS based Attendance System: All the field officers have to mark their attendance online using their function. It mainly captures latitude and longitude information, exact time & date and specific remarks if any.
    b. Inspection (Lease, Stockiest, Vehicle/Road, FS, and Citizens Complain): The app also offers uploading inspection report with corresponding details pertaining to the entity being inspected.
2) CGM Gujarat: It is an application for reporting mining complaints and information dissemination for the Citizens. This has features of GR & Circulars, Stockist, Mineral, and Petrography Lab Information.
3) CCC is expected to show analytics which includes the types of complaints, frequency of receipts of different types of complaints. CCC should have capability to turn a complaint into an incident.

3. CGM ERP

ERP has been the far-fetched vision that CGM has geared up to implement to streamline all the departmental and workflow related functions. The major modules envisaged for ERP are:

- Lease Application and Management.
- Project & Planning Management
- Finance Management
- Materials Management
- Quality Management
- Document Management System
- Legal & vigilance Case Management.
- Human Resource Management & Employee self-service portal (including Payroll)-Optional
- Business Intelligence
- Interfaces (ILMS, GIS, and GPS etc.)

All the above mentioned applications are hosted in state data centre, Gandhinagar, It would be the responsibility of the bidder to fetch necessary information, data from these systems for analytics, dashboarding. G-SWAN connectivity between State data centre and data centre at CCC would be provided by office of the CGM

2.4.2 Architecture and functional Requirements

As a part of the scope, CCC application has to provide a centralized information dashboard by fetching data from various sub systems mentioned above. The dashboard will be integrated with the existing, proposed and the future

applications of CGM and will have function and role based view to analyse information for decision making and investigation for enforcement related activities of Flying Squad. An indicative diagram depicting some of elements of the dashboard is mentioned above. The CCC users should be able to command and control, correlate, analyse various parameters of the sub systems using the centralized information dashboard.

2.4.3 Use cases for CCC & Dashboard Application Implementation

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

Following are some of the indicative use-cases/ data details from various systems which needs to be shown/taken action on or from the CCC. The detailed use cases, KPI's, parameters have to be worked out by SI which shall be approved by the office of the CGM.

Following are some of the use-cases/ data details from various systems which needs to be shown/taken action on or from the CCC

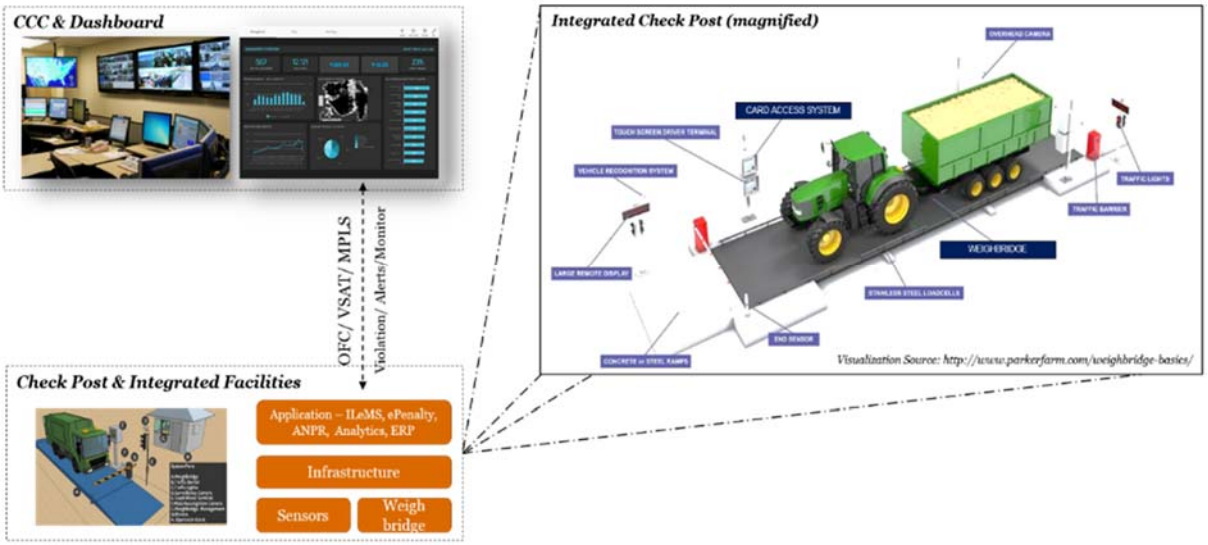
1) **Monitoring use cases**
   - Real time vehicle tracking and monitoring & Visualization on GIS
   - Flying squad movements
   - Live feeds from the surveillance cameras from all the 7 check posts
   - Mineral movements across the state
   - Time taken by each vehicle within the check post- average and for every vehicle
   - Identifying the movement of seized or blocked vehicle

2) **Violation use cases**
   - Real time overweighing alerts from check posts weighbridges
   - Seizure alerts from check posts as the seizure happens
   - Material movement information outsize georeferenced area
   - Seized vehicle & material movements from check posts- based on data from parking sensors
   - Vehicles which averted check post
   - Report a violation if any non-seized vehicle stays in check post for more than 10 minutes(configurable)

3) **Analytics Use cases**
   - Real time data for royalty collected as is – from ILMS
   - Real time data for penalty collected as is - from ILMS
   - What if analysis- In build CCC software capability
   - Real time vehicle data and its location- from VTMS
   - Registered complaints- from Gujmine App
   - Loading and unloading locations details and alerts if the vehicle is not loading or unloading from destined location
   - Real time weighment data – E-weighbridge
   - Seized vehicle movements and placement- Parking application
   - Camera surveillance data –VMS
   - Vehicle default history

4) **Dashboard view use cases**
   - Lease info on map with locations- from ILMS
   - Stockiest info on map with locations- from ILMS
   - Mineral movement real time on map- from VTMS
   - Vehicle movement real time on map- from VTMS
   - Royalty and Penalty collected information- from VTMS
   - Ability to view weighment data , bucket image of vehicle, concerned royalty pass, vehicle & vehicle owners details, lease information and destination information for all the violations, overweight scenarios at E-weighbridge for every checkpost
   - Various alerts as configured in the CCC application
   - All the information to be filtered on city, taluka level

5) **Data from Check post use cases**



   - **Parking sensors data**- Data of vehicle movements from a designated parking slot from a check post
   - **Vehicle details** as identified from RFID reader at check post and correlate, crosscheck with the ANPR data for the same vehicle, if available on the check post.
   - **Surveillance data** – real time streaming of the feeds from all the cameras at check posts. Real time bucket image from the camera housed on top of the e-weighbridge. Alerts may be provided at CCC with the bucket image in case of vehicle being overweight.
   - **E-weighbridge data**- Real time weighment data from the check posts. Alerts may be provided at CCC with the bucket image and weighment data in case of vehicle being over weigh.
   - **RFID sensors data**- in order to identify the vehicle and its related information
   - **Smart lights**- the status of the lights, ON/OFF, Working/Non-Working from the check post

Some other use cases pertaining to the various systems to be integrated are

1. VTMS platform integration

- Registered driver details as well along with the vehicle details. Also the ability to block the driver if he commits any assault or anything untoward on the CGM staff anywhere from the CCC dashboard.

- Ability to view all the vehicles carrying a particular minerals across the state and ability to zoom it
- Ability to view vehicle ratings which is provided by VTMS solution based on the vehicle in terms of fair practices based on the penalty, seizure and assault instances, a rating from 1 to 5 would be preferred, where 1 being the lowest and 5 being the highest
- Ability to de-register the vehicle, if seized for more than x number of times and track and highlight its location subsequently
- Ability to send notifications for any instances to district and central staff via SMS and email
- Ability to integrate with RTO API's to fetch the real time vehicle RTO data to fetch vehicle's actual carrying capacity along with the identity of vehicle owner
- Ability to provide ad hoc details pertaining to vehicle movement, loading, unloading locations, vehicle whereabouts to CCC as requested
- Ability to trigger an alert if the vehicle passes a nearby check post without going in, (nearby – range of radius 1 km)
- Provide violations alerts for vehicles if they have crossed any geo-fenced area or they have bypassed from their area of registration

2. ILMS Integration

1. Royalty pass /Delivery challan details
    a. Details of all the current and previous royalty passes/Delivery challans used by the vehicle
    b. No of times the vehicles have been seized
    c. Total amount of penalty paid by the vehicle owner and identify their corresponding royalty passes
    d. Location of leases, stockiest, mines etc. and their respective information about the penalty, royalty income, mining plans etc. This should be filtered on taluka level
2. Analytics Required
    a. Total amount of minerals carried by the vehicle till date, separated by Major, Minor minerals and further drilled down by mineral type
    b. Regions where the vehicles operates and gets seized most of the times
    c. Total amount of penalty paid for major, minor minerals and further broken down mineral wise
    d. Provide historical reports for vehicles about penalty, violations, and seizures on demand and while looking for details of any vehicle on CCC. These historical reports should be filtered region wise (up to taluka level), mineral wise and route wise
    e. Identify a combination of defaults which most frequently happen and provide actionable intelligence to CGM which include
        i. Combination of vehicle and the lease sources, stockiest which gets seized maximum number of times
        ii. The region where a vehicle gets seized maximum number of times
        iii. The mineral for which the vehicle gets seized maximum number of times
3. Loading and Unloading locations
    Ability to track the loading and unloading location of the vehicles as per the royalty pass and alert CGM staff if there is a slight deviation in vehicle either loading or unloading to a different place. This data should also be time stamped to understand when the vehicle was loaded and unloaded.

3. Integration with GIS Platform

1. Ability to consume GIS maps when developed and provide the vehicle information on the GIS maps of CGM. Until the GIS platform comes up, CCC can use any other reliable map service to show office of the CGM assets.
2. Ability to view requested map view (satellite, normal map view or hybrid) on CCC software as requested.
3. All the CGM assets including check posts, lease info and stockiest info should be visible on CCC. Until the GIS application is available CCC software may use any other reliable map services to display the assets. Once the GIS application is available, the assets needs to be shown using GIS application.

4. Integration with Gujmine

- Ability to take a vehicle number from Gujmine complaints and track the vehicle movements and show it on CCC by integrating with VTMS platform until CGM staff unpins the complaint or mark it as resolved
- Provide a list of all the complaints pertaining to a particular vehicle, lease etc and ability to filter it region wise to identify future raid locations by the flying squad team.

5. Integration with RFID Platform

- Ability to identify the vehicle and the vehicle owner based on the RFID tag being read by various RFID readers located at check posts.
- Ability to cancel the exist tag and provide new tag to the same vehicle owner, if required
- Ability to identify and report weighment breaches done by the vehicle

The required database level/ field level access for all the existing office of the CGM It systems shall be provided by the office of the CGM.

The above mentioned use cases shall not be assumed as final. The detailed use cases have to be worked by the SI

2.5 Check post Scope

2.5.1 Objectives

Office of the CGM has decided to setup 7 check-posts in Gujarat at strategic locations to monitor mineral movements and increase the purview of surveillance activities to curb illegal transport of the excavated minerals across state. With the help of technology and introduction of (electronic) E-weighbridge with integrated facilities at check-posts, it is envisaged that the administration and enforcement activities will become more effective. One of the key focus areas is to establish ancillary infrastructure to facilitate remote operations and ensure 24 x 7 uptime. It is expected that the ICT infrastructure at checkposts would detect, report and update CCC real-time regarding violations and other exigent situations.

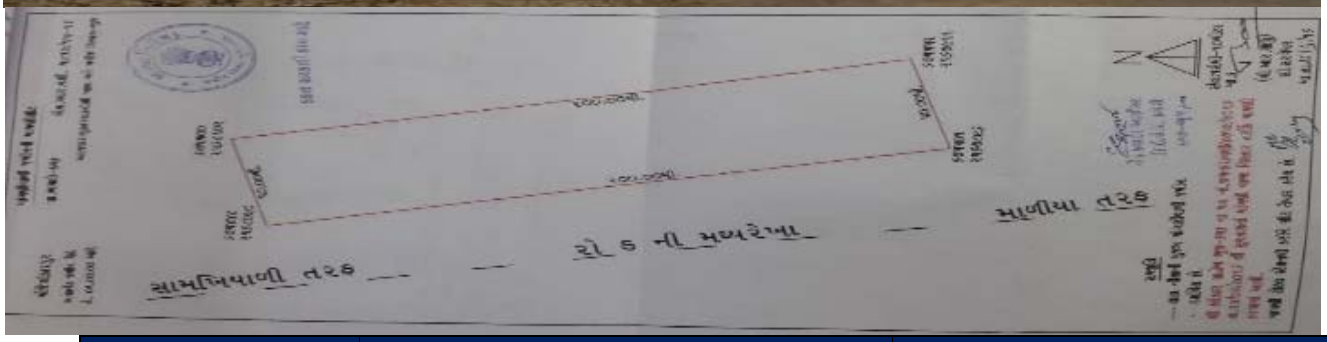
2.5.2 Checkpost Locations

As per initial findings, each check post has been allocated 1 hector land with defined set of facilities and technology components. The identified check post locations are

Sr.	Check post Name	Geo Coordinates (Lat., Lon.)	Status (Land)
1.	Shikarpur (Kutch)	23.233007, 70.691141 (existing) 23.209784, 70.715141 (allotted)	Allotted
2.	Harshad (Dev Bhumi Dwarka)	21.8498647, 69.3637360 (existing) 21.851602, 69.362014 (allotted)	Allotted
3.	Chhota Udaipur (Chhota Udaipur)	22.0181030, 73.6934090 (existing & allotted)	Allotted
4.	Bagodara (Ahmedabad)	22.637703, 72.191046 (existing)	In Process
5.	Arambhada (Dev Bhumi Dwarka)	22.436337, 69.041653 (existing)	Not Allotted
6.	Chiloda (Gandhinagar)	23.2160319, 72.7252749 (existing)	Not Allotted
7.	NH-8 (Surat)	21.3022670, 72.9542080 (existing)	Not Allotted

2.5.3 Site Details

1. Shikarpur (Kutch)



Category	As-Is	Required
Transport	350 T/Day, 5 Escape	Need to curb escape and overweight
Weigh bridge	4 Km away	Need to integrate the CGM plan
Key Minerals	Silica, Black Trap, Clay	-
Ways	One way but There are places to escape	-
Shade	No	Min. 20 Vehicle Parking for Seizure

Key factors to consider: Traffic management at the allotted site is very crucial as the land location is adjacent to highway that is single lane with heavy traffic. The allotted land is in salt water area that will need minimum 8 ft. of land filling to level the check post with the highway. Electricity, Network and Water-Sewage connection access is to be determined with support from local administration.

2. Harshad (Dev Bhumi Dwarka)

Category	As-Is	Required
Transport	450-700 T/Day, 10 Escape	Need to curb escape and overweight
Weigh bridge	2 Km away	Need Digital Weight Bridge
Key Minerals	Bauxite, Lime stone, Black trap	-
Ways	Two way	-
Shade	Behind check post	Min. 20 vehicle parking for seizure

Key factors to consider: Traffic management at the allotted site is very crucial as the mineral transport is two way hence for screening vehicles, it requires check post entry control through both the sides including approach roads/ inter sections from highway with adequate permissions. Moreover, the land is in area that will need minimum 4 ft. of land filling to level the check post with the highway. Electricity, Network and Water-Sewage connection access is to be determined with support from local administration.

3. Chhota Uddepur (Chhota Udaepur)

Category	As-Is	Required
Transport	350-400 T/Day, 10 Escape	Need to curb escape and overweight
Weigh bridge	8 Km away, Govt. WB under construction	Need to integrate the CGM plan
Key Minerals	Silica, Dolomite	-
Ways	One way (C.Udaipur, Panchmahal, Dahod)	-
Shade	Yes, 4 Trucks Parking Space	Min. 10 Vehicle Parking for Seizure
Manpower & Vehicle	2 (+2 Security) & 1	-

Key factors to consider: The existing check post is having a weigh bridge under construction from local union support however considering CGM provision, it requires integration/ upgradation to E-Weighbridge. Electricity, Network and Water-Sewage connection access is to be determined with support from local administration.

4. Bagodara (Ahmedabad)

Land Structure and Site photographs not available

Category	As-Is	Required
Transport	~300 T/ Day	No Check post to inspect
Weigh bridge	NA	Need Digital Weighbridge
Key Minerals	Silica	-
Ways	One	-
Shade	No	Required for 5 seizure

Key factors to consider: There is no infrastructure at checkposts and hence it requires planning from scratch with identification of Electricity, Network and Water-Sewage connection access etc

5. Arambhada (Dev Bhumi Dwarka)

Category	As-Is	Required
Transport	120-150 T/Day, 5 Escape	Need to curb escape and overweight
Weigh bridge	5 Km away	Need Digital Weight Bridge
Key Minerals	Bauxite, Lime stone, Black trap, Silica	-
Ways	One way	-
Shade	None	Min. 5 Vehicle Parking for Seizure

Key factors to consider: As the land is not allotted yet, the Electricity, Network and Water-Sewage connection access is to be determined with support from local administration.

6. Chiloda (Gandhinagar)

Category	As-Is	Required
Transport	150-180 T/Day, 5 Escape, 15 Escape	Need to curb escape and overweight
Weigh bridge	7 Km away	Need Digital Weight Bridge
Key Minerals	Silica, Black trap	-
Ways	One way	-
Shade	None	Min. 10 Vehicle Parking for Seizure

Key factors to consider: Traffic management at the allotted site is very crucial as the land location is adjacent to highway where some of the land options are under consideration for highway broadening. Moreover, Electricity, Network and Water-Sewage connection access is to be determined with support from local administration.

7. NH-8 (Surat)

Category	As-Is	Required
Transport	350 T/Day, 5 Escape	Need to curb escape and overweight
Weigh bridge	4 Km away	Need to integrate the CGM plan
Key Minerals	Silica, Black Trap, Clay	-
Ways	One way but There are places to escape	-
Shade	No	Min. 10 Vehicle Parking for Seizure

Key factors to consider: As the land is not allotted, it is important to identify the land at strategic location that can cover all mineral bearing areas in the region where there is the sizeable transport. Electricity, Network and Water-Sewage connection access is to be determined with support from local administration.

2.5.4 Automated Check Post facilities – Details

The facilities are broadly listed hereunder but the list is however indicative only:

A. E- weighbridge system

- These would ideally be E-weighbridge system which will continue weighing operations for 24 hours 7 days a week (with the help of an operator). The system is proposed to have an easy interface which can be easily used by any truck driver or operators.
- Weighbridge traffic barriers will control the flow of vehicles on and off the weighbridge, while the safety loops ensure the barriers raise and lower correctly. Weighbridge traffic lights will control and direct the vehicle movement onto the weighbridge.
- These weigh bridge would have the capability to be integrated with Automatic number plate recognition, RFID readers, Boom-Barrier, Surveillance camera (mounted on to of E-weighbridge), traffic lights, etc Automatic number plate recognition, RFID reader will be used to detect the vehicle registration as it

approaches the weighbridge. Surveillance cameras at the Weighbridge deters site vandalism and allows remote viewing of the weighbridge and the vehicles using it.

- Weighbridge vehicle positioning sensors will ensure that the vehicle is located correctly on the weighbridge. These are ideal for ensuring the entire vehicle is on the bridge when it is weighed.
- These weighbridges will have provisions of remote displays which will be ideal for showing high visibility scale weight reading at considerable distances.

Approach area

An approach area will be provided with dedicated lanes for vehicles to enter for their easy moving. Identified vehicles will enter the checkpost through the approach area and all kinds of monitoring mechanism will be installed for effective screening of vehicles to prevent any illegal transfer of minerals. The sub-components of an approach area will include:

- Gates/ Security Gates
- Boom barriers
- Lane Controller
- Pavements
- Flexible pavement for internal roads
- Pre-cast CC block pavements for Truck Parks

B. Administration & Accommodation Building with IT Infrastructure Hosting Room: Currently there is no administration office at Check Posts for real-time disposal of grievances, storing seized vehicles – minerals, supporting staff administration and amenities and security. The introduction of building will augment the check-post operations. Moreover, the check-posts are at the remote locations away from civic facilities. Construction of buildings like Administration Block, Dormitory, Parking area, Storage Area, Compound wall, Toilet Blocks, Security Barrack, etc. at the check post site shall help hosting officers and staff during raids and keeping check post operational 24 x 7. These buildings shall be provided with adequate water supply, sewage and sanitary arrangements & internal electrification. Overhead water storage tank of required capacity for internal & external use of 24 hours running water at Checkpost. The key components are:

Administration Block

The administration block would be placed right in front of the weigh bridge. It will act as the primary office space for staff to control the day to day activities of the check post. It shall comprise of 3 operators booths, computers, office desks, printer / scanner, storage space for documents and all necessary ICT requirements (LAN, CCTV, network racks, etc.)

Operator Booths & officer's rooms

Operator booths may be provided with partition walls of brick masonry / gypsum boards. The Operator booths shall have adequate space for seating of staff of various Govt. Departments, computers, printers, cash boxes, etc. It should have provision for light, fan and air conditioning.

Dormitory

The dormitory shall act as a resting place for staff members staying overnight at the check post. It shall consist of an officers retiring room along with a separate dorm room with bunk beds for 4 persons. Both rooms should have toilet facilities.

Security Barrack

There shall be one security barrack near the exit gate which monitors the exit of trucks from the check post. It shall be equipped with basic facilities like desk, CCTV, LAN, etc. The staff at security barrack will have manual control of the boom barrier which would regulate the exit of trucks from the check post.

Toilet Blocks with sewage disposal or Septic Tank

Separate male & female toilet block for official staff. Another common toilet block for truck drivers / road users. All toilet blocks to have a sewage disposal system through a septic tank. Fittings of pipe lines for sewage and waste water disposal from toilet, pantry, etc. to septic tank shall be provided with PVC pipes of suitable dia with required sanitary traps in accordance as per relevant code, standard & specification and good industry practice.

Fire-fighting system

For protection of entire Check Post area against fire hazards, adequate fire protection arrangements shall be made. Firefighting system / equipment shall be installed in Administration Building, Parking shed & DG area.

Power Back up – DG set

Check Post will be provided with a diesel generator set of suitable capacity. The noise less DG set will be housed close to the administration block and shall be provided with control panel having all measuring protection equipment. Totally enclosed silencer shall be provided for DG set. The necessary permission/approval required for installation/running of DG set shall be obtained in advance.

Roadside furniture

1. **Traffic Signs**: Traffic signs include roadside signs, overhead signs and kerb-mounted signs along the entire Project
2. **Pavement Markings**: Pavement markings shall cover road marking standard and specifications
3. **LED Traffic Blinkers & Delineators**: LED Traffic Blinkers for the entire project highway at the locations
4. **Lighting**: Lighting shall be provided at the following locations:

Peripheral Lighting shall be provided at the Check Post Boundary. The Street lighting shall be provided at every lane of the check post. High Mast Lighting shall be provided as per the layout plan.

Other components include

- Boundary wall, Entrance, Exit Gates
- water drainage/ open/ covered drainage
- Water supply & distribution system
- Equipment & Systems such as Internal/ External Signage
- Landscaping

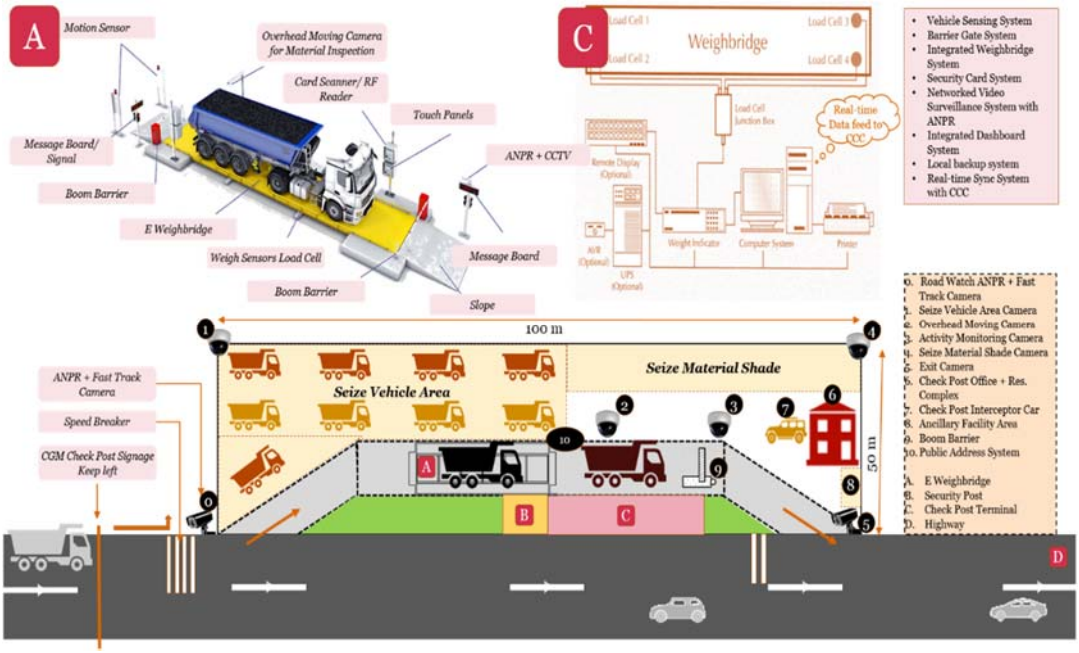
C. Covered Inspection shed: This will ensure security of seized vehicles and minerals from illegal operations. The shed shall act as a detention area for trucks which show noncompliance at the weigh bridge / require

further inspection before being allowed to exit the check post. The parking area shall have capacity to park 20 trucks at a time with lane markings for each parking space.

Civic Facilities: This is to offer local transport service support for vehicles (puncture, air, vehicle parts, and tools) emergency medications

2.5.5 Functional Specifications for Checkpost solution

As the vehicles enters the checkpost, they would approach to E-weighbridge where its weighment would be check with the weight for which the royalty was paid. Genunity of the royalty pass being carried by the vehicle driver would also be checked. In case the vehicle's royalty pass is found not to be genuine or if the vehicle is found to be overweight the vehicles would be seized and be parked in one of the parking slots at the checkpost. If the weighment data and the royalty pass of the vehicles is found genuine then the boom barrier at the exit would open up and the vehicle would pass from the checkpost. The checkpost would be continuously monitored using surveillance cameras. Below mentioned are the ICT interventions at the checkposts..



is for and Above mentioned an indicative diagram depicting expected checkpost operations and facilities. This is reference and understanding purposes only should be considered as final design.

2.5.5.1 Surveillance (CCTV) Cameras

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

1. Information to be captured by Edge Devices
2. Information to be analysed at CCC
3. Role Based Access to the Entire System
4. Storage / Recording Requirements
5. Other General Requirements

Information to be captured by Edge Devices

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

S/n	CCTV Camera operations (Fixed and PTZ)	FPS	Resolution
1.	24 hours	25	1920x1080

NVR's are required to be put at every check post for recoding the video surveillance data. These NVR's should be capable of automatic network replenishment, when the connectivity get reinstated between check post and DC. SI is expected to produce detailed architecture of check post ICT infrastructure.

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

s/n	Type of Storage	DC Storage for days
1.	Primary Storage	30 days for CCTV feeds and ANPR feeds and sensors data.
2.	Secondary Storage	• Subsequent 45 days for CCTV feeds and ANPR feeds, 180 days for rest of sensors. • Permanent storage for the marked data (data which would be tagged by the concerned authorities and detected as a violation by the system)

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

Information to be analysed at Command and Control Centre

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

As informed in the Tender, not all the surveillance cameras would be simultaneously viewed at Command and Control Centre. CCC application should have the ability to view the camera feeds from any surveillance camera from any checkposts at any given point of time. Video management system should have event alert facility over E-Map.

Role Based Access to the Entire System

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

S/n	Minimum Requirements	Bidder Compliance (Yes/No)
1.	The management module should be able to capture basic details (including mobile number & email id) of the office of the CGM authorities or district authorities requiring Viewing / Administration rights to the system. There should be interface to change these details, after proper authentication.	
2.	Rights to different modules / sub-modules / functionalities should be role based and proper log report should be maintained by the system for such access.	
3.	Biometric standardized coupled with login name & password should be enabled to ensure that only the concerned personnel are able to login into the system	
4.	There should be provision to specify hierarchy of operators / officers for control of the cameras from various locations.	
5.	The number of users shall increase as per phase wise implementation. SI is expected to estimate and provision the same based on the phase wise requirements given in RFP. Windows Active Directory/LDAP or any such system can be used to design role based access.	

Storage/Recording Requirements

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

1. 75 days of storage (30 days on primary and 45 days on secondary) for all check post surveillance camera feeds
2. Data on storage would be over-written automatically by newer data after the stipulated time period. If some data is flagged by police personnel (or by designated personnel) as important data / evidence data due to some reporting of crime or accident in the area or due to court order or due to suspicious activity, it would need to be stored for longer duration, as per requirements. Office of the CGM would analyse such flagged data every 3 months to take such decisions for preservation of the flagged data beyond 90 days.
3. Full audit trail of reports to be maintained for 90 days.

Please refer Annexure C of this document of Tender for specifications for storage

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

Other General Requirements

Management/Integration functionality

S/n	Minimum Requirements	Bidder Compliance (Yes/No)
1.	The Surveillance System shall offer centralized management of all devices, servers and users.	
2.	The Surveillance System should not have any limit on the number of cameras to be connected for Surveillance, Monitoring and recording. Any increase in the no. of cameras should be possible by augmentation of Hardware components.	
3.	The Surveillance System should have ability to knit the video streams from multiple cameras, based on the date/time stamp. Every video stream shall have date, time, source camera location, FPS etc. water-marked. These attributes shall be finalized at the System Design time. There shall be a centralized NTP server, from which all devices shall synchronize the date and time.	
4.	The Surveillance System shall support distributed viewing of any camera in the system using Video walls or big screen displays.	
5.	The Surveillance System shall support alarm management. The alarm management shall allow for the continuous monitoring of the operational status and event-triggered alarms from system servers, cameras and other external devices.	
6.	It should be possible to integrate the Surveillance System with 3rd-party software, to enable the users to develop customized applications for enhancing the use of video surveillance solution. For e.g., integrating alarm management to initiate SMS, E-Mail, VoIP call etc.	
7.	The Management system shall store the overall network elements configuration in central database, either on the management server computer or on a separate DB Server on the network.	
8.	System should be able to be integrated with Event Management / Incident Management System, if implemented by office of the CGM in future.	
9.	From the office of the CGM, 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.	
10.	The Recording Server / System shall support camera (analogue and IP cameras) devices from various manufacturers.	
11.	The Recording Server / System shall support the PTZ protocols of the supported devices listed by the camera OEMs.	
12.	The system shall support full two-way audio between Client systems and remote devices. (Audio from certain set of cameras can be recorded in future).	
13.	**Failover Support**	
a.	The system shall support automatic failover for recording servers. This functionality shall be accomplished by failover server as a standby unit that shall take over in the event that one of a group of designated recording servers fails. Recordings shall be synchronized back to the original recording server once it is back online.	
b.	The system shall support multiple failover servers for a group of recording servers.	
14	**SNMP Support**	

S/n	Minimum Requirements	Bidder Compliance (Yes/No)
a.	The system shall support Simple Network Management Protocol (SNMP) in order for third-party software systems to monitor and configure the system.	
b.	The system shall act as an SNMP agent which can generate an SNMP trap as a result of rule activation in addition to other existing rule actions.	

Rules

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

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

Client System

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

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

Other Miscellaneous Requirements

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

2.5.5.2 Parking Sensors

S/n.	Functional Requirements	Bidder Compliance (Yes/ No)
1.	These would be in ground parking sensors deployed at every parking slot in the check posts. Every parking slot would be having a unique identifier, hence every parking sensor would be tied up to a particular parking slot of a particular.	
2.	These sensors would regularly give the occupancy status of every parking slot for every check post locations.	
3.	When a seized vehicle is kept at a particular parking slot at a particular check post, the parking sensor's id would be mapped with the vehicle details. As soon as the vehicle moves from its location' the parking sensor would send a trigger/log an incident at the CCC, if the vehicle movement was genuine then, it would trigger the release parking slot process else it would trigger SOP's identified for the unauthorized movement of the vehicle.	
4.	When any vehicle does an unauthorized movement, it would automatically be tracking using GPS devices and nearest district's (based on vehicle's current position) would be notified	
5.	For any unauthorized movement of the vehicles from the parking slot, all the related stakeholders would get an alert and message.	

6.	The parking system would create a log of all the movements of vehicles to and fro from a particular parking slot and for all the check posts.	
7.	Parking sensors' software would be a client server (master-slave) based software where at client side(check post locations) authorities are able to allocate/ deallocate parking slots and all the necessary triggers from all the client locations should go to server system and being viewed on CCC software,	

2.5.5.3 RFID Ecosystem (RFID readers & tags)

S/n	Functional Requirements	Bidder Compliance (Yes/ No)
1.	RFID tags are envisaged to be used for vehicle identity detection. It is planned to give a unique RFID tag for every vehicle, after registering vehicle and vehicle owner's details	
2.	These tags would also correspond to the vehicle data and vehicle owner's data in the VTMS system, once developed	
3.	These RFID tags cannot be duplicated and taken out, any attempt to take out these tags would destroy them. Hence they would be unique for any particular vehicle at any given point of time. These RFID tags would be passive UHF RFID tags. These RFID tags would be placed on the windshield of the vehicle and shall not occupy more than 50 sq cm of space. These tags would be placed such that they are perfectly in line of sight of the RFID reader.	
4.	RFID readers would be deployed at every checkpost near the weighbridge. Since the vehicle would be at a stationery position on the weighbridge, there are very high chances of RFID reader detecting the RFID tag on the vehicle and uniquely identify the vehicle.	
5.	These RFID readers would read the RFID tags, when vehicle is doing weighment on weighbridge and share the vehicle identification data to CCC and to other applications as required. These RFID vehicle data would also be available locally at all the checkposts for vehicle detection.	
6.	The RFID ecosystem would create a log of all the movements of vehicles to and fro from a particular checkpost and for all the checkposts.	

2.5.5.4 E-weighbridge

S/n	Functional Requirements	Bidder Compliance (Yes/ No)
1.	E-weighbridge is one of the most important element of the checkposts. They are predominantly being used to weigh the vehicles while they are carrying the minerals.	
2.	These E-weighbridges are smart weighbridges and expected to have client server architecture, where the server component is at DC while the client software is at checkpost locations. This is done to ensure that every transactions syncing should not be required every time.	

3.	These E-Weighbridges would be connected to a controller, which in turn would be connected to a boom-barrier, fixed camera, traffic light, RFID reader, and hooter. As soon as the vehicle mounts on the weighbridge, the controller would do following 1. Check the alignment of vehicle on the weighbridge and if the alignment is not proper, a hooter sound would be initiated 2. Once the vehicle is aligned properly on the weighbridge, the ANPR system would detect the number plate of the vehicle and uniquely identify the vehicle 3. The traffic light near the weighbridge would show red sign. 4. Also the RFID reader near the weighbridge would read the RFID tag on the vehicle and uniquely identify the vehicle 5. Controller would tally/compare the unique identify of vehicle in step 2 & Step 4 and send the data to E-weighbridge's client software 6. E-weighbridge's client software would then check the vehicle's carrying capacity using RTO's API and see if the vehicle is doing any violation 7. E-weighbridge's client software would then check the validity of royalty pass using ILMS system and identify whether the royalty pass is genuine or fake. 8. E-weighbridge's client software would also check the qty mentioned on the royalty pass and the weight that the vehicle is actually carrying. 9. In case the royalty pass is fake or if the vehicle is carrying minerals more than the qty for which the royalty was paid, the vehicle would get seized. 10. Once a vehicle is seized vehicle it is kept at a particular parking slot at a particular checkpost, the parking sensor's id would be mapped with the vehicle details. Every seizure would send a trigger/log an incident at the CCC and it would trigger the release parking slot process else it would trigger SOP's identified for the unauthorized movement of the vehicle. 11. For every weighment on checkpost, the controller would show green sign on the traffic light on the weigh bridge and facilitate taking corresponding bucket image from a camera located on top of the weighbridge would be taken. This is to identify what mineral actually the vehicle was carrying 12. If the vehicle is fine with the weighment and if the royalty pass is genuine, then the controller would automatically have the exit boom-barrier automatically open, allowing the vehicle to exit 13. If the vehicle is fine with the weighment and if the royalty pass is genuine, then the controller would automatically have the exit boom-barrier automatically open, allowing the vehicle to exit. As a redundant device to establish the vehicle identify, we have RFID readers at the exit near boom-barrier as well.	
4.	The E-weighbridge software would create a log of all the movements of vehicles to and fro from a particular checkpost and for all the checkposts, along with a list of all the violations.	

5.	The E-weighbridge software has to keep at track of the time the vehicle spends in a particular checkpost, also needs to be calculated is average time a vehicle spends in a checkpost	
6.	The E-weighbridge needs to work in offline mode that is in case the connectivity breaks between the DC and checkpost, the E-weighbridge needs to work in offline mode and sync all the data back to DC, once the connectivity reinstates. Working offline mode does not involve the data interchange/interaction which happens with other application for which connectivity is required like fetching details using RTO API or from ILMS applications.	
7.	The E-weighbridge software should have a configurable tolerance limit per checkpost for overweight scenarios. With tolerance limits in place, the hooter for overweight vehicles will only blow once the vehicle's weight crosses the overweight limit.	

2.5.5.5 Boom-Barrier

S/n	Functional Requirements	Bidder Compliance (Yes/ No)
1.	Boom-Barrier are deployed at the exit gate of the checkpost to ensure that vehicles entering the checkpost should not escape without following necessary procedures.	
2.	These Boom-Barrier would be linked with the controller of the weighbridge and would automatically open up, if all the data pertaining to the vehicle is found genuine.	
3.	In case of any technical or mechanical issue, these boom-barrier could be manually opened to prevent clogging of vehicles at the checkpost.	
4.	If the boom-barrier is opened forcibly when all the other corresponding systems were running fine, then in that case the controller would raise a trigger and it would be sent as an incident to CCC and defined SOP action would be followed.	
5.	Every checkposts' Boom barrier should be able to be remotely openable from CCC.	

2.5.5.6 ANPR Camera

S/n	Description	Bidder Compliance (Yes/No)
1.	**Vehicle Detection by Color** • The system shall detect the colour of all vehicles in the camera view during daytime and label them as per the predefined list of configured system colours. The system will store the colour information of each vehicle along with the license plate information for each transaction in the database. • The system shall have options to search historical records for post event analysis by the vehicle colour or the vehicle colour with license plate and date time combinations	

S/n	Description	Bidder Compliance (Yes/No)
2.	**Alert Generation** • The system should have option to input certain license plates according to the hot listed categories like “Wanted”, “Suspicious”, “Stolen”, etc. by authorized personnel. • The system should be able to generate automatic alarms to alert the control room personnel for further action, in the event of detection of any vehicle falling in the hot listed categories.	
3.	**Vehicle Status Alarm Module** • On successful recognition of the number plate, system should be able generate automatic alarm to alert the control room for vehicles which have been marked as "Wanted", "Suspicious", "Stolen", "Expired". (System should have provision/expansion option to add more categories for future need). • The system should support manual keying of vehicle number in case the number plate is not detected • The Instantaneous and automatic generation of alarms. In case of identity of vehicle in any category which is define by user.	

2.5.5.7 Smart LED lights

S/n	Functional Requirements	Bidder Compliance (Yes/ No)
1.	The smart lighting solution should be able to operate in any/all weather conditions	
2.	The smart lighting solution should be able to communicate to the centralized software installed at Command and Control Centre	
3.	The solution should be able to operate the luminaires on/off, increase/decrease luminosity (Dimming) as per the command received from the centralized software. This control of smart lights should also be available through a mobile App (compatible with iOS, Android)	
4.	The software should have the capability to apply policies to the smart lighting system.	
5.	The administration should be able to see the real time status of the LED luminaires (like state, power consumption etc) on a city map view of the centralized software	
6.	The checkpost/CGM administration should be able to operate the Smart Lighting System manually too.	
7.	The smart lighting solution should be able to communicate the system issue or failure to the centralized software.	
8.	Should enable Over the Air (OTA) firmware update	

It any of the cases when there is any connectivity lost from checkposts to CCC, checkpost should be able to function in an offline mode until the connectivity reinstates. The SI has to provision the SOP’s for the offline functioning of the checkposts and sync or manually input vital data once the connectivity is back.

3 Detailed Project Considerations

3.1 Inception Phase

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

i. Define an organized set of activities, milestones and risks for the project

ii. Resource planning, responsibilities and loading for each phase/activity. This must also indicate where each resource would be based during that phase, i.e. onsite at the CGM's office or off site at SI premises.

iii. Measure project deadlines and performance objectives.

iv. Communicate the project plan to stakeholders with meaningful reports.

v. Project Progress Reporting/Project dashboard. During the implementation of the project, the SI should present monthly reports. This report will be presented in the steering committee meeting to office of the CGM. The report should contain at the minimum the under mentioned:

   a. Results accomplished during the period (monthly)

   b. Cumulative deviations from the schedule date as specified in the finalized Project Plan

   c. Corrective actions to be taken to return to planned schedule of progress

   d. Plan for the next month-week by week

   e. Proposed revision to planned schedule provided such revision is necessitated by reasons beyond the control of SI

   f. Support needed

   g. Highlights/lowlights

   h. Issues/Concerns

   i. Risks/Show stoppers along with mitigation

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

3.2 Requirement Phase

1. SI shall study and revalidate the requirements given in the RFP with office of the CGM and submit as an exhaustive FRS document.

2. SI must get the sign off from user groups formed by office of the CGM.

3. For all the discussion with office of the CGM team, SI shall be required to be present at office of the CGM office with the requisite team members.

3.3 Design Phase

1. The solution proposed by SI should comply with the design considerations requirements as mentioned in this tender document.

3.4 Development Phase

It is expected that SI to provide all the software considering the scope set in this RFP and the software, other tools, accessories required to make the integration or execution complete. The SI shall carefully consider the solutions it proposes and explicitly mention the same in the technical proposal.

For the software, other tools, accessories proposed by SI, they would be responsible for all the licenses, compliances and penalty, if applied. SI should also provide list of all the proposed tools, solutions in the technical proposal and produce their respective documentation. These licenses along with other relevant document shall be made available to the office of the CGM as and when required.

FRS, SRS, HLD, LLD, Traceability matrix, manuals and guides, quality documents, reports, SOP's ,policies and processes, software documentation, programming commenting, change management histories, testing logs and other relevant docs as required by the office of the CGM should always be kept updated. After the end of every phase these documents should be submitted to the office of the CGM for their review.

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

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

3.6 Integration & Testing Phase

1. The Command and Control Centre should be integrated with feeds/data of all ICT equipment present on all the 7 checkposts. The SI shall provide the testing strategy including traceability matrix, test cases and shall conduct comprehensive testing of various components of the software developed/customized at every stage of the development and for the entire solution.

3.7 Go-Live Preparedness and Go-Live

i. SI shall prepare and agree with office of the CGM, the detailed plan/criteria for Go-Live (in-line with office of the CGM's implementation plan as mentioned in RFP).

ii. **The SI shall ensure that all the data migration is done from existing systems to the new systems and the same shall be easily available using an efficient graphical user interface.**

iii. SI shall submit signed-off UAT report (issue closure report) ensuring all issues raised during UAT are being resolved prior to Go-Live.

iv. SI shall ensure that Go –Live criteria as mentioned in User acceptance testing of Project is met and SI needs to take approval from office of the CGM team on the same.

v. Go-live of the application shall be done as per the finalized and agreed upon Go-Live plan.

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

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

3.9 Project Management & Facilities Management Services

The SI will be required to provide facilities management services to support the office of the CGM to perform their day-to-day functions related to this system. SI is required to depute a dedicated, centralised project management and technical team for the overall project management and interaction with office of the CGM.

3.10 Provision of the Operational Manpower

The Current estimation of the man-power required from the SI for check post and CCC operations is as follows

Sr.	Manpower	Overall Qty.
1.	Check post operators 1 per shift for 7 check posts	21
2.	CCC Supervisors 2 people in 2 shifts and 1 at night shift	5

The SI is required to provide suitable manpower to supervise the CCC operators, who will monitor the data feeds at CCC and support office of the CGM in operationalisation of the project. The manpower provided by the SI should be on reducing basis such that after 5 years entire manpower would be of office of the CGM. A suitable plan for this transfer of knowledge should be provided by the SI All such manpower shall be minimum graduate pass, without criminal background and having educational qualification a defined in RFP requirements

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

3.10.1 Basic Infrastructure Services

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

i. Ensure availability of the scalable infrastructure (both physical and IT) including but not limited to Water, Power, Cooling, Racks, Storage and other peripheral equipment installed at the time of Project commissioning as per the SLAs.

ii. Proactive and reactive maintenance, repair and replacement of defective, faulty/non-functional components (physical and other peripheral IT infrastructure) installed for the Project through this RFP. The cost for repair and replacement shall be borne by the SI.

iii. Any component that is reported to be faulty / non-functional on a given date should be either fully repaired or replaced by temporary substitute (of equivalent configuration) within the time frame agreed upon in the Service Level Agreement (SLA). SI shall maintain logs of all the repairs, replacements, maintenance done.

iv. All the devices that will be installed in the project as part of the physical infrastructure should be SNMP enabled and shall be centrally and remotely monitored and managed on a 24x7x365 basis.

3.10.2 Integration Testing

This shall be a black-box testing role primarily to ensure that the application to be deployed does not disrupt the office of the CGM operations. The technical tasks to be carried out shall be as follows:

i. Functional Testing: - Both manual as well as automation testing.

ii. Performance Testing:- Using performance monitoring tools

iii. Security Testing: - Using automation tools.

3.10.3 Vendor Management Services

The activities shall include:

i. Coordination with all the project stakeholders, vendors to ensure that all office of the CGM activities are carried out in a timely manner as per the SLA and timelines agreed

ii. SI shall also ensure that unresolved issues are escalated to office of the CGM and respective departments. SI should ensure consolidated quarterly SLA performance report is submitted

3.11 Compliance to Standards & Certifications

During project duration, the SI will ensure adherence to prescribed standards as provided below:

Sr.	Component/Application/System	Prescribed Standard
1.	Information Security	ISO 27001
2.	IT Infrastructure Management	ITIL specifications
3.	Service Management	ISO 20000 specifications
4.	Project Documentation	IEEE/ISO/CMMi (where applicable) specifications for documentation

a. Apart from the above the SI need to ensure compliance of the project with Government of India IT security guidelines including provisions of:

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

b. While writing the source code for application modules the SI should ensure high-quality documentation standards to improve the readability of the software module. The code should be properly commented.

3.12 Project Management and Governance

3.12.1 Project Management Office (PMO)

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

3.12.2 Steering Committee

The Steering Committee will consist of senior stakeholders from the office of the CGM, its nominated agencies and SI. The SI shall participate in monthly Steering Committee meetings and update Steering Committee on Project progress, Risk parameters (if any), Resource deployment and plan, immediate tasks, and any obstacles in project. The Steering committee meeting will be a forum for seeking and getting approval for project decisions on major changes etc. The SI shall maintain logs of all the meetings and decisions taken.

3.12.3 Change Management & Control

3.12.3.1 Change Orders / Alterations / Variations

i. The SI agrees that the requirements given in the Bidding Documents are minimum requirements and are only indicative. The SI would need to sketch out the details at the time of preparing the design document prior to actual implementation.

ii. It shall be the responsibility of the SI to meet all the requirements of technical specifications contained in the RFP and any upward revisions and/or additions of quantities, specifications sizes given in the Bidding Documents required to be made during execution of the works, shall not constitute a change order and shall be carried out without a change order and shall be carried out without any time and cost effect to Purchaser.

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

3.12.3.2 Change Order

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

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

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

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

3.13 Testing and Acceptance Criteria

SI shall demonstrate the following mentioned acceptance criteria prior to acceptance of the solution as well as during project operations phase, in respect of scalability and performance etc. The SI may propose further detailed acceptance criteria which the office of the CGM will review. Once the office of the CGM provides its approval, the acceptance criteria can be finalized. A comprehensive system should be set up that would have the capability to log & track the testing results, upload & maintain the test cases and log & track issues/bugs identified.

Type of Testing	Responsibility	Scope of Work
1. System Testing	SI	1. Should be performed through manual as well as automated methods
2. Integration Testing	SI	1. Integration testing to be performed through manual as well as automated methods
3. Performance and load Testing	• SI • The office of the CGM / Third Party Auditor (to monitor the performance testing)	1. SI to do performance and load testing. On performance parameters such as transaction response time, throughput, and page loading etc. 2. Load and stress testing of the Project to be performed on business transaction volume 3. Performance testing to be carried out in the exact same architecture that would be set up for production.
4. Security Testing (including Penetration and Vulnerability testing)	• SI • The office of the CGM / Third Party Auditor (to monitor the security testing)	1. The solution should demonstrate the compliance with security requirements as mentioned in the RFP including but not limited to security controls in the application, at the network layer, network, data centre(s), security monitoring system deployed by the SI 2. The solution shall pass vulnerability and penetration testing for rollout of each phase and on the developed solution. The solution should pass web application security testing for entire project, mobile app and other systems and security configuration review of the infrastructure. 3. Security testing to be carried out in the exact same environment/architecture that would be set up for production.

		4. During O&M phase, penetration testing to be conducted on yearly basis and vulnerability assessment to be conducted on half-yearly basis.
5. User Acceptance Testing of Project	• The office of the CGM or its appointed third party auditor	1. SI to prepare User Acceptance Testing test cases 2. UAT to be carried out in the exact same environment/architecture that would be set up for production 3. SI should fix bugs and issues raised during UAT and get approval on the fixes from the office of the CGM / third party auditor before production deployment 4. Changes in the application as an outcome of UAT shall not be considered as Change Request. SI has to rectify the observations.

All the above mentioned testing must be carried out as per the proposed and approved testing plans by manual and automation testing methods. All the tools used by SI for the automated testing should be the responsibility of the SI and office of the CGM would neither be bearing and license cost of the same nor would own them. Office of the CGM at any point of time could involve third party auditors to validate the testing results. Post Go-Live; the production environment should not be used for testing and training purpose. The testing results should be shared by the SI for all the testing conducted. The cost of rectification of non-compliances, if there shall be borne by the SI. STQC/Other agencies appointed by the office of the CGM shall perform the role of TPA. SI needs to engage with the TPA at the requirement formulation stage itself. The audit needs to be completed before Go-Live of different phases. It shall be responsibility of the SI to conduct annual security audit and submit its report to the CGM every year.

Final Acceptance Testing

The final acceptance shall cover 100% of the deployment, commissioning and functioning of all the 7 check posts, centralized information dashboard and Command and Control Centre setup at CGM office Gandhinagar. After successful testing by the office of the CGM or its PMU; a Final Acceptance Test Certificate (FAT) shall be issued by the office of the CGM.

Prerequisite for Carrying out FAT activity:

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

The FAT shall include the following:

1. All hardware and software items must be installed at respective sites as per the specification.
2. Availability of all the defined services shall be verified.
3. The SI shall be required to demonstrate all the features / facilities / functionalities as mentioned in the RFP.
4. The SI shall arrange the test equipment required for performance verification, and will also provide documented test results.
5. The SI shall be responsible for the security audit of established system to be carried out by a certified third party as agreed by the office of the CGM.
6. Any delay by the SI in the Final Acceptance Testing shall render him liable to the imposition of appropriate Penalties. However, delays identified beyond the control of SI shall be considered appropriately and as per mutual agreement between the office of the CGM and SI. In the event the SI is not able to complete the installation due to non-availability of bandwidth from the bandwidth service providers, the Supplier and the office of the CGM may mutually agree to redefine the Network so the SI can complete installation and conduct the Final Acceptance Test within the specified time.

3.14 Project Design Considerations

3.14.1 Platform Approach

It is critical that a platform based approach is taken for any large scale application development, to ensure adequate focus and resources on issues related to scalability, security and data management.

3.14.2 Guiding Architecture Principle

The IT architecture principles defined in this section are the underlying general rules and guidelines that will drive the subsequent development, use and maintenance of architectural standards, frameworks and future state target architecture.

The office of the CGM system will be built on the following core principles:

3.14.2.1 Openness

Adoption of open stateless API, open standards and wherever prudent open source products are of paramount importance for the system. This will ensure the system to be lightweight, scalable and secure. Data access must be always through APIs, no application will access data directly from the storage layer or data access layer.

3.14.2.2 Data as an enterprise asset

Effective and careful data management is of high importance and top priority should be placed on ensuring where data resides, that its accuracy can be relied upon, and it can obtained when and where needed.

3.14.2.3 Performance

The solution should be designed in a manner that the following can be achieved:

- Modular design to distribute the appropriate system functions on web and app server

- Increase in-memory Operations (use static operations)
- Reduce number of I/O operations and N/w calls using selective caching
- Dedicated schemas for each function making them independent and avoiding delays due to other function accessing the same schema.
- Solution should provide measurable and acceptable performance requirements for users, for different connectivity bandwidths.

3.14.3 Key Design Considerations

Key design considerations taken into account are as follows –

- **Designed for 24x7 online** availability of application.
- **API based architecture** for Integration with other web applications and Mobile applications
- **Business Rule Driven Approach**- Flexibility to configure and change business rules
- **Data Distribution Service**- As a future roadmap it is envisaged that the functionalities provided by this project should be available as services that could be offered to other stakeholders on request
- **Scalability** – for more users, data volume, open protocol, adding more functionalities, application integration, horizontal and vertical scaling
- **No vendor lock-in and replace ability** – Any product or service from any OEM must be wrapped in vendor neutral API. At least 2 OEMS should be available with the same product services to avoid vendor lock in.
- **User interfaces**- should be simple, elegant and easy to use
- **Readability**- system should reliably process data received, provide required time bound outputs, prevent duplicate processing, unauthorized alteration, zero data loss etc.
- **Manageability**- System must be resilient to failures, all layers must be manage using automation, should be able to restart by itself using minimal human intervention
- **Availability**- System should be highly available, load should be properly balanced, should fool a distributed architecture. All the components should be up 99.99% of time.
- **SLA driven solution-** System should perform as per the SLA's mentioned.
- **Reconstruction of truth-** System should not allow any data to be tempered by any one and should have tamper resistance capacity and source of truth (original data). System should use Meta data to configure itself.
- **Integration architecture-** It is proposed to have real time integration using SOA based architecture. The integration can be done via SOAP/ RESTful /Message based interfacing/ETL/ESB etc. Following integration gateways are proposed

SMS Gateway: SMS services are envisaged to be made available as part of the solution design. The service provider has to deploy its own SMS Gateway services to the office of the CGM. The SMS gateway would be used to send

violation alerts and other communications to lease holders, vehicle owners and other stakeholders etc. These messages can be customized or bulk messages.

Email Services: Email services are envisaged to be made available as part of the solution design to send alerts/intimations/automated messages to registered email ids, based on preferences set up/opted by individual users. An authenticated SMTP mail service with other standard features is envisaged to be integrated with the solution for sending mail from the solution, and delivered to intended inbox. Support antispam features.

3.15 Security

Data exchange should abide by all laws on privacy and data protection Security Architecture

This section recommends the proposed security architecture aligning with the overarching architectural principles. Design controls that protect confidentiality, integrity and availability of information and services for all the stakeholders must be implemented.

3.15.1 User Security and Monitoring

3.15.1.1 Authentication & Authorization

A strong authentication mechanism should be considered to protect unauthorized access to the CCC and checkpost applications.

3.15.1.2 Levels of Authentication

Based on the security requirements the following levels of authentication should be evaluated.

- For applications handling sensitive data it is recommended that in the least one factor authentication key in the form of a password is essential.
- For applications handling highly sensitive data it is recommended that two factor authentication mechanisms should be considered.

3.15.1.3 Authorization

Authorization of system users should be enforced by access controls. It is recommended to develop access control lists.

3.15.1.4 Data Security

Traditional Structured Enterprise Data

Project information should be protected against unauthorized access, denial of service, and both intentional and accidental modification. Data security, audit controls and integrity must be ensured across the data life cycle management from creation, accessed, viewed, updated and when deleted (or inactivated).

Audit Trail & Audit Log

Audit trails or audit logs should be maintained. There are a number of devices and software that should be logged which include hardware & software based firewalls, web servers, authentication servers, central/domain controllers, database servers, mail servers, file servers, routers, DHCP servers etc.

3.15.1.5 Application Security

Project must comply with the Application Security Plan and security guidelines of Government of India as applicable. Project must also adhere to various other leading application security paradigms and preventing major vulnerabilities.

3.15.1.6 Infrastructure Security

In order to discover and solve security vulnerabilities of the IT systems of the office of the CGM it is recommended to deploy and use anti-virus software, perimeter security technologies, web content filtering, enterprise-level e-mail anti-security software, periodic scanning of the network, regularly monitoring logs and alerts, automatic provisioning of firewall policies, privileged accounts, DNS, application identity etc. for enhanced application security.

4 Annexure A- Technical requirements

4.1 Video Wall Screen

It is proposed to have a 3x2 video wall for Surveillance and CCC project.

Video Wall Configuration

Sr.	Parameter	Minimum Specifications
1.	Technology	Seamless Video-wall of rear projection DLP cubes (non-bulging and anti-reflection) of Minimum 70 inch in 3x2 formation, LED light source
2.	Screen Size	Min 70''
3.	Bezel Size	<=1mm
4.	Resolution	Full HD (1920x1080) or better; 16:9 Widescreen
5.	Contrast ratio	Min 2000::01 or better
6.	Brightness	800 or More, uniformity <=90%
7.	Viewing angle	160 degree/160 degree (H/V) or Better
8.	Input	Min 1x Digital DVI-I, 1x Digital DVI-D/HDMI Port or higher
9.	Output	Min 1x Digital DVI-D, HDMI, RJ45
10.	Control	IP based control/RS-422/RS-232/IR IR remote control shall be supported. Shall be supplied as accessory along with display
11.	Operations	24 x 7
12.	Lifespan	Min 60000 hours
13.	Display technology	1 Chip DLP
14.	Power Supply	Dual/Redundant power supply, Suitable adaptor shall be supplied to make the equipment work on 230V +10% or shall directly work with 230VAC power supply,
15.	Maintenance Access	Rear
16.	Certification	ANSI/ETL/UL, FCC, CE, BIS certified at the time of bidding
17.	Accessories & Cables	Should be supplied with all the required accessories and cable like Dual Link DVI-D /DP cable, power cable for daisy chain, AC cable, Remote Controller etc.

4.2 Video Wall Display Controller/ Video Distributor

Sr. No.	Parameters	Minimum Requirements
1.	Controller	Controller to control Video wall in a matrix (3x2 output) as per requirement along with software with 4 DVI D output ports
2.	Chassis	Rack mount
3.	Processor	Latest Generation 64 bit x86 Quad Core processor (2.0 Ghz) or better

4.	Operating System	Pre-loaded 64-bit Operating System Windows / Linux / Equivalent, with recovery disc
5.	RAM	8 GB DDR3 ECC RAM
6.	HDD	Min 2x500 GB 7200 RPM HDD (Configured in RAID 0) should be upgradable
7.	Networking	Dual-port Gigabit Ethernet Controller with RJ-45 ports, support for add on network adapters and OF Interface adapters
8.	RAID	Should support all RAID levels
9.	Power Supply	(1+1) Redundant hot swappable
10.	Input/ Output support	VI/DVI/HDMI/USB/ LAN/ VGA/SATA port
11.	Accessories	104 key Keyboard and Optical USB mouse, DVD-R, DVD+RW
12.	USB Ports	Minimum 4 USB Ports
13.	Redundancy support	Power Supply, HDD, LAN port & Controller
14.	Scalability	Display multiple source windows in any size, anywhere on the wall
15.	Control functions	Brightness/ Contrast/ Saturation/ Hue/ Filtering/ Crop/ Rotate
16.	Inputs	To connect to minimum 2 sources through HDMI
17.	Output	To connect to minimum 16 Displays through HDMI
18.	Operating Temperature	10°C to 40°C, 80 % humidity
19.	Cable & Connections	Successful bidder should provide all the necessary cables and connectors, so as to connect Controller with Display units

4.3 Video Wall Management Software

Sr.	Parameter	Minimum Specifications
1.	Display & Scaling	Display multiple sources anywhere on display up to any size should be equipped with a cube control & monitoring system Should be able to control & monitor individual cube , multiple cubes and multiple video walls

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

4.4 Video Management System

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

VMS Overview

Sr.	Description	Bidder Compliance (Yes/No)
1.	VMS shall be used for centralized management of all field camera devices, video servers and client users.	
2.	VMS server shall be deployed in a clustered server environment or support inbuilt mechanism for high availability and failover.	
3.	VMS shall support a flexible rule-based system driven by schedules and events.	

Sr.	Description	Bidder Compliance (Yes/No)
4.	VMS shall be supported for fully distributed solution for monitoring and control function, designed for limitless multi-site and multiple server installations requiring 24/7 surveillance with support for devices from different vendors.	
5.	VMS shall support ONVIF compliant internet protocol (IP) cameras.	
6.	The bidder shall clearly list in their proposal the make and models that can be integrated with the VMS, additionally all the offered VMS and cameras must have Open Network Video Interface Forum (ONVIF) compliance. VMS shall be enabled for any standard storage technologies and video wall system integration.	
7.	VMS shall be enabled for integration with any external Video Analytics Systems both server & edge based.	
8.	VMS shall be capable of being deployed in a virtualized server environment without loss of any functionality.	
9.	All CCTV cameras locations shall be overlaid in graphical map in the VMS Graphical User Interface (GUI). The cameras selection for viewing shall be possible via clicking on the camera location on the graphical map. The graphical map shall be of high resolution enabling operator to zoom-in for specific location while selecting a camera for viewing.	
10.	VMS shall have an administrator interface to set system parameters, manage codecs, manage permissions and manage storage.	
11.	VMS day to day control of cameras and monitoring on client workstations shall be controlled through the administrator interface.	
12.	Whilst live control and monitoring is the primary activity of the monitoring workstations, video replay shall also be accommodated on the GUI for general review and also for pre- and post-alarm recording display.	
13.	The solution design for the VMS shall provide flexible video signal compression, display, storage and retrieval.	
14.	All CCTV camera video signal inputs to the system shall be provided to various CCC and the transmission medium used shall best suit the relative camera deployments and access to the CCTV Network.	
15.	VMS client shall have the capability to work with touch enabled multi-monitor workstations. It shall be capable of displaying videos in up to three (3) monitors simultaneously.	

Sr.	Description	Bidder Compliance (Yes/No)
a.	AVI files	
b.	Motion- Joint Photographic Experts Group (M-JPEG)	
c.	Moving Picture Expert Group-4 (MPEG-4)	
d.	MP4 Export or Latest	
16.	All streams to the above locations shall be available in real-time and at full resolution. Resolution and other related parameters shall be configurable by the administrator in order to provide for network constraints.	
17.	The VMS shall support field sensor settings. Each channel configured in the VMS shall have an individual setup for the following settings, the specific settings shall be determined according to the encoding device:	
18.	The VMS shall support the following operations:	
a.	Adding an IP device	
b.	Updating an IP device	
c.	Updating basic device parameters	
d.	Adding/removing channels	
e.	Adding/removing output signals	
f.	Updating an IP channel	
g.	Removing an IP device	
h.	Enabling/ disabling an IP channel	
i.	Refreshing an IP device (in case of firmware upgrade)	
j.	Multicast at multiple aggregation points	
19.	The VMS shall support retrieving data from edge storage. Thus when a lost or broken connection is restored, it shall be possible to retrieve the video from SD card and store it on central storage. System should support to view the recordings available over cameras local storage device (such as an SD card), and copy them to the server.	
20.	The VMS shall support bookmarking the videos. Thus, allowing the users to mark incidents on live and/or playback video streams.	

Sr.	Description	Bidder Compliance (Yes/No)
21.	The VMS shall allow the administrator to distribute camera load across multiple recorders and be able shift the cameras from one recorder to another by simple drag and drop facility.	
22.	VMS shall support automatic failover for recording.	
23.	VMS should also support dual recording or mirroring if required.	
24.	VMS shall support manual failover for maintenance purpose.	
25.	VMS shall support access and view of cameras and views on a smartphone or a tablet (a mobile device).	
26.	VMS shall support integration with the ANPR application.	
27.	VMS shall support integration with other online and offline video analytic applications.	
28.	VMS shall be able to accept alerts from video analytics built into the cameras, other third party systems, sensors etc.	

4.4.1 Client System

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

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

4.4.2 Remote Web Client

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

4.4.3 Mobile Client

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

4.4.4 Matrix Monitor

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

4.4.5 Alarm Management Module

Sr.	Description	Bidder Compliance (Yes/No)
1.	The alarm management module shall allow for continuous monitoring of the operational status and event-triggered alarms from various system servers, cameras and other devices. The alarm management module shall	

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

4.4.6 Management / Integration Functionality

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

Sr.	Description	Bidder Compliance (Yes/No)
6.	The Management system shall store the overall network elements configuration in central database, either on the management server computer or on a separate DB Server on the network.	
7.	System should be able to be integrated with Event Management / Incident Management System.	

4.4.7 System Administration Functionality

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

4.4.8 Major Server components for VMS

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

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

4.5 LED TV (Professional Displays)

Sr.	Parameters	Minimum Specifications
1.	Technology	HD IPS LED Display, Direct LED Backlight
2.	Computer Connectivity	HDMI (Including HDMI cable), VGA
3.	Screen Size	50 inch or higher diagonal
4.	Resolution	Full High Definition (Min 1920 x 1080) 16:9 Widescreen
5.	Contrast ratio	Native (standard) 5000:1 or more
6.	Brightness	300 Cd/m2 or more
7.	Viewing angle	160 degree or better
8.	Response time	8 to 12ms or less
9.	Controls	• On Screen Display (OSD) • IR remote control
10.	Operations	Rated for 24x7 operations
11.	Certifications	ANSI/ETL/UL, FCC, CE, BIS certified at the time of bidding
12.	Accessories & Cable	Should be supplied with all the required accessories and cables

4.6 CCC Monitoring Workstations

Sr.	Parameter	Minimum Specifications
1.	Processor	Latest Intel Xeon E series with min 3 GHz or higher
2.	Chipset	Latest compatible 64bit Chipset
3.	Motherboard	OEM Motherboard

4.	RAM	Minimum 8 GB DDR4 or higher expandable up to 32 GB or more 4expandable to 32 GB
5.	Graphics card	Integrated Graphic controller with Minimum 2 GB video memory (non- shared), NVIDIA Quadro/AMD FirePro/Intel HD Graphics, it should supports 3 monitors (27 inches each) simultaneously with no degradation in video quality considering HD video quality
6.	HDD	2 TB SATA Hard drive @7200 rpm. Provision for installing more drives
7.	Network interface	1000BaseT, Gigabit Ethernet (10/100/1G auto sensing)
8.	Audio	Line/Mic IN, Line-out/Spr Out (3.5 mm)
9.	Ports	Minimum 6 USB ports (min 2 USB3.0), 1XHDMI These would be disabled for data transfer.
10.	Keyboard	104 keys or higher mechanical keyboard
11.	Mouse	2 button optical scroll mouse (USB/wireless)
12.	PTZ joystick controller	PTZ speed dome control for IP cameras Minimum 6 programmable buttons Multi-camera operations Compatible with all the camera models offered in the solution Compatible with VMS /Monitoring software offered
13.	Monitor	Three monitors of 27" or higher TFT LED monitor, Minimum 1920 x1080 resolution, 5 ms or better refresh rate, TCO 05 (or higher) certified at the time of bidding
14.	Certification	Energy star /BEE certified at the time of bidding
15.	Operating System	pre-loaded Windows 10 professional (64 bit) with recovery disc and latest version of MS office suite

4.7 Layer 2: 24 Port Managed Switch at CCC

Sr.	Parameter	Minimum Specifications
1.	Ports	24 X 10/100/1000 Base-TX (Full Duplex) ports and extra 2 nos of 10G Base SX/LX ports as per network solution offered.
2.	MAC	8 K or more
3.	Port Features	Must support Port Mirroring, Port Trunking and 802.3ad i.e. LACP Link Aggregation port trunks
4.	Flow Control	Support IEEE 802.3x flow control for full-duplex mode ports.
5.	Protocols	IPV4, IPv6 from day one Support 802.1D, 802.1S/ 802.1w Support 802.1Q VLAN encapsulation, IGMP v1, v2 and v3 snooping DHCP, NTP, RSTP, MSTP, SNMP (v1, v2, v3) support Support for multiple VLANS
6.	Access Control	Support port security Support 802.1x (Port based network access control).

Sr.	Parameter	Minimum Specifications
		Support for MAC filtering. Should support TACACS+ and RADIUS/LDAP authentication
7.	VLAN	Support 802.1Q Tagged VLAN and port based VLAN
8.	Management	Switch needs to have console port for management via PC Should have a dedicated OOB management port using CLI(SSH),WebUI(SSL), SNMP(v1, v2, v3), TFTP etc.
9.	Throughput	Should have minimum switching capacity of 30 Gbps.
10.	Form Factor & Power Supply	The Switch should be Rack mountable & the switch should be supplied with Indian standard AC power cord.
11.	Others	All necessary SFP's, interfaces, connectors, patch cords (if any) & licenses must be delivered along with the switch from day one.

4.8 Layer 3: 24 port Switch (Aggregation Switch) For Check post and CCC

Sr.	Parameter	Minimum Specifications
1.	Ports	Layer 3 switch with minimum For Checkpost -20 X1G + 4X10G + 4 X10 G uplink ports For CCC- 24 X1G + 4X1G uplinks ports
2.	Throughput	Should have minimum switching capacity of 40 Gbps.
3.	MAC	Minimum 8K or more
4.	Flow Control	Support IEEE 802.3x flow control for full-duplex mode ports.
5.	Protocols	IPV4, IPv6 from day one Support 802.1D, 802.1S/802.1w Support 802.1Q VLAN encapsulation, IGMP v1, v2 and v3 snooping Support DHCP, NTP, SNMP (v1, v2, v3), MSTP Support Multicasting
6.	Access Control	Support port security Support 802.1x (Port based network access control). Support for MAC filtering. Should support TACACS+ and RADIUS/LDAP authentication
7.	VLAN	Support 802.1Q Tagged VLAN and port based VLANs
8.	Management	Should have a dedicated OOB Management port using CLI(SSH), WebUI(SSL), SNMP(v1, v2, v3), TFTP etc.
9.	Form Factor & Power Supply	The Switch should be Rack mountable & the switch should be supplied with Indian standard AC power cord.
10.	Others	All necessary SFP's, interfaces, connectors, patch cords (if any) & licenses must be delivered along with the switch from day one.
11.	Power Supply	N+1 (redundant power supply and fan)

4.9 8 port Managed outdoor L2 switch (Edge Level) with Fibre port

Sr.	Parameter	Minimum Specifications
1.	Total Ports	• Minimum 8 X 10/100/1000 Base-TX PoE+ ports (Full Duplex), 2x1G SFP Uplink ports.
2.	Throughput	Minimum switching capacity of 8Gbps or more
3.	PoE Standard	IEEE 802.3af/ IEEE 802.3at or better , power budged should be sufficient to support the device being used
4.	Protocols	• IPV4, IPV6 ready from day one • Support 802.1Q VLAN • DHCP support • IGMP snooping (v1, v2, v3) and min. 100 multicast groups • SNMP (v1, v2, v3) Management • Should support Loop protection and Loop detection • End point Authentication • Should support NTP, Duplicate Address Detection (DAD)
5.	Access Control	• Support port security • Support 802.1x (Port based network access control). Support for MAC filtering
6.	PoE Power per port	Sufficient to operate the CCTV cameras/edge devices connected
7.	Operating Temperature	0°C to 55°C or better
8.	Management	Should have console port for administration & management, CLI and web based GUI for easy management

4.10 Desktop PC

Sr.	Item	Minimum Specifications
1.	Processor	Intel Core i5-latest generation with minimum 2.8 Ghz, 4MB cache or higher OR AMD A10 7850B with Minimum (3.0 2 Ghz), 4MB cache processor or higher
2.	Memory	Minimum 8 GB DDR3/DDR4 RAM or higher expandable upto 16 GB or more.
3.	Motherboard & chipset	OEM Motherboard and compatible 64-bit chipset
4.	Hard Disk Drive	Minimum 1 TB SATA Hard Disk @7200 RPM or higher
5.	Audio	Line/Mic In, Line-out/Speaker Out (3.5 mm)
6.	Network port	10/100/1000 Mbps auto-sensing on-board integrated RJ-45 Ethernet Port
7.	USB Ports	Minimum 4 or more USB ports (min 1 USB 3.0)
8.	Display Port	1 Display Port (HDMI/VGA) port
9.	Power supply	Maximum Rating 250 Watts, 80 plus certified power supply
10.	Keyboard	104 keys or higher Mechanical Keyboard Rupee Symbol to be engraved.
11.	Mouse	USB/Wireless optical scroll mouse

12.	Monitor	Minimum 19.5" diagonal or higher LED Monitor with 1600x900 or higher resolution. Must be TCO5 certified
13.	Operation System and Support & Software	Pre-loaded with Windows 10 -64 bits (or latest) Professional with recovery disc and latest version of MS office suite
14.	Certification for Desktop	RoHS, Energy Star / BEE star certified at the time of bidding

4.11 RDBMS Licenses

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

4.12 Office Productivity suite

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

4.13 Network B/W Laser Printer

Sr. No.	Minimum Technical Specification
1.	Print – Minimum 18 ppm for A4 size
2.	1200 dpi effective resolution;
3.	Copy – 14 cpm for A4 size
4.	600*400 dpi resolution
5.	Minimum 8 MB RAM;
6.	Scan – 600*600 dpi optical resolution,
7.	USB connectivity
8.	Minimum 400 MHZ Printer Processor OR System Processor Utilization,
9.	Input Tray : Min 50 A4 sheets capacity
10.	OS Compatibility : Windows, Linux

4.14 Indoor Wi-fi Access Point for CCC centre

Sr.	Parameter	Minimum Specifications
1.	Ports	AP should have one Auto-sensing 10/100/1000 Base-T RJ45 Ethernet ports

2.	Connectivity	Support 802.3 af standard Power-over-Ethernet (PoE) with full capacity operation at full power of the radios
3.	Mount	Ceiling and/or wall mounting options, And should be supplied with its mounting brackets
4.	Management	The Access Point should have the technology to improve downlink performance to all mobile devices. Real-time, fully integrated spectrum analyser capabilities on the APs that does not required dedicated sensors or separate operating system running on the AP radios
5.	Mobility	Access Points proposed must include radios for both 2.4 GHz and 5 GHz with 802.11n/ac or newer. Each AP Should support 4 WLANs for SSID deployment flexibility.
6.	High throughput	Access Point should be 802.11/ac or newer ready from day one
7.	Diagnostics	Real time packet capture on the APs, without disconnecting clients
8.	Features	• It should be compatible and be able to integrate with the Cloud based Controller. Must support SSH & SNMP protocol; • Should support Proactive Key Caching or other methods for Fast and Secure Roaming; • AP's Should support Minimum 50 feet radial coverage & Minimum 50 concurrent users @ each radio channels • The Access point shall be rated for operation over an ambient temperature range of 0° to 40°C • Should support interference detection and avoidance for both Wi-Fi and non-Wi-Fi interferes
9.	Other	Access point should be supplied with OEM mounting kit, all accessories

4.15 Enterprise Management Systems (EMS)

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

1. SLA and Contract Management System
2. Network fault Monitoring & performance System for IP/SNMP enabled devices like router, switches, CCTV devices, Sensors etc
3. Server fault Monitoring & performance System IP/SNMP enabled devices like router, switches, CCTV devices, Sensors, etc
4. Helpdesk System
5. Log Management System (Syslog, Access Log, application log and windows event log): should allow log retention for forensic purpose with minimum log retention period of 12 Months.

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

4.15.1 SLA & Contract management System

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

- It must be a centralized monitoring solution for all IT assets (including servers, network equipment etc.)
- The solution must have integrated dashboard providing view of non-performing components / issues with related to service on any active components
- The solution must follow governance, compliance and content validations to improve standardization of service level contracts
- Application should be pre-configured so as to allow the users to generate timely reports on the SLAs on various parameters.
- The solution must support Service Level Agreements & Lifecycle Management including Version Control, Status Control, Effectively and audit Trail to ensure accountability for the project.
- The solution must have the ability to define and calculate key performance indicators from an End to End Business Service delivery perspective related to Surveillance Project under discussion.
- The solution should support requirements of the auditors requiring technical audit of the whole system
- The solution most have an integrated dashboard, view of Contract Parties & current SLA delivery levels and view of Services & current SLA performance
- The solution should support SLA Alerts escalation and approval process.
- Solution should support effective root-cause analysis, support capabilities for investigating the root causes of failed service levels and must make it possible to find the underlying events that cause the service level contract to fail.
- Accept Data from a variety of formats, provide pre-configured connectors and adapters, Ability to define Adapters to data source in a visual manner without coding.
- Support for Defining and Calculating service Credit and Penalty based on clauses in SLAs.

4.15.2 Reporting

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

- Resource utilization exceeding or below customer-defined limits
- Resource utilization exceeding or below predefined threshold limits

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

4.15.3 Network Management System

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

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

4.15.4 Server Performance Monitoring System

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

4.16 Centralized/Enterprise 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.):

Sr.	Description	Bidder Compliance (Yes/No)
1.	Ability to scan through all file types and various compression formats. Ability to scan for HTML, VBScript Viruses, malicious applets and ActiveX controls.	
2.	Must update itself over internet for virus definitions, program updates etc. (periodically as well as in push-updates in case of outbreaks)	
3.	Able to perform different scan Actions based on the virus type (Trojan/ Worm, Joke, Hoax, Virus, other)	
4.	Shall provide Real-time product Performance Monitor and Built-in Debug and Diagnostic tools, and context- sensitive help.	

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

4.17 Internet Router

S/N	Specification
1.	Router should support capacity of minimum 1 Gbps and should be supplied with 2x1G and Min 4 nos. of 10/100 Base-Tx Ethernet Ports
2.	Router should support Redundant Power Supply and should also support On line insertion and removal of the same from day one.
3.	Router must support TCP/IP, PPP, Frame Relay, HDLC
4.	Router should support IPv4 and IPv6 from day one
5.	Router should support all standard routing protocols like BGP, MBGP, OSPF v2/v3, IS-IS, RIP/RIPv2, static routes, IGMP (v1, v2, v3), Ipv6 tunneling, NAT, NTP, etc.
6.	Router should have a dedicated OOB Management port using CLI(SSH), WebUI (SSL), SNMP (v1, v2, v3), TFTP, etc.
7.	Router should support AAA features using TACACS+, Radius, LDAP, etc.
8.	Should have console port and an external modem for remote management
9.	All necessary SFP's, interfaces, connectors, patch cords (if any) must be delivered along with the router from day one.
10.	The Router should be Rack mountable and should be supplied with Indian Standard power cables.
11.	The Router should be supplied with all applicable Licenses from day one.

4.18 UTM

Sr.	Parameter	Minimum Specifications	Compliance (Yes/No)
1.	Industry Certifications and Evaluations	The Firewall appliance should have certifications like NDPP/ ICSA / EAL4 or more	
2.	Hardware Architecture	The appliance based security platform should be capable of providing following 7 security functionalities in a single appliance from day one, 1)Firewall 2)Intrusion Prevention system 3)Antivirus 4) Anti-Spam 5) Web Content Filtering 6) Application Control	
		The appliance should support at least 7 10/100/1000Gigabit ports from Day one configurable as WAN/LAN port	
		The appliance should support at least one 10/100/1000 dedicated management interfaces to configure/manage the firewall policies, perform image upgrades even in case of failure of the data interfaces.	
3.	Performance & Scalability	Firewall throughput shall be at least 1.9 Gbps	
		VPN throughput shall be at least 1.1 Gbps.	
		IPS throughput should be more than 400 Mbps.	
		Firewall should support at least 60 concurrent VPN peers both IPSec & SSL	
		Firewall should support at least 200,000 concurrent sessions	
		Firewall should support at least 10,000 connections per second	
		Firewall should support at least 200 vlans	
4.	UTM/Firewall Features	Firewall should support IPv4 & IPv6 dual stack functionality to be able to use IPv4 & IPv6 simultaneously	
		Firewall should support creating access-rules with IPv4 & IPv6	
		Firewall should support operating in routed & transparent mode	
		Firewall should provide application inspection for DNS, FTP, HTTP, SMTP, ESMTP, LDAP, MGCP, RTSP, SIP, SCCP, SQLNET, TFTP, H.323, SNMP etc.	
		The administrator shall be able to define application control list based on selectable application group and/or list and its corresponding actions.	
		Firewall should be able to create access policies based on the User/group info from the Active Directory/Local	

		available either through clientless or agent based mechanism.	
		Firewall should support static nat, pat, dynamic nat, pat & destination based nat	
		Firewall/UTM have the ability to provide Anti-Spam capabilities over SMTP without external solution, devices or hardware modules.	
		Should have facility to block files based on file extensions over HTTP, HTTPS, FTP, SMTP, POP3 etc.	
		Firewall should support Nat66 (IPv6-to-IPv6), Nat 64 (IPv6-to-IPv4) & Nat46 (IPv4-to-IPv6) functionality	
		Firewall should support integration with Radius, Tacacs+, RSA	
5.	High-Availability Features	Firewall should support stateful failover of sessions in Active/Standby & Active/Active mode	
		Firewall should support failover of IPv4 & IPv6 sessions	
		UTM should support Multiple WAN Link load balancing across multiple WAN interfaces using Round Robin, Spill-over or Percentage based methodology.	
6.	Routing Features	Firewall should support IPv4 & IPv6 static routing, RIP, OSPF v2 & v3 and BGP	
		Firewall should support PIM multicast routing	
		Firewall should support SLA monitoring for static routes	
7.	Management Capabilities	Firewall should support management of firewall/IPS/SSL VPN via Client, Telnet, SSH & inbuilt GUI management interface or using External Management Server	
		Firewall should support syslog	
		Should provide Granular reporting (type, source, destination, action required etc.)	
		Firewall should support SNMP logging & specify which messages are to be sent to SNMP servers	
		Firewall Gui management interface should support backing up & restoring configurations	
		Firewall should support packet capturing functionality to send the packet capture to ethereal/wire-shark for detailed packet analysis	
		Firewall should support the functionality of Auto-Update to check for latest software versions & download the same	

4.19 Blade Server with Chassis

Sr.	Parameter	Minimum Specifications
1.	Processor	Latest series/ generation x86 processor(s) with 10 or higher Cores Processor speed should be minimum 2.2 GHZ or more Minimum 2 processors per each physical server
2.	RAM	Minimum 256 GB Memory per physical server
3.	Internal Storage	2 x 900 GB SAS (10k rpm) hot swap disks
4.	Network interface	2 X 10 G ports for providing Network connectivity 1 X Dual-port 8G HBA cards for providing Storage connectivity
5.	RAID support	As per requirement/solution
6.	Operating System	Licensed latest version of Linux/ Microsoft® Windows based Operating system)
7.	Form Factor	Blade
8.	Virtualization	To be provided with Industry standard virtualization hypervisor like Hyper-V, VMWARE, Oracle VM and required number of virtualization licenses based on the sizing
9.	Blade Chassis	Compatible to support the network and application infrastructure

4.20 Storage (Primary and Secondary)

Sr.	Parameter	Minimum Specifications
1.	Primary and secondary Storage	• Primary Storage Capacity to be decided by SI (usable, after configuring in offered RAID configuration) • Secondary Storage Capacity to be decided by SI (usable, after configuring in offered RAID configuration) • RAID solution offered must protect against double disc failure. • Disks should be minimum of 6 TB capacity for SAS and 8 TB for SATA (combination as per performance and SLA requirements of overall solution) • To store all types of data (Data, Voice, Images, Video, etc) Proposed Storage System should be scalable (vertically/horizontally)
2.	Hardware Platform	Rack mounted form-factor Modular design to support controllers and disk drives expansion
3.	Controllers	Storage solution should comprise of Active-Active Load Balancing Storage Controllers The controllers/Storage nodes should be upgradable without any disruptions / downtime
4.	RAID support	Should support various RAID Levels
5.	Cache	Active-Active load balancing storage controller with Minimum 32GB cache from day one with scalability up 128 Gb cache without replacing existing controller
6.	Single point of failure	The storage should have no single point of failure on components like controllers, disks, cache memory, I/O Ports, Power supply, Fan, etc.

Sr.	Parameter	Minimum Specifications
7.	Management software	All the necessary software (GUI Based) to configure and manage the storage space, RAID configuration, logical drives allocation, snapshots etc. are to be provided for the entire system proposed. Licenses for the storage management software should include disc capacity/count of the complete solution and any additional disks to be plugged in in the future, up to max capacity of the existing controller/units. A single command console for entire storage system. Should also include storage performance monitoring and management software Should provide the functionality of proactive monitoring of Disk drive and Storage system for all possible disk failures and controller failures Should be able to take "snapshots" of the stored data to another logical drive for backup purposes
8.	Data Protection	The storage array must have complete cache protection mechanism either by de-staging data to disk or providing complete cache data protection with battery backup for up to 4 hours

4.21 Server Load Balancer

- Server Load Balancing Mechanism
  - Cyclic, Hash, Least numbers of users
  - Weighted Cyclic, Least Amount of Traffic
  - NT Algorithm / Private Algorithm / Customizable Algorithm / Response Time
- Redundancy Features
  - Supports Active-Active Redundancy
  - Segmentation / Virtualization support along with resource allocation per segment, dedicated access control for each segment
- Routing Features
  - Routing protocols RIPv1/RIPv2/OSPF
  - Static Routing policy support
- Server Load Balancing Features
  - Server and Client process coexist
  - UDP Stateless
  - Service Failover
  - Backup/Overflow
  - Direct Server Return
  - Client NAT
  - Port Multiplexing-Virtual Ports to Real Ports Mapping
  - DNS Load Balancing
- Load Balancing Applications
  - Application/ Web Server, MMS, RTSP, Streaming Media
  - DNS, FTP- ACTIVE & PASSIVE, REXEC, RSH,
  - LDAP, RADIUS
- Content Intelligent SLB
- HTTP Header Super Farm

- URL-Based SLB
- Browser Type Farm
    - Support for Global Server Load Balancing
    - Global Server Load Balancing Algorithms
    - HTTP Redirection,
    - HTTP
    - DNS Redirection, RTSP Redirection
    - DNS Fallback Redirection, HTTP Layer 7 Redirection
- SLB should support below Management options
    - Secure Web Based Management
    - SSH
    - TELNET
    - SNMP v1, 2, 3 Based GUI
    - Command Line

4.22 Server/Networking Rack

Sr.	Parameter	Minimum Specifications
1.	Type	42U racks mounted on the floor Floor Standing Server Rack - 42U with Heavy Duty Extruded Aluminium Frame for rigidity. Top & Bottom cover with cable entry gland plates. Heavy Duty Top and Bottom frame of MS. All racks should have mounting hardware Packs, Blanking Panels as per requirements. Stationery Shelf (2 sets per Rack) All racks must be lockable on all sides with unique key for each rack Racks should have Rear Cable Management channels, Roof and base cable access
2.	Wire managers	Two vertical and four horizontal minimum
3.	Power Distribution Units	2 per rack Power Distribution Unit - Vertically Mounted, 32AMPs with 25 Power Outputs. (20 Power outs of IEC 320 C13 Sockets & 5 Power outs of 5/15 Amp Sockets), Electronically controlled circuits for Surge & Spike protection, LED readout for the total current being drawn from the channel, 32AMPS MCB, 5 KV AC isolated input to Ground & Output to Ground

4.	Doors	The racks must have steel (solid / grill / mesh) front / rear doors and side panels. Racks should NOT have glass doors / panels. Front and Back doors should be perforated with at least 60% or higher perforations. Both the front and rear doors should be designed with quick release hinges allowing for quick and easy detachment without the use of tools.
5.	Fans and Fan Tray	Fan 90CFM 230V AC, 4" dia (4 Nos. per Rack) Fan Housing Unit 4 Fan Position (Top Mounted) (1 no. per Rack) - Monitored - Thermostat based - The Fans should switch on based on the Temperature within the rack. The temperature setting should be factory settable. This unit should also include - humidity & temperature sensor
6.	Metal	Aluminium extruded profile
7.	Side Panel	Detachable side panels (set of 2 per Rack)

4.23 Backup Software

- The software shall be primarily used to back up all the data.
- Scheduled unattended backup using policy-based management for all Server and OS platforms
- The software should support on-line backup and restore of various applications and Databases
- The backup software should be capable of having multiple back-up sessions simultaneously
- The backup software should support different types of backup such as Full back up, Incremental back up, Differential back up, Selective back up, Point in Time back up and Progressive Incremental back up and snapshots
- The backup software should support different types of user interface such as GUI, Web-based interface

4.24 10U Rack Cabinets

The suggested technical specifications for the 10U Rack Cabinets are as follows:

Sr.	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Maximum Height	700.00 mm	
2.	Maximum Width	560.00 mm	
3.	Maximum Depth	620.00 mm	
4.	Maximum Mounting Depth	450.00 mm	
5.	Rack Height	10U	
6.	Rack Width	19”	
7.	Others	The front door shall be insulated metallic door fitted with rubber gasket and a central glass for clear visibility of all	

		components installed in the rack	
		The 10U rack shall have one cable manager for network cables.	
		The 10 U Rack shall have provision for two separate top entries one for power and one for network cables.	

4.25 42U Rack Cabinets

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

Sr.	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Height	1900 mm	
2.	Width	600 mm	
3.	Depth	1000 mm	
4.	Minimum Mounting Depth	190 mm	
5.	Maximum Mounting Depth	900 mm	
6.	Rack Height	42U	
7.	Rack Width	19”	
8.	Colour	Black or Grey	
9.	Vertical Post Thickness	16 Gauge	
10.	Front Door	16 gauge	
11.	Rear Door	18 gauge	
12.	Roof	18 gauge	
13.	EIA Mounting Rails	14 gauge	
14.	Side Panels	18 gauge	
15.	Others	The front door shall be insulated metallic door fitted with rubber gasket and a central glass for clear visibility of all components installed in the rack	
		The 42U rack shall have two cable managers fully separated so they do not cross each other for power and network cables.	
		The 42U Rack shall have provision for two separate top entries one for power and one for network cables.	
		The 42U Rack shall have sufficient number of shelves to accommodate specified equipment in the Mega Point Of Presence (POP)	

4.26 E-Weighbridge & Application

The suggested technical specifications for the E-weighbridge are as follows:

Sr.	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Foundation	Fully Welded Foundation-less Modular Weighbridge	
2.	Technology	Foundation less Technology	
3.	Platform Size	18 X 3 Meter	
4.	Scale height	350 ~ 375 mm Maximum from Ground Level	
5.	Capacity	100 Metric tonnes	
6.	Painting Specification	Painting for Long anti-rust	
7.	Transmission cable length	Min 1200 Meter or more	
8.	Certifications	BIS- IS 9281(Pt III):1981 with latest amendments, if any.	
9.	Environmental protection	Min IP68 / IP69	
10.	Principal operating technology	Microprocessor – 32 bit or better	
11.	Distance from platform	Suggestible : 2 Meter (500 Mtr. without use of signal repeaters)	
12.	Keyboard	USB or any other Keyboard supported	
13.	Printer port	Compatible parallel port for Directly Connect Dot Matrix Printer or other printers	
14.	Display	Min 240 X 64 mm - High Bright Full Graphical Display	
15.	Remote display port	To connect optional 1/2inch, 1inch, 2.3inch or 4inch bright red LED display	
16.	Remote display	Min 7 Segment Red LED Display (50 mm Jumbo Display)	
17.	Indications	Buzzer/hooter for fault and data entry	
18.	Protection	1) RFI/EMI filter for input power, 2) Spike Suppressor for input Transients	
19.	Consolidated reports	Serial No./Key No./Truck No./Gross Weight/Tare Weight/Net Weight/Material etc.	
20.	Position sensor	3 Pair of vehicle position sensor	
21.	Safety Overload	150%	
22.	Load Cell	Rocker Column Compression Type digital Load Cells with anti-skid, anti-mud, anti-rust, with anti-rat cables	
23.	Application software	Client server based software, with ability to manage multiple client side applications. The server application should be able to receive and process inputs from multiple client side applications.	

4.27 Indoor Fixed Dome camera with PoE for Surveillance

Sr.	Parameter	Minimum Specifications
1.	Video Compression	H.264, H.265, MJPEG
2.	Video Resolution	1920 X 1080 P
3.	Frame rate	Min. 25 fps @1080P or better
4.	Image Sensor	1/3" or better Progressive Scan CMOS 2MP or better
5.	Lens	3.0 to 9.0 mm or better, DC-iris, motorized
6.	Minimum Illumination	Colour: 0.5 lux/f.12, B/W: 0.05 lux/f.12
7.	Day/Night Mode	Manual/Auto/Scheduled
8.	S/N Ratio	≥ 50 db
9.	Auto adjustment + Remote Control of Image settings	Colour, brightness, sharpness, contrast, white balance, exposure control, backlight compensation, Gain Control, Auto back focus,
10.	Wide Dynamic Range	100 dB or better
11.	IR Range	Min. 20 mtr. Or better
12.	Multiple Streams	Individually configurable min 03 video streams (H.264/H.265), Streaming Method-Unicast/Multicast
13.	Open standard	ONVIF Profile S & G compliant
14.	Audio	Full duplex, line in and line out, G.711, G.726 with mic
15.	Protocol	IPv4, IPv6, DNS, HTTP, HTTPS, FTP, RTSP, RTP, TCP/IP, UDP, RTCP, SMTP, NTP,DHCP,
16.	Security	Password Protection, IP Address filtering, User Access Log, HTTPS encryption
17.	Intelligent Video	Motion Detection & Tampering alert
18.	Operating temperature	0 to 40°C
19.	Casing	IK10 rated
20.	Certification	UL, EN/CE,FCC certified at the time of bidding
21.	Power	PoE (802.3af)
22.	Mounting Accessories	Should be supplied with required mounting accessories for Wall/Surface/pole Mounting with required bracket.
23.	• The camera should be automatically discovered and configured when connected to VMS or Network Switch,to set the right network parameters for the video stream on the network • Camera should be supplied with min. 32GB Micro SD/SDHC for recording	

4.28 ANPR System

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

Sr.	Description	Bidder Compliance (Yes/No)
1.	Alert Generation • The system should have option to input certain license plates according to the hot listed categories like “Wanted”, “Suspicious”, “Stolen”, etc. by authorized personnel. • The system should be able to generate automatic alarms to alert the control room personnel for further action, in the event of detection of any vehicle falling in the hot listed categories.	
2.	Vehicle Status Alarm Module • On successful recognition of the number plate, system should be able generate automatic alarm to alert the control room for vehicles which have been marked as "Wanted", "Suspicious", "Stolen", "Expired". (System should have provision/expansion option to add more categories for future need). • The system should support manual keying of vehicle number in case the number plate is not detected • The Instantaneous and automatic generation of alarms. In case of identity of vehicle in any category which is define by user.	
3.	Vehicle Log Module • The system shall enable easy and quick retrieval of snapshots, video and other data for post incident analysis and investigations. • The system should be able to generate suitable MIS reports that will provide meaningful data to concerned authorities and facilitate optimum utilization of resources. These reports shall include. o Report of vehicle flow at each of the installed locations for Last Day, Last Week and Last Month. o Report of vehicles in the detected categories at each of the installed locations for Last Day, Last Week and Last Month. o Report of Vehicle Status change in different Vehicle Categories. • The system shall have Search option to tune the reports based on license plate number, date and time, site location as per the need of the authorities. • The system shall have option to save custom reports for subsequent use. The system shall have option to export report being viewed to common format for use outside of the ANPRS or exporting into other systems. • The system should provide advanced and smart searching facility of License plates from the database. There should be an option of searching number plates almost matching with the specific number entered (up to 1 and 2 character distance)	

Sr.	Description	Bidder Compliance (Yes/No)
4.	Vehicle Category Editor • The system should have option to input certain license plates according to category like "Wanted", "Suspicious", and “Stolen", “Expired" etc. by Authorized personnel. • The system should have an option to add new category by authorized personnel. • The system should have option to update vehicle status in specific category by authorized personnel. E.g. on retrieval of stolen vehicle, system entry should be changed from "Stolen" to "Retrieved". • System should have option to specify maximum time to retain vehicle records in specific categories.	
5.	Central Management Module • The Central Management Module shall run on the ANPRS Central Server in control booth. It should be possible to view records and edit hotlists from the Central Server. ANPR Specification • Base Specification of Fixed Box Cameras must be part of the ANPR specifications. Camera Housing • IP66 standard with sunshield vandal proof Housing	
6.	Systems requirement • The system must run on a Commercial off the Shelf (COTS) server. • The system should be sized to cover the traffic across 8 lanes • The system should run on the workstation/desktop supplied as a part of this project • Should be able to integrate with the Video Management Software to be proposed under this RFP Should be able to store the details captured in Storage system as per the guidelines received from the Office of CGM	

4.29 Field Junction Box with adjustable mounting frames

Sr.	Parameter	Minimum Specifications
1.	Size	Suitable size as per site requirements to house the field equipment. The cabinet has to be provided of size suitable for the mounting of the associated network devices, power, UPS and battery components securely and safely within the cabinet.
2.	Built	The Outdoor Utility Cabinet will be constructed with a front sheet steel door with 3-point Locking system to ensure the security of the cabinet. Side and Wall Panels shall be double wall constructed, with fixing bolts internal to the cabinet. The Cabinet should have the required frames to mount the required components like, network device, power, UPS, LIU, battery, etc.
3.	Utility & IP rating	Should be Made for 24/7/365 Outdoor Applications; The Utility Cabinet shall be IP 67 or better rated with built-in air-conditioning system. Air-conditioning cooling unit shall be inherent in the design. Junction Box design should ensure to keep the operating temperature / ambient temperature within suitable operating range 0° C to 55° C for equipment's and should also avoid condensation, corrosion, intentional water splash and dust intake.
4.	Power Slot	Minimum 3 x 5 way Indian Standard PDU's has to be provided to support the site equipment. PDU type should be as per actual requirement as per Indian standards.
5.	Cable Managements	Proper cable management should be provided. Cable Routing: Power connection cable shall be provided from the nearest access point provided by Power utility company to the Outdoor Utility Cabinet through Power meter enclosure.
6.	Mounting	Each Cabinet will be mounted on a raised height Plinth, 600 - 1000 mm high, as per site requirements.
7.	Form Factor	Rack Mount/DIN Rail

4.30 Fixed Box Camera

Sr.	Parameter	Minimum Specifications or better
1.	Video Compression	H.264, H.265, MJPEG
2.	Video Resolution	1920 X 1080 P
3.	Frame rate	30 FPS or better at full resolution
4.	Image Sensor	1/2.8" or better Progressive Scan CMOS & Minimum 2 MP or better
5.	Multi Focal Lens#	≤6 mm to ≥50 mm Lens or better,
6.	Multiple Streams	

		Individually configurable min 03 video streams (H.264/H.265), Streaming Method-Unicast/Multicast
7.	Minimum Illumination	Colour: 0.5 lux @ 30 IRE f1.2 (Colour), B/W: 0.05 lux (at 30 IRE)f1.2
8.	IR Cut Filter	Automatically Removable IR-cut filter
9.	Day/Night Mode	Colour, Mono, Auto
10.	S/N Ratio	≥ 50 dB
11.	Auto adjustment + Remote Control of Image settings	Colour, brightness, sharpness, contrast, white balance, exposure control, backlight compensation, Gain Control, Auto back focus, 2D+3D DNR
12.	Wide Dynamic Range	True WDR ≥ 100 dB or better
13.	Ethernet Interface	RJ-45, 10/100 Base-T
14.	Local storage	Camera should be supplied with 32GB Micro SD/SDHC for recording and In the event of failure of connectivity to the central server the camera shall record video internally or on the SD card automatically. .
15.	Protocol	IPv4, IPv6, DNS, HTTP, HTTPS, FTP, RTSP, RTP, TCP/IP, UDP, RTCP, DHCP, ONVIF Profile S, should meet all functional requirement of the project
16.	Security	Password Protection, IP Address filtering, User Access Log, HTTPS encryption
17.	Intelligent Video	Motion Detection & Tampering alert
18.	Alarm I/O	Minimum 1 Input & 1 Output contact for 3rd part interface
19.	Operating conditions	0 ~ 50°C (Temperature), 0 ~ 90% (Relative Humidity)
20.	Casing	NEMA 4X / IP-66 rated & IK 10 or above rated
21.	Certification	UL, EN/CE,FCC certified at the time of bidding
22.	Power	802.3af PoE and 12VDC/24AC
23.	Casing	NEMA 4X / IP-66 rated & IK 10 rated enclosure for outdoor box/fix camera from the same OEM
24.	Open Standard	ONVIF Profile S compliant
25.	Mounting Accessories	Should be supplied with required mounting accessories for Wall/Surface/pole Mounting with required bracket.

4.31 PTZ Camera

Sr.	Parameters	Minimum Specifications or better
1.	Video Compression	H.264, H.265, MJPEG
2.	Video Resolution	1920 X 1080 P or better
3.	Frame rate	Min. 25 fps @1080P
4.	Image Sensor	1/3” OR better Progressive Scan CMOS, Min. 2MP
5.	Lens	5.2 ~ 104 mm Varifocal, IR Corrected
6.	Focus	Automatic with manual override
7.	Optical Zoom	20X or better
8.	Digital Zoom	12X or better
9.	Multiple Streams	Individually configurable minimum 03 video streams (H.265/ H.264) Streaming Method: Unicast/Multicast

10.	Minimum Illumination	Colour: 0.05 lux, B/W: 0.05 lux with IR or better
11.	Day/Night Mode	Colour, Mono, Auto (ICR)
12.	White Balance	Auto / Manual /ATW/Indoor/Outdoor/Daylight lamp/Sodium lamp
13.	Region of Interest	Required
14.	True Wide Dynamic Range	≥ 100 dB or better
15.	S/N Ratio	≥ 50dB
16.	Pan and Tilt Range	Pan: 360˚ Endless, Tilt: 0˚~90˚ (Auto Flip-180˚)
17.	Pan Speed	Pan Manual speed : 0.1˚~160˚/s ; Pan Preset speed : 240˚/s
18.	Tilt Speed	Tilt Manual speed : 0.1˚~120˚/s ; Tilt Preset speed : 200˚/s
19.	Proportional Zoom	Pan / Tilt speed can be adjusted automatically according to zoom multiples
20.	PTZ Functions	Preset: Min. 50 preset positions
21.	Auto Resume Function	Supported
22.	Auto adjustment + Remote Control of Image settings	Colour, brightness, sharpness, contrast, white balance, exposure control, backlight compensation, Gain Control, Electronic Image Stabilisation, , 2D/3D ultra DNR, Defog
23.	IR Range	Internal/ External with Minimum 150 mtr. coverage
24.	Operating Conditions	0 ~ 50°C (Temperature), 0 ~ 80% (Relative Humidity)
25.	Network Protocol	IPv4/IPv6, HTTP, HTTPS, FTP, RTSP, RTP, TCP, UDP, NTP, RTCP, DHCP, SMTP, UPnP
26.	Ethernet Interface	RJ-45, 10/100 Base-T
27.	Open Standard	ONVIF Profile S compliant
28.	Security	Password Protection, IP Address filtering, User Access Log, HTTPS encryption
29.	Local Storage	Camera should be supplied with 64GB Micro SD/SDHC for recording and in the event of failure of connectivity to the central server the camera shall record video internally or on the SD card automatically.
30.	Intelligent Video	Motion Detection & Tampering alert
31.	Alarm I/O	Minimum 1 Input & Output contact for 3rd part interface
32.	Operating conditions	0 to 50°C
33.	Casing	NEMA 4X / IP-66 rated & IK10 or above rated
34.	Power	802.3 af/at or 24V AC/ DC12V/ 100- 230VAC
35.	Certification	UL, EN/ CE ,FCC certified at the time of bidding
36.	Mounting accessories	Should be supplied with required mounting accessories for Wall/Surface/pole Mounting with bracket

4.32 External IR Illuminators

The External infrared illuminators are to be used in conjunction with the proposed cameras specified above to enhance the night vision.

Sr.	Parameter	Minimum Specifications
1.	Range	Min 50 meter at 60-degree angle
2.	Minimum Illumination	High sensitivity at Zero Lux
3.	Angle of illumination	Adjustable
4.	Power	PoE, Automatic on/off operation
5.	Casing	NEMA 4X / IP-66 rated and IK10 rated
6.	Operating Temperature	0° to 55°C
7.	Certification	UL, CE/EN, FCC certified at the time of bidding
8.	Form Factor	It should be separate device from the camera/Housing

4.33 Parking –Sensor & application

The suggested technical specifications for the Parking-Sensors are as follows:

Sr.	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Power Supply	200 - 260VAC 50Hz 1.5VA	
2.	Sensor Type	Into the ground with Magnetic & IR detection	
3.	Protection	IP 67 or more, water proof, rust proof, dust proof, PE housing	
4.	Detection height	Min 35 inch or more	
5.	Raise/Lower Output Relay	5A/220VAC.	
6.	Power supply	Built in battery- Lithium Iron or other	
7.	Expected lifetime	At least 8 years	
8.	Indicators	LED indicators show: Power and vehicle presence	
9.	Environmental tracking	Automatic Compensation	
10.	Controller	LAN /Wireless based Controller to support at least 25 channels	
11.	Load Resistance	Heavy Traffic	
12.	Application software	Client server based software, with ability to configure, allocate/ un-allocate parking slots from client end. Receive and process inputs from multiple client side applications.	

4.34 RFID Tag

The suggested technical specifications for the RFID Tag are as follows:

Sr.	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Power Supply	Tags are Passive	
2.	Frequency	UHF 860 MHZ to 960 MHZ as per EPC Gen 2 standards	

3.	Data Transfer Rate	At least 512 kbps under ideal conditions & 64 to 512 kbps under field conditions	
4.	Protocol	EPC Gen 2, ISO 18000-6C	
5.	Material	Plastic substrate with printed antenna	
6.	Physical printing of Tag ID on the Tag	The Tag ID shall be physically printed on the Tag using the Hexadecimal numbering system and shall be adequately clear for easy visual recognition	
7.	Relative Humidity	95% condensing	
8.	Operating Temperature	0°C to 50°C ambient	
9.	Storage Temperature	0°C to 50°C	
10.	Location	The RFID Tag shall be installed at a fixed location on the inside of the Windshield of the vehicle(*location to be optimized for each class of vehicle during trials)	
11.	Installation mechanism	The RFID Tag shall have a self-adhesive backing with which it can be fixed to inside of the windshield. The adhesive shall be such that i) It allows reliable and accurate reading of the Tag by the Transceiver located at a specified distance ii)The RFID chip and/ or the antenna get irreparably damaged when an attempt is made to remove the installed Tag from the windshield by any means. After such an attempt the Tag shall become inoperable.	
12.	Tag Memory (minimum)	Unique Tag ID – 64 bits, EPC memory – 240 bits	
13.	Data Retention	10 Years minimum with UV protection for normal sunlight exposure and ambient temperature of 45 Deg C	
14.	Dimensions (including the substrate/ backing)	Maximum area occupied on the windshield shall be 50 Sq. cm.	
15.	Read Distance	Minimum 6 -8 Mtr (Programmable)	

4.35 RFID Reader

The suggested technical specifications for the RFID Reader are as follows:

Sr.	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Method	Passive Type	
2.	Radio Interface	Air Interface Protocols: ISO 18000-6C (EPC Class 1 Gen 2), ISO 18000-6B Frequency- UHF 865-867 MHz (specified in India) Power output :- +10 to +30 dBm (EIRP 1W / port) Interference Rejection:- Dense interrogator Mode	
3.	Connectivity:	Communications:- Ethernet/Serial communication (EIA standard RS 232C)	

		Protocol- EPC Gen 2, ISO 18000-6C and general conformance requirements of the standard. General Purpose I/O:- 2 Inputs and 2 Outputs Power Supply:- PoE / POE + Antenna Ports: -2 Ports (Minimum)	
4.	Environmental	Operating/Storage Temp.: 0 to +5oC (Ambient) Humidity:- 95% non-condensing Sealing: (Minimum) -IP53 for Reader and IP 65 for Antenna	
5.	Hardware & Software	Enclosure – Light-weight enclosure for the RFID transceiver and circularly polarized antenna , IP65 or better for outdoor units Firmware Upgrade: -Web based and remote firmware upgrade for future protocols and management functions Network Services:- DHCP, HHT PS, FTPS, SSH, HHT P, FTP, Telnet, SNMP and NTP, WS Discovery IP addressing Static and Dynamic ED indicators- to show sensing status and fault communication	
6.	Regulatory	WPC-Equipment type approval.	
7.	Operational & Performance	Reading reliability exceeding 99.5% in distance range specified, The transceiver technology used must have the capability to optimized read rates for vehicle identification application and be designed to adapt to instantaneous noise and interference levels. Design-Designed to be kept always ON (Transmitting)	
8.	Reading Distance	The coverage of antenna should not exceed more than a 3.6 m diameter (programmable)	
9.	RF power maximum	1 W- transmitted & 4 W – EIRP(equivalent isotopically radiated power)	

4.36 Poles for Camera

Sr.	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
1.	Pole type	Hot Dip Galvanized after Fabrication with Silver coating of 86 micron as per IS:2629; Fabrication in accordance with IS-2713 The pole should support 3 number of cantilever of varying length from 0.5 to 2.0 meters.	
2.	Height	6 Meters (or higher), as-per-requirements for different types of cameras & Site conditions	
3.	Pole Diameter	Min. 10 cm diameter pole (bidder to choose larger diameter for higher height)	
4.	Cantilevers	Based on the location requirement suitable size cantilevers to be considered with the pole. The cantilever should be fitted such that the can be rotated to change the direction or adjust the angle, if required. The Cantilever should be strong enough so as to mount at least 2 CCTV camera's, if required.	
5.	Bottom base plate	Minimum base plate of size 30x30x6 mm	
6.	Mounting facilities	To mount CCTV cameras, cantilever, Junction Box etc.	

Sr.	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
7.	Pipes, Tubes	All wiring must be hidden, through tubes/pipes. No wires shall be visible from outside.	
8.	Foundation	Casting of Civil Foundation with foundation bolts, to ensure vibration free erection (basic aim is to ensure that video feed quality is not impacted due to winds in different climatic conditions). Expected foundation depth of min. 100cms. Please refer to earthing standards mentioned elsewhere in the document.	
9.	Protection	Lightning arrester, earthing etc. shall be provided, to protect all field equipment mounted on pole.	

4.37 Traffic Light for E-weighbridge

The suggested technical specifications for the Traffic light are as follows:

Sr.	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Description- Two colour – Red and Green	Stop/Go - Red and Green Traffic Light	
2.	Housing	200MM-Standard molded, MS Housing for robustness	
3.	LED	Ultra-bright LEDs of 5mm or smaller	
4.	Power consumption	10W or better	
5.	MTBF	should be > 50,000 hours	
6.	Visibility	100 meter in normal conditions	
7.	Operating Temperature	5°C~+55°C	
8.	Compliance	CE	
9.	Power input	230 V AC/50 Hz, Operating Voltage: 110 VAC-260VAC-50 Hz	
10.	Pole	Traffic lights should be installed on MS pipes (ISI Marked) of 1.5" thick diameter at a minimum height of 6 feet above the ground level such that they are clearly visible by the drivers	

4.38 Intelligent Controller for controlling E-weighbridge operations

The suggested technical specifications for the controller for E-weighbridge are as follows:

Sr.	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Operating Voltage	100V to 240V AC ~ (50Hz)	
2.	Operating Current	Maximum 1000mA	

3.	Weight	1800gms (Approx.)	
4.	Enclosure	IP65 (Weatherproof)	
5.	Operating Temperature	10ºC To +50ºC	
6.	Communication	Ethernet 10Mbps/100Mbps, RS232 – 2 Nos, RS485	
7.	I/O	4 Digitial	
8.	Processor type	32 Bit processor	
9.	Memory	192+4 Kbyte (RAM), 1MB (Flash)	
10.	Data Rate	o Speed:168Mhz / 210DMIPS	

4.39 Boom-Barrier

The suggested technical specifications for the Boom-Barrier are as follows:

Sr.	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Mechanism	Eletro-Mechanical	
2.	Power Supply	AC 220-230V, 50/60 HZ	
3.	Power Consumption	120 W	
4.	Opening/Closing Speed	3 to 4 Seconds	
5.	Maximum Boom Barrier Length	Minimum 4 meter	
6.	Housing	Mild steel with Zinc coating (inside & outside) plus anti-corrosion treatment	
7.	Operative Option	Remote Control or Push Button	
8.	In Case of Power Failure	Open/Close option with mechanical handle or key type mechanism	
9.	Safety Features	• Warning/Traffic Light • Photocell Eye for Human Safety • Loop Detector for Vehicle Safety	
10.	Operating Temperature	0°C to 55°C	
11.	Humidity	10%-95%	
12.	MTBF	5 Million Operation	

4.40 Structured Cabling Components

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

4.41 Electrical cabling component

Sr.	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)

1	Standards	All electrical components shall be design manufactured and tested in accordance with relevant Indian standards IEC's	

4.42 Smart LED lighting

The suggested technical specifications for the smart led lighting are as follows:

4.42.1 LED Luminaire

Sr.	Minimum Specifications
1.	High bright white power LEDs shall be used in the Luminaries and the wattage of these LEDs shall be>2W
2.	Operation mode- ON/OFF/DIM
3.	Life span of LEDs used in the Luminaire shall be more than 50,000 hours at 70% light output.(Manufacture shall submit the proof- L70& TM 21 test report)
4.	Color rendering index (CRI) of the LEDs used in the luminaire shall be greater than 70.
5.	Color temperature of the proposed white color LED shall be 5000K-6000K
6.	Junction Temperature; Should be less than value at which LM80 (IS16105) data published. Should be less than 105 Degree C
7.	The distribution of luminaire illumination (control of distribution) shall be based on type of roads as per BIS standard IS 1944
8.	Power Factor: greater than or equal to 0.95
9.	Chip Efficacy: Shall be greater than 135 lumen/watt, system lumen output at 25 degree C, supported by LM80 report shall be submitted.
10.	CRI of Luminaries:>=70 (supported by LM79)
11.	Light Uniformity ratio (Emin/ Eavg) shall be as IS 1944 based on category of road
12.	The luminaire light output (lumen) shall be constant. The voltage variations/ fluctuations in the specified voltage range shall not impinge upon the lumen it produce maximum +/-2% is allowed throughout in the input operating voltage range
13.	Operating voltage: 120 V to 270 V universal electronic driver with surge protection of 10 KV (As per IEC:61000-4-5)
14.	Total Harmonic Distortion: <10% THD Test method IEC:610003-2
15.	LEDs shall be operated at a current less than 90% of its rated current
16.	LED driver efficiency: >=350ma<=1000mA
17.	LED driver efficiency Driver (High Voltage, Low current):>85%
18.	Luminaire body temperature should not exceed 30 deg C from ambient (45 deg C) without tolerance of 10 deg. C after 24 Hrs.
19.	Heat dissipation/heat sink: Well-designed thermal management system with defined heat sink
20.	Input Current< 1000mA
21.	Should have Open Circuit protection

22.	Housing-High quality aluminium die-cast body with extruded aluminium heat sink for heat dissipation. The luminaire shall be of side entry type and tiltable. The control node should be installed on top of the light fixture along with a NEMA receptacle.
23.	The Luminaire shall be built in such a way it can withstand wind speed of 150Kmph
24.	Each LED should be equipped UV protected secondary lens to bring about required uniformity Fixture cover-UV stabilized Polycarbonate/heat resistance toughened glass/modular optics system or equivalent will be accepted for the Luminaire with lens.
25.	Frequency: 50 Hz+/-3%
26.	Operating temperature: Range -10C to +50 C
27.	Protections: IP66 for all wattage, Surge protection 10 KV, IEC61000-4-5
28.	Working humidity: 10% to 90% RH
29.	Conformation standards of Luminaire: • The Luminaire should conform to IEC 60598/IS:10322. The Luminaire should be tested as per IEC 60598-2-3:2002/IS:10322 Part 5 sec-3 standards and following test reports should be submitted. Heat resistance test, thermal test, Ingress protection test, drop test electrical/insulation resistance test, endurance test, humidity test, photometry test (LM80 report) vibrant test.
30.	Finish: Aesthetically designed housing with corrosion resistant polyester powder coating
31.	Luminaire configuration/technical requirement: Side entry type. Shall consist of separate optical and color gear compartments. It should be easy replacement in the field condition
32.	Compliance: RoHS/CE/ERTL/ERDI, LM79, LM80, IS10322/60598,
34.	Lamp starting time: Max 10 sec
35.	Overall system efficacy: >85%
36	LED system wattage- min 120 watt (+/- 5%)
37	Lumen output- >15000 lumens
38	IK >=07
39	Over voltage auto restart protection greater than 280 VAC

LED Luminaire Controller

Sr.	Specifications
1.	Advance 32 bit Microcontroller based design, with flash, watchdog timer protection.
2.	Metering accuracy-0.5% certified as per IEC standards
3.	Data Measurement for Monitoring and controlling – measure voltage, current, frequency, PF, KW, KWH, etc.
4.	Radio- 2.4 GHZ, IEEE 802.15.4/ 865-868 Khz RF data Rate-250 kbps Transmit power- +20 dBM Receiver sensitivity - -104dBM Network type- self forming mesh network Network fault tolerance : Self-healing mesh Open field range: 5000 ft/1.5 Km Data protection- 256 bit AES encrypt Hardware -IEEE802.15.4-2003 CSMA-CA algorithm

5.	Power consumption less than 1 Watt
6.	Surge protection- CAT C
7.	Real time clock with battery backed RTC
8.	Operating conditions- 0 to 55 degree centigrade, 20-90% Rh non condensing
9.	Certifications- UL773, CE, FCC certified Radio, IEC certified Power Metering
10.	Enclosure- UV treated poly carbonate, IP 67

• All the required test reports of any one capacity have to be mandatorily submitted as mentioned in the remarks column along with the tender.

• The luminaire should be tested for all type tests as per IS 10322 Part 5 Sect 3 or IEC 60598-2-3:2002 standards

• Required test certifications for luminaires obtained from Independent Third Party NABL laboratory and should be submitted for the specification stipulated in this section for LED streetlights luminaire.

4.43 Standardized Signs for CCTV Camera Locations

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

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

4.43.1 Reference Designs

Type	Sign Design	Remarks

B		To be used at all the check posts where. Text should be in Gujarati, Hindi and English at all the checkposts.

4.44 Online UPS

Sr.	Parameter	Minimum Specifications
1.	Capacity	Adequate capacity to cover all above IT Components at CCC and Smart DC
2.	Output Wave Form	Pure Sine wave
3.	Technology	True On-line High-Frequency Design UPS with Double Conversion technology Rectifier & Inverter both to be IGBT based PWM
4.	Input Protection	Thermal Circuit Breaker/Isolator with fuses
5.	Input Power Factor at Full Load	0.99
6.	Input	Three Phase 3 Wire
7.	Input Voltage Range	305-475VAC at Full Load, Three Phase
8.	Input Frequency	50Hz +/- 3 Hz (auto sensing)
9.	Output Voltage	400V AC, Three Phase
10.	Output Frequency	50Hz +/- 0.5Hz
11.	Inverter efficiency	>90%
12.	Over All AC-AC Efficiency	>85%
13.	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
14.	Battery Backup	1 hrs in full load
15.	Battery Type	VRLA (Valve Regulated Lead Acid) SMF (Sealed Maintenance Free) Battery
16.	Battery Make	Exide, Quanta, Panasonic, CSB, Yuasa, Relicell or equivalent
17.	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.

Sr.	Parameter	Minimum Specifications
18.	Audio Alarm	Battery low, Mains Failure, Over temperature, Inverter overload, Fault etc.
19.	Cabinet	Rack / Tower type
20.	Operating Temp	0 to 40 degrees centigrade
21.	Management Protocol	SNMP Support through TCP/IP, RS 232 & USB port with software for UPS status monitoring
22.	Relative Humidity	20-90% RH @ 0-40° C (Non-condensing)
23.	Miscellaneous	ECO Mode Operation with Enable/Disable function Cooling: Forces Air Cooling Emergency Power Off (EPO) BYPASS Mode Operation with Enable/Disable function Cables: With all necessary cables and plug and Battery links Rack: Suitable Metallic Rack for housing of SMF Batteries to be provided
24.	Battery Replacement	The successful bidder has to replace the UPS battery during the 3rd year of O&M for uninterrupted and smooth operations. OEM should confirm battery replacement in UPS.

4.45 Networking Standards

- ANSI/TIA-942, Telecommunications Infrastructure Standard for Data Centres, if applicable
- ANSI/TIA/EIA/568-C.1, Commercial Building Telecommunications Cabling Standard – 2009
- ANSI/TIA/EIA 568-C.2, Copper Cabling Components Standard
- ANSI/TIA/EIA 568-C.3, Optical Fibre Cabling Components Standard, if OFC connectivity is preferred
- ANSI/TIA/EIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces
- ANSI/TIA/EIA-606-A, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- ANSI/J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- Building Industries Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM) – Preferred

5 Annexure B: Non-IT (Civil, Electrical, Mechanical) Requirements

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

5.1 Specification for Workmanship - Civil Specification

In general, Indian Standards (IS) specifications shall apply for quality of materials, works & workmanship unless specified.

5.1.1 Excavation & Earthwork

- **Site Clearance**

The Contractor shall clear the construction areas within the site of all natural obstructions, rubbish and any other artificial obstructions, which would interfere with construction of building, roads, paths, and drains. In case The Contractor fails to comply with the requirements of this clause, the Engineer shall have the right to get the work done at the Cost of The Contractor. However the Engineer shall give notice before taking such action.

- **Nature of Excavation**

The Contractor must examine and ascertain for himself as to the nature of the material to be excavated and price the work accordingly as no allowance will be made beyond the Contract Sum for any alleged ignorance or consequence of any misunderstanding or incorrect information or on the grounds of insufficient description or any ignorance, nor shall the Owner be under any obligation to pay the same.

- **General Excavations**

It is the responsibility of The contractor to check and examine the Site and satisfied himself as to the nature of the existing levels and logistics prior to commencing of the work as no extra payment will be made in respect of any alleged excavations carried out due to levels being above that shown upon the drawings without the prior written Instruction of the Clerk of Works. Where such Instruction is given it is The Contractor's responsibility to record the levels and to agree these levels jointly with the Clerk of Works prior to commencement of the excavation.

- **Over-Site Excavations**

Over-site excavation over the areas of building has been measured in this section down to a general level. Removal of vegetable soil has been measured and is to be stock piled for disposal as directed by the Clerk of Works. Excavated material suitable for backfilling around foundations and for making of levels under roads, floors etc. is to be kept separate from the vegetable soil and shall be used as directed or spread and levelled as per instruction of the Clerk of Works on the site at the end of excavation operations, if surplus.

- **Excavations**

Excavation for foundations and pipe, cable etc. trenches shall be as per drawing to width, depth, line, level, and gradient as specified. Use of planking and strutting along foundation lines will not be considered as formwork. The Contractor, while excavating shall not cause damage or destruction to the existing underground wire, pipelines, cables, or other Industry or any other Authority.

- **Inspection**

When excavations are to the sizes and depths required, the Site-In-Charge shall be called to the Site immediately for an inspection. Only upon approval of the Site-In Charge, shall The Contractor proceed with the work. The Contractor shall keep the excavation dry at all times. The excavations are to be left open until any variation in depth has been measured and agreed by the Engineer.

- **Excavation below Required Depth**

Should any excavation be made below the levels or lines shown on drawings or otherwise required by the Site-In Charge, The Contractor must fill up the resultant over- excavation to the proper levels or lines with Concrete Mix 1:4:8 at his own expenses.

- **Protection of Pipes, Cables, etc.**

The Contractor shall be liable for the cost of repairs to any services damaged as a result of carrying out the works and shall further be liable for any damage which may be shown during the period of maintenance, to have arisen through the execution of these works.

- **Suitable Materials**

Suitable material shall comprise all that which is acceptable in accordance with the Contract Documents for use in the Works and which is capable of being compacted in the manner specified to form a stable fill having side slopes as indicated on the Drawings and to the specified densities.

- **Unsuitable Materials**

Unsuitable material shall mean material from swamps; marshes or bogs, peat, logs, stumps and perishable material, material susceptible to spontaneous combustion, clay of liquid limit exceeding 80 and/or plasticity index exceeding 55 and materials having moisture content greater than the maximum permitted for such materials in the Contract, unless otherwise permitted by the Clerk of Works.

- **Rock**

Rock shall mean those geological strata and individual boulders, exceeding 0.5 m3 in size which, necessitate the use of burning and splitting with wedges or approved pneumatic tools for their removal. Material removed by ripping shall not be considered as Rock.

- **Rock Fill**

Rock fill shall consist of hard material of suitable size for deposition and compaction and may comprise rock as defined in this sub clause 1.13, broken stone, hard brick, Concrete or other comparable hard inert fill.

Note:

- No explosives shall be used on the site without the written consent of the Clerk of Works.
- No excavated material shall be removed from the site unless authorized in writing by the Clerk of Works.

- **Filling**

Filling to make up levels under floors shall be of approved granular material arising from excavations, which has been separated from other excavated material for its suitability. Filling shall be placed in layers not exceeding 200 mm

thick and shall be rolled with a power roller of at least 700 kg mass. The rolling process shall be continued for every layer until the specified density is achieved.

Payment for return, fill and supply, fill and ram shall be made on compacted quantity only. No extra payment will be allowed for subsequent excavation through the filling, replacing and re-compacting.

- **Specification for Earth Filling & Compaction**

Material: Material shall be cohesive in nature.

Sampling from Borrow Pit: Sampling shall be done for each strata of earth with proper demarcation of borrow pit and minimum three number of samples shall be taken for each borrow pit for each strata of soil and subsequent testing shall be carried out if borrow pit changes.

Testing for Borrow Pit Material: Proctor test shall be conducted in laboratory for borrow pit material to obtain Maximum Dry Density and Optimum Moisture Content as per method described by IS: 2720 (Part VII & VIII).

Field Testing Criterion: Each layer of earth shall be compacted for a thickness not more than 200 mm and second layer shall be started only after field testing of existing layer completed. Field testing shall be done for percentage compaction achieved in each layer having frequency of 1 sample in 1000 sqm area. Field testing shall be carried out by Sand Replacement Method as per procedure mentioned by IS: 2720 – Part 28.

Field Test Results: Percentage compaction achieved for each layer shall not be less than 98% of proctor density test results.

Required test for filling material:

- Gradation test based on wet sieve analysis test confirming to IS 2720(part-4)1985.
- Liquid limit & plastic limit confirming to IS 2720 (part-5)-1985.
- Standard proctor density & optimum moisture content confirming to IS 2720 (part-7)-1980.
- Deleterious constituents (only in salt infected areas where presence of salt is suspected confirming to IS 2720 part-27-1977).
- Randomly selected samples shall be tested at NABL accredited laboratory. The costing towards the same will be borne by contractor.

- **Levelling**

The ground shall be levelled before concreting. No extra payment for levelling shall be allowed.

- **Disposal of Surplus Excavated Material**

The Contractor shall include transporting and dumping of surplus excavated earth and all other rubbish arising out of construction anywhere within 1 (one) km as directed by Clerk of Works.

- **Earthwork to be kept free of Water**

Earthwork shall be kept free of water coming from any source. This water shall be removed and discharged into permanent drains. Adequate precaution should be taken for trapping of silt. Wherever necessary, temporary watercourses should be provided with sufficient gradient and depth to avoid ponding

- **Planking and Strutting**

Sides of all excavations must be supported to prevent falls or collapse of the earth face. The term "planking and strutting" is deemed to include any methods which The Contractor adopts to uphold, protect and maintain the sides of excavations. The Contractor will be responsible for any consequences of his failure in this respect or any other damage thereof, including clearing away fallen material and any extra concrete or other works including formwork ordered by the Site-In- Charge due to such failure. An item has been included in these Bills of each relevant section.

- **Hard core**

Hard core shall consist of broken stone, concrete or other similar materials. It shall be substantially free from dust, earth, mortar, timber, easily crushable materials and rubbish of any kind and shall be "all-in" material passing a 150 mm sieve. The proportion of material passing a 6 mm sieve shall not exceed 10%. The material proposed by The Contractor shall be approved by the Engineer in writing before being brought to Site.

5.1.2 Concrete

5.1.2.1 Requirements

Any requirement for concrete work under other sections of this specification shall be governed by the requirements of this section. Each stage of construction of plain or reinforced concrete work, including the making and testing of the cubes and the maintenance and calibration of mixing and measuring plant is to be supervised continuously by competent and responsible members of The Contractor's staff.

The Engineer shall be given ample opportunity to inspect and approve all formwork and reinforcement before the concrete is poured. Such approval given by the Engineer will not absolve The Contractor from his responsibility for maintenance of the quality, lines and levels, dimensional accuracy and strength requirement of the work. No concrete shall be prepared or placed in position except in presence of the Engineer, unless he has instructed in writing to carry out the work in his absence.

5.1.2.2 Indian Standard Specifications

Except where they are varied by the requirements of these Specifications the requirements of the following Indian Standard Specifications (herein after referred to as “IS) and / or codes of Practice shall form part of these Specifications.

- IS-456-2000 Indian Standard Code for plain and Reinforced concrete- including all relevant Codes mentioned in this Code.
- IS-3370 Code of Practice for concrete structures for the storage of liquids.
- IS-516 Methods of Tests for strength of concrete.
- IS-4082 Recommendations on stacking and storage of construction Material at site.
- IS-7861 Code of practice for extreme weather concreting part.1.

5.1.3 Mortar

5.1.3.1 General

Mortars for masonry shall be prepared in accordance with I.S. 2250-1965. Cement used for brick Masonry work shall be ordinary or rapid hardening Portland cement (I.S.269- Latest revision). Lime shall confirm to requirements of I.S.712-1956 Field slaking of lime shall be done in accordance with I.S. 2116-1968 and shall be free from shale clay, alkali and organic matter. Water used for masonry mortar shall be clean and free from injurious amount of deleterious material.

5.1.3.2 Cement Mortar

Cement mortar shall be preferably mixed in Mechanical Mixer. If done by hand mixing the operation shall be carried out on a clean watertight platform.

Cement and sand shall be mixed dry in required proportion to obtain uniform colour. The required quantity of water shall then be added and the mortar mixed to produce workable consistency.

In the case of mechanical mixing the mortar shall be mixed for at least 3 minutes after addition of water.

In case of hand mixing the mortar shall be hoed back and forth for 10-15 minutes with addition of water.

The mortar so mixed shall be used within 25 minutes of mixing. The mortar left beyond a specified period shall be rejected. Waterproofing of mortar shall not be permitted.

5.1.3.3 Re-tempering of Mortar:

In case of mortar using cement, the mortar that has stiffened because of evaporation of water from the mortar may be re-tempered by adding water as frequently as needed to restore the requirements of consistency but this re-tempering shall be permitted only within two hours from the time of addition of cement.

5.1.3.4 Lime Mortar

Lime mortar shall be prepared by mixing and grinding lime putty, sand, or cinder in the specified proportions. The ingredients shall be mixed on watertight masonry platforms or in troughs. This shall then be sprinkled with requisite quantity of water and ground in a masonry lined mortar mill.

The mortar shall be ground for not less than 180 revolutions. It shall be raked up continuously during the process, particularly at the angles of the mill. Water shall be added as required during grinding. Care shall be taken not to add more water than what is actually needed to bring the mortar to the consistency of a stiff paste.

5.1.4 Brick Masonry

5.1.4.1 General

All brick work shall confirm to IS 2212

5.1.4.2 Workmanship

Every brick shall be thoroughly soaked in clear water (for at least 24 hours before use). The surface on which the brick work is to be started shall be thoroughly cleaned and wetted (hacked in case of concrete) and a thin coat of cement slurry shall be applied over the entire surface. If fresh masonry is to be stretched on old masonry, it shall be thoroughly cleaned with wire brush and washed to remove all loose deposit, loose set mortar, mud or dirt.

The first course itself shall be made horizontal by providing enough mortar in bed joints to fill up any undulation in bed course. For laying bricks, layer of mortar shall be spread on the full width of suitable length of lower course. Each brick shall be pressed into mortar and shoved in final position so as to embed the brick fully in mortar. Brick shall be laid with indentation uppermost.

Brick work 230mm thick and over shall be in English Bond; and 102mm thick (half brick) work shall be built in Stretcher or Running Bond.

Broken brick shall not be used, except as closers. The course shall be truly horizontal and the work strictly in plumb. Joints shall be broken vertically and the lap not less than half width of brick. They shall not exceed 12mm in thickness.

All joints vertical and horizontal shall be well filled with mortar. When the mortar is green the joints in brick work shall be raked out 12mm deep to afford a good key for plaster.

Fixing of timber and frame work shall be done in accordance with relevant I.S. and shall be fixed simultaneously as masonry work proceeds to ensure proper bond.

Brick work shall not be raised more than 12 single courses a day. No portion of the work shall be left more than 90 cm lower than the other. Where masonry of one part is delayed the brick shall be raked back suitably at angle not exceeding 45 degrees according to Bond/but not toothed.

The brick work shall be carried out with all necessary setbacks, projections, cuttings and toothings in conformity with the drawings.

If necessary The Contractor shall have to provide wooden plugs, etc. for his own work and for which there will be no special payment on that account by the Owner.

The brick work shall be cured by watering at least three times a day for 10 days commencing from 24 hours after the course is laid and the work shall be well protected with gunny bags or tarpaulin during the rainy season to prevent mortar from being washed.

All uneven, irregular and bad brick work poor in workmanship shall be demolished when directed by the Engineer and shall be rebuilt by The Contractor at The Contractor's expenses.

5.1.5 Plastering

- **Mortar**
  Mortar proportions specified on Drawings and / or Bills of Quantities shall be used.
- **Scaffolding**
  Scaffolding for carrying out plastering work shall be double scaffolding having two sets of vertical supports so that the scaffolding is independent of the walls
- **Preparation of Surface**
  All putlog holes in brickwork and junction between concrete and brickwork shall be properly filled in advance. Joints in brickwork shall be raked about 10 m and concrete surface hacked to provide the grip to the plaster. Projecting burrs of mortar formed due to gaps at joints in shuttering shall be removed.
  The surface shall be scrubbed clean with wire brush/coir brush to remove dirt; dust etc. and the surface thoroughly washed with clean water to remove efflorescence, grease and oil etc. and shall be kept wet for minimum of six hours before application of plaster.
  The Contractor shall prepare test specimens for different types of plaster at his own cost for approval by the Engineer.
- **Application**

  For external plaster the operation may be started from top and worked downwards. For internal plaster plastering may be started wherever the building frame and dado work are ready and temporary supports on wall and floor are removed. Ceiling plaster shall be completed before commencement of wall plaster - all wall plaster shall be started from top and worked downwards.

  Gauges of plaster 75 x 75mm shall be first applied horizontally and vertically at not more than 2m intervals over the entire surface to serve as guides for plastering and to ensure even thickness and a true surface. The surfaces of these gauged areas shall be truly in plane of the finished plaster surface. In suspending the work

the plaster shall be left cut clean of line both horizontal and vertical. The work shall be closed on body of wall and not nearer than 15 cm. to any corner of arises. When recommencing, the edge of the old work shall be scraped or rubbed down with the carborundum stone and wetted before plaster is applied to adjacent areas.

The finished plaster surface shall not show any deviation more than 4mm when checked with a straight edge of a length placed against the surface. Any cracks which appear in the surface and all portions which sound hollow when tapped or are found to be soft or defective shall be cut out in rectangle shape and redone as directed.

Curing shall be started 24 hours after finishing the plaster and the plaster shall be well cured for at least 7 days. No paint, colour wash or white wash shall be applied to plastered surfaces for at least two months or until the Contractor has satisfied the Engineer that the walls and plaster are thoroughly dry.

- **Cement plaster with smooth cement finish**

  Cement and fine sand will be thoroughly mixed dry in 1:4 proportions. Only minimum water shall then be added and the mortar mixed until homogenous and required consistency obtained.

  Only that mortar which can be used in 1/2 hour shall be mixed.

  It shall be used in two coats and on prepared surface the scratch coat 12 mm thick applied and levelled with a wooden trowel. This surface shall be cross stretched horizontally to provide a mechanical key for final coat. The surface shall be kept continuously damp for minimum 3 days.

  The finish coat shall be 6 mm thick. Before application the scratch coat shall be dampened evenly by spray and the surface rubbed smooth after floating it with a coat of pure Portland cement.

  The use of dry cement shall not be permitted. All plaster work shall be cured for a period of 10 days after the finishing coat.

- **Cement Plaster with Neeru (Lime Putty) finish**

  The same specification of cement plaster is applicable except that plaster is applied in single coat to specified thickness and instead of cement slurry Neeru shall be applied as thin as possible to avoid surface cracking and rubbed over to an even smooth finish. The plaster shall be kept wet for 10 days and shall receive one coat of white wash finally.

  Neeru shall be prepared as follows:

  The lime for preparing Neeru shall be from approved sources and shall be slaked lime powder. Slaked lime powder shall be added to water in preparation tanks to form slurry. The slurry shall be sieved through a fine mesh sieve (5 mesh per linear cm) and thorough slaking for a period not less than twenty days. The surplus water in the slurry shall be drawn off or allowed to evaporate before use. The slaked lime paste thus formed shall be used for preparing Neeru.

  Neeru shall be prepared by mixing together 10 M3 of slaked lime paste, 0.01 M3 of Portland Cement, 0.03 CM of fine sieved sand and 4 Kg. of finely chopped jute fiber, thoroughly mixed with sufficient water to form a paste of the desired consistency.

The finishing coat of Neeru prepared as above shall be applied with steel trowels to a uniform thickness in a thin layer and finished smooth by steel trowelling.

- **Sand Faced Plaster**

  The external plaster shall be in two coats of an overall thickness of 20 mm.

  On a prepared surface backing coat of 12mm thickness and in cement mortar (1:4) shall be applied smooth and even. It shall be combed when wet to give a good bond for the finishing coat. The backing coat shall be cured for 7 days before applying of the finishing coat.

  For finishing coat only sand screened through 3mm mesh shall be used. It shall be 6mm thick and in cement mortar (1:3) and applied smooth and even.

  The entire surface should be rubbed with approved sponges to expose sand grains and cured for 10 days. Curing shall start after 24 hours.

  All external plaster shall be waterproofed with approved waterproofing compound added to cement in proportion of 1.5 kg/50 kg of cement as per Manufacturer's specifications.

- **Rough Cast Cement Plaster**

  Follow general procedure for surface preparation for plaster; vis. close hacking of concrete surfaces, raking of joints in masonry to a depth of 12 mm minimum, and cleaning and wetting of all masonry. Rough cast cement plaster shall be done in two coats, backing coat 16mm thick in cement mortar 1:4 shall be applied, finished with wooden floats and left rough. Waterproofing compound at 2 percent by weight of cement shall be added to the backing coat at no extra cost.

  As soon as the backing coat is slight set the finishing coat shall be applied 16mm thick and in a mix of 1 part of cement: 1 parts of sand: 1 part of pea gravel. This mixture shall be dashed by means of trowel against the backing coat. The gravel should be seen prominently on the surface. The distribution of gravel should be uniform over the surfaces.

  Plaster to be well cured for at least 10 days.

- **Vineratex Finish**

  Follow general procedure for surface preparation for plaster; vis. close hacking of concrete surfaces, raking of joints in masonry to a depth of 12mm minimum, and cleaning and wetting of all masonry. Apply cement plaster backing coat 12 to 16 mm thick in cement mortar 1:4 backing, finished with wooden floats and left rough. Allow to cure. Apply one coat of ready mixed decorative textured Vineratex as Manufactured by Vemera Industries, Madras, India, or approved equal. Mix shall be in custom colour and selected aggregate as approved by the Engineer.

5.1.6 Floor and Wall Finishes

5.1.6.1 Scope and General Requirement

All flooring, skirting, etc. shall be executed strictly as per relevant IS Specifications and in workmanlike manner.

5.1.6.2 Indian Patent Stone

Method of mixing, placing and compacting shall generally confirm to the Specifications under plain and reinforced cement concrete described earlier. A stiff mix consistent with workability shall be used.

Preparation of Surface: Before the operation for laying topping is started the surface of base concrete shall be thoroughly cleaned of all dirt, loose particles slacked mortar, droppings and laitance if any, by scrubbing with coir or steel wire brush. When the concrete has hardened so much that roughening of surface by wire brush is not possible, the surface shall be roughened by chipping or hacking at close intervals. The surface shall then be cleaned with water and kept wet for 12 hours and surplus water shall be removed by mopping before the topping is laid.

Finishing the Surface: After the concrete has been fully compacted it shall be finished by trowelling or floating with neat cement rendering. Finishing operations shall start shortly after the compaction of concrete and the surface shall be trowelled three times at intervals so as to produce a uniform and hard surface. The satisfactory resistance of floor to wears depends largely upon the care with which trowelling is carried out. The time interval allowed between successive trowelling is very important. Immediately after placing cement rendering, only just sufficient trowelling shall be done to give a level surface. Excessive trowelling in the earlier stages shall be avoided, as this tends to bring a layer rich in cement to the surface. Sometime, after the first trowelling, the duration depending upon the temperature, atmospheric conditions and the rate of set of cement used, the surface shall be re-trowelled to close any pores in the surface and to bring to surface and to scrape off any excess water in concrete or laitance. No dry cement shall be used directly on the surface to absorb moisture or to stiffen the mix. The final trowelling shall be done well before the concrete has become too hard but at such a time that considerable pressure is required to make any impression on the surface.

Ironite Topping: Instead of finishing the top with rendering coat of 1:1 cement mortar, the top shall be finished with 10 mm thick Ironite topping. Unless otherwise directed, one part of Ironite and four parts of ordinary cement by weight shall be mixed dry thoroughly. This dry mixture shall be mixed with stone grit 6mm (1/4") and down size or as otherwise directed in the ratio of 1:2 by volume and well turned over. Just enough water shall be added to this dry mix and mixed thoroughly well and laid to uniform thickness of 10 mm and compacted. After initial set has started the surface shall be finished as directed.

Terrazzo in Site Work in Flooring, Skirting etc.: The terrazzo finish shall be laid on an under layer of thickness as specified in the respective items. The topping shall consist of a layer of marble chips of selected sizes, colour and design approved by Clerk of Works mixed with desired shade of pigment.

The proportion of terrazzo mix shall be three parts of cement and one part of marble powder by weight. For every part of cement marble powder mix, the proportion of marble aggregate by volume shall be 1.5 parts unless otherwise specified.

The topping shall be mixed and laid in panels as described in IS: 2114 and as per decorative designs approved by Site-In-Charge. The dividing strips for panels shall be of Aluminum or as specified in the Schedule of Quantities. It shall be polished as specified in IS: 2114.

Glazed Tiles, Ceramic Tiles and Marble Tiles in flooring and Dado: White glazed tiles shall be of specified size and thickness. All specials viz. coves, internal and external angles corners, beads etc. shall be used wherever directed. Under layer of specified thickness and mortar of stipulated proportion shall be laid as described in marble mosaic flooring. Tiles shall be washed clean and set in cement grout and each tile being gently tapped with a wooden mallet

till it is properly bedded and in level with the adjoining tiles. The joints shall be kept as thin as possible and in straight lines or to suit the required pattern. After the tiles have been laid, surplus cement grout shall be cleaned off.

The joints shall be cleaned off the grey cement grout with a wire brush or trowel to a depth of 5 mm (3/16") and all dust and loose mortar removed. Joints shall then be flush pointed with white cement. The floor shall then be kept wet for seven days. After curing, the surface shall be washed with clean water. The finished floor shall not sound hollow when tapped with a wooden mallet.

Marbles in flooring and dado: Under laying of specified thickness and mortar of stipulated proportion shall be laid as described in marble mosaic flooring marble shall be set in cement grout and being gently tapped with a wooden mallet fill it is properly bedded. The joints shall be kept as thin as possible and in straight lines or to suit the required pattern. After the marble has been laid, surplus cement grout shall be cleared off. The joints shall be cleaned off the grey cement grout with a wire brush or trowel to a depth of 5mm (3/16") and all dust and loose mortar be removed. Joints shall then be flush pointed with white cement. The floor shall then be kept wet for seven days. After curing, the surface shall be washed with clean water. The finished floor shall not sound hollow when tapped with a wooden mallet.

5.1.7 Doors & Windows

The construction and installation of doorframes, shutters and ironmongery shall follow relevant Indian Standard Specifications and Codes of Practice. The following IS Specifications and Codes of Practice shall form part of these specifications.

- IS-1003 Specifications for Timber Panelled and Glazed shutters - Part I, Door Shutter.
- IS-2202 Specifications for Wooden Flush Door Shutters (Solid Core Type) Part I, Plywood Face Panels
- IS-2202 Part 2, Particle Board and Hardboard Face Panels
- IS-4021 Specifications for Timber Door, Window and Ventilator Frames
- IS-1081 Code of Practice for Fixing and Glazing of Metal Doors, Windows and Ventilators.
- IS-1038 Specifications for Steel Doors, Windows and Ventilators
- IS-4351 Specifications for Steel Door Frames
- IS-419 Specifications for Putty, for Use of Window Frames
- IS-420 Specifications for Putty, for Use on Metal Frames.

Installation of Pressed Steel Door Frames

Procedure outlined in Appendix-A, IS-4351 shall be followed.

Handling and fixing of Metal Doors, windows and Ventilators.

Procedure outlined in various clauses of IS-1081 shall be followed.

Timber door frames and shutters

Procedure outlined for Handling, fixing in position and alignment given in IS 1003, 2202 and 4021 shall be followed.

M.S. Rolling Shutters

M.S. Rolling shutters shall be made out of 18 gauge black lath either mechanically operated from both inside and outside or manually operated. It shall be fitted with two self-aligning ball bearing with locking arrangement including

G.I. housing, hooks, M.S. Pressed side guides and bottom rails brackets, door suspension shafts, top rolling springs pressed etc. complete.

The rolling shutter shall be painted with two coats of approved paint over coat of primer. In case, the fixing of rolling shutters is to be carried out by an agency other than The Contractor, The Contractor shall provide all facilities to the Erection Contractor.

Aluminium Doors and Windows

The fixing of aluminium doors and windows shall be carried out by the agency appointed by the Manufacturers. The Contractor shall provide all facilities to the Erection Contractors.

5.1.8 Painting

5.1.8.1 Scope and General Requirement

Wherever scaffolding is necessary, it shall be double scaffolding.

The surface shall be thoroughly brushed free from mortar, droppings and foreign matter. All steel work shall be cleaned of loose rust, mill scales etc. so as to expose be the original surface. All broken edges, creaks, loose plaster and wavy surface shall be brought up either by patch plaster work or by plaster of Paris.

5.1.8.2 Materials

All materials viz. dry distemper, oil bound distemper, oil paint, synthetic-enamel paint, cement primer, red lead and other primers and metallic paints shall be supplied by The Contractor as per the specification prescribed herein or the standard fixed by the Engineer in writing.

5.1.8.3 White Washing

White wash shall be prepared from lime slaked on spot, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for 24 hours and shall be screened through clean cloth. Four kg of gum dissolved in hot water shall be added to each cubic meter of the cream. Glue shall be added to give required whiteness. The approximate quantity of water to be added in making cream shall be five litres per kg. of lime. White wash shall be applied in specified coats by using flat brushes or spray pumps. Each coat shall be allowed to dry before next coat is applied. If additional coats than what have been specified, are necessary to obtain uniform and smooth finish, it shall be given at no extra cost. The finished dry surfaces shall not show any signs of cracking and peeling nor shall come off readily on the hand when the material is rubbed.

5.1.8.4 Cement Wash

Exposed concrete surfaces shall be thoroughly cleaned, rubbed and shutter marks removed before applying wash, unless specified otherwise.

Cement shall be mixed with water to form slurry to the consistency of good ready mixed oil paint and the slurry applied with flat brushes to form smooth bodied opaque surfaces. Two coats of cement wash shall be applied. Adequate time interval shall be allowed between the applications of successive coat for hardening.

5.1.8.5 Colour Wash

Colour wash shall be prepared by adding mineral colours not affected by cement to cement slurry as prepared in "Cement Wash". No colour wash shall be done until a sample of the colour wash to the required tint or shade has been got approved from the Site-In-Charge. Colour wash shall be applied as specified under "Cement Wash".

5.1.8.6 Oil bound Distemper

The surface shall be prepared as specified above. A primer coat of either cement primer or an approved distemper primer shall be applied. After the primer coat has dried, the surface shall be lightly sand-papered and dusted to make it smooth to receive distemper.

Distemper shall be prepared as per the directions of the Manufacturer and conforming to shade approved by the Engineer. It shall be applied in specified coats, taking care to allow for drying of each coat before subsequent coats are applied.

5.1.8.7 Waterproof Cement Paint

The surface shall be prepared as specified above and thoroughly wetted with clean water before waterproof cement paint is applied.

The paint shall be prepared strictly as per Manufacturer's specifications and in such quantities as can be used up in an hour of its mixing, as otherwise the mixture will set and thicken, affecting the flow and finish.

The paint thus prepared shall be applied on clean and wetted surface with brush or spraying machine. The solution shall be kept stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that the direct heat of the sun on the surface is avoided. The completed surface shall be watered after the day's work. Number of coats shall be as specified in the item.

5.1.8.8 Enamel Paint

The surface shall be prepared as specified above and a coat of approved primer shall be applied. After 24 hours drying, approved or specified quality paint shall be applied evenly and smoothly. A filler putty coating may be given to give a smooth finish. Each coat shall be allowed to dry out thoroughly and then lightly rubbed down with sand paper and cleaned of dust before the next coat is applied. Number of coats shall be as specified in the item and if the finish of the surface is not uniform, additional coats as required shall be applied to get good and uniform finish at no extra cost. After completion no hair marks from the brush or clogging of paint puddles in the corners of panels, angles or mouldings etc. shall be left on the work. The glass panes, floor etc. shall be cleaned of stains. Thinner if required shall be of approved brand and used as per manufacturer's recommendations.

5.1.9 Water Supply

5.1.9.1 Execution of work

The work under this section shall be executed only by a licensed plumber. The Contractor shall take prior approval of the Engineer while selecting plumbing agencies as per the Article 9 of the General Contract Condition

5.1.9.2 Cross connection

There shall be no cross-connection whatsoever between the distribution system for drinking water supply and any pipe or fitting containing unwholesome water, or water liable to be contaminated. The provision of non-return valves or closed and sealed stop valves shall not be constructed as a permissible substitute for complete absence of cross-connection.

All pipe work shall be so laid, connected and fixed so as to remain completely water tight, thereby avoiding wastage, damage to property and the risk of contamination.

To reduce frictional losses, the method of joining shall be such as to avoid internal roughness and projection at the joints. No bend or curve in piping shall be made when is likely to materially diminish or alter the cross-section.

5.1.9.3 Laying of Pipes

The relevant IS Codes of Practice for laying of pipes shall be followed and shall form part of this specification. The different Codes of Practice are IS-783 Code of Practice for Laying of Concrete Pipes

IS-783 Code of Practice for Laying of Concrete Pipes

IS-5822 Code of Practice for Laying of Welded Steel pipes

IS-7634 Code of Practice for Laying of Plastic pipes

National Building Code Part IX- Section I - Water Supply.

5.1.9.4 Excavation and Refilling

The bottoms of trench excavations shall be so prepared that the barrels of the pipes when laid are well bedded for their whole length on a firm surface and are true to line and gradient. In refilling the trenches, the pipes shall be surrounded with fine selected material, well compacted so as to resist subsequent movement of the pipes.

The pipes shall be carefully cleared of all foreign matter before laying.

5.1.9.5 Cleaning and Disinfection of the Supply System.

The procedure outlined in National Building Code of India Part IX, Section I, Clauses 14 shall be followed.

5.1.10 Sanitary Installation

5.1.10.1 General

All pipe and accessories shall be handled in such manner as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure pipe coating. If coating or lining of any type of pipe or fitting is damaged, repair shall be made prior to installation. No other pipe or material shall be placed inside of a pipe or fitting after coating has been applied. Pipe shall be carried into position and not dragged. Rubber gaskets that are not to be installed immediately shall be stored in a cool, dark place and out of the sun. Installation procedures shall provide for safe conduct of the work, careful removal and disposition of materials, protection of property, which is to remain undisturbed, coordination with other work in progress, and protection of utility services.

Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be laid closer horizontally than 10 feet to a water main or service line. Where sewer lines pass above water lines, the sewer shall be encased in concrete for a distance of 10 feet on each side of the crossing.

Where sewer lines pass below water lines, no joint in the sewer line shall be closer than 3 feet horizontal distance to the water line. Where sewer lines cross power or communication lines, a minimum separation of 6 inches shall be maintained with a minimum cover of 30 inches above the power or communication lines.

5.1.10.2 Pipe laying and jointing

Each section of pipe shall be inspected for defects before being lowered into the trench. Defective, damaged or unsound pipe shall not be used. Trenches shall be kept dry during bedding and laying operations. Pipe that has the grade, alignment or joint disturbed after laying shall be taken up and re-laid. If the maximum width of the trench specified is exceeded, concrete cradling, pipe encasement or other bedding as may be required to support the added load of the backfill shall be installed. Trenches shall be kept free from water until the joints have been properly coupled. Pipe shall not be laid when the conditions of the trench or weather are unsuitable. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth, or other substances can enter the pipe or fittings.

Joints shall not be covered until approved. Pipe, pipe fittings, or appurtenances found defective after installation shall be replaced. Pipe shall be laid true to line and grade to form a close concentric joint with adjoining pipe and to prevent offsets of the flow line. Sections of pipe shall be so laid and fitted together that when complete, the sewer shall have a smooth and uniform invert. As the work progresses, the interior of the sewer shall be cleaned of all dirt and superfluous materials. Where cleaning after laying is difficult because of small pipe size, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after the jointing has been completed. Pipe cutting where necessary shall be done neatly, without damage to the pipe. Unless otherwise authorized, cutting shall be done by means of an approved type of mechanical cutter.

Each pipe and fitting shall be carefully inspected before and after installation and those found defective shall be rejected. Proper facilities shall be provided for lowering sections of pipe into trenches. Any pipe or fitting that does not allow sufficient space for proper caulking or installation of joint material shall be replaced by one of the proper dimensions. Open ends of pipe at the end of each day's work shall be closed temporarily with wood blocks.

5.1.10.3 Tests

Tests of completed piping systems shall be conducted in strict accordance with testing procedures and requirements of ASTM C828 or AWWA C600, as applicable by the SI.

Do not backfill piping (more than minimum required to hold in place for testing) prior to receipt of acceptance from Owner's Representative for results of tests.

Conduct repairs and retests when required due to unaccepted test results at no cost to Owner.

5.1.11 Road Work

In general, all the Works specified under this Section shall be governed by “Specifications for Road & Bridge Works”, Fifth Revision - published by Ministry of Shipping, Road Transport & Highways - Unless noted otherwise.

5.1.11.1 Earthwork

Earthwork in cutting, filling, embankment, compaction and disposal of surplus earth shall be as mentioned in specification of "EXCAVATION AND EARTHWORK" here before.

5.1.11.2 Consolidation of Sub-grade

The sub grade shall be consolidated with power road roller of 8 to 12 tone. The roller shall run over the sub grade till the soil is evenly and densely consolidated and behaves as an elastic mass (Roller shall pass minimum of five runs on the subgrade). All undulations in the surface that develop due to rolling shall be made good with earth or quarry spoils as the case may be and the subgrade rerolled.

5.1.11.3 Soling Course

The stones in soling shall be hand packed with greatest length across the road. All interstices between stones shall be wedged in with smaller stones of suitable size, well driven in, to enable tight packing and complete filling of interstices. Such filling shall be carried out simultaneously with the placing in position of soling stone and shall not lag behind. The soling shall then be thoroughly consolidated with power roller of minimum 8 tone weight, starting at edges and working towards the centre. The roller shall run over the same surface of rolling for at least eight times till the soling course is well consolidated.

25mm thick or as specified, layer of murrum as directed by the Engineer shall be laid on top of soling course. This shall be watered and rolled before the wearing course is laid.

5.1.11.4 Wearing Course (W.B.M.)

One or two as specified wearing courses of stone aggregate each 7.5 cm thick or as specified, shall be provided. The first course shall be consolidated and thrown open to traffic at least for a period of 2 to 6 weeks, depending upon the intensity of traffic and the period available for completion of the work. The surface of the first course shall then be scarified undulation filled up and the second course then laid accordingly to profile and consolidated. The procedure of consolidation as given below should be repeated for both the courses separately.

5.1.11.5 Consolidation

The stone aggregate shall be consolidated by dry rolling and wet rolling with power roller of 8 tones minimum weight. In case of straight reach of the road, the rolling shall be commenced at the edges and worked towards the center. In case of super elevated curve the rolling shall commence from the inside edge of the curve to the outside edge.

5.1.11.6 Dry Rolling

The stone aggregate shall first be rolled dry and then lightly sprinkled with water of just sufficient quantity to moisten the earth cushioning below and to facilitate interlocking of aggregates. Rolling shall continue till the aggregate has become well consolidated and do not get displaced. During the process of rolling, camber and grade of the aggregate surface shall be checked. All undulations shall be loosened by hand racking or racking tools surplus material removed from high spots and depressions filled with surplus and fresh material and the surface rolled again, small quantities of aggregate having been kept in stock for this purpose. When all the surface defects are removed dry rolling shall be stopped, as otherwise the edges of the aggregate may get crushed, which is not desirable.

5.1.11.7 Wet Rolling

After the dry rolling has been completed as described above, the road surface shall be watered copiously so as to keep the water level up to the top of the aggregate and rolling with power roller preceded with, till the roller makes no visible impression on the surface and the interstices between the stone have been filled up by consolidation of aggregate and a piece of 25 mm size stone placed on surface gets crushed under the roller without being driven in.

5.1.11.8 Rolling with Blinding Materials

After wet rolling of the wearing surface course, the surface shall be tested with a 3m straight edge laid parallel to the center line of the road and any irregularity exceeding 12 mm shall be corrected by loosening the surface and re-compacting the same after adding or removing materials as required. If further required by the Engineer, the surface shall be checked with long string also.

Kankar murrum red bajri in specified ratio shall then be spread evenly over the surface to a 6mm to 12mm thickness copiously watered and rolled till the slurry, after filling all voids, shall form a wave before the wheels of the moving roller. Wet bajri sticking to the wheel shall be removed simultaneously when the roller is moving, by spades and sprinkling water on the wheels. The rolling shall be done a minimum of four passes or till a hard smooth solid surface is obtained.

Finished surface shall give a uniform appearance and the road shall be closed to traffic till next day or lapse of 24 hours.

5.1.11.9 Edging

Edging shall be done 225 mm wide and 110 mm deep or as specified with first class bricks.

5.1.11.10 Dense bitumen Macadam (Premix) surfacing

Tack Coat

Cleaning: Prior to the application of tack coat, all dust, dirt, mud, animal dung, loose and foreign material etc. shall be removed to 30 cm on either side beyond the full width to be treated by means of wire brushes, small picks, brooms, etc. The material so removed shall be disposed of as directed by the Engineer.

The paving bitumen (cut back bitumen) as mentioned in the specification shall be heated in a boiler to a temperature specified above and maintain at that temperature. This paving bitumen shall then be applied evenly to the already prepared dry surface by means of pressure sprayed at the rate of 0.75 kg/sq.mts of the road surface. The binder shall be applied longitudinally along the length of the road and never across it. The edges of tack coat shall be defined by wire or other cord lines stitched in position.

Base course (Premix)

Preparation of Mix and Laying

The stone aggregate of 10 mm nominal size as defined later shall be surface dry and contain no more than 2% moisture before use. It shall be screened of dust and measured in boxes and then loaded into a drum mixer according to the capacity of this drum. The aggregate shall be heated to facilitate mixing with the paving bitumen in cold weather, where so directed by the Engineer. The stone aggregate will be used at the rate of 3 cubic meters for 100 square meters of the surface area.

The paving bitumen (cut back bitumen) will be heated to a temperature as mentioned in a boiler. This heated bitumen shall be poured over the aggregate in the drum mixer at the rate of 64 kg per cubic meter of aggregate and mixing started and continued till aggregate is uniformly coated with bitumen.

This hot mix shall be spread on the road surface immediately after the application of tack coat to a thickness sufficient to achieve a thickness of 25 mm after consolidation.

Consolidation of Pre-Mix

When the mix is sufficiently tacking and stiff and has not become hard or brittle, the carpet shall be compacted by a 6-8 tone roller until no impression is made thereby on the newly laid surface. The rolling shall progress gradually from each side towards the centre. To prevent the pre-mix from adhering to roller wheels the wheels shall be dampened by means of gunny bags soaked in water. Any high spots or depressions, which become apparent, shall be corrected by addition or removal of pre-mix material. The finished surface shall be thoroughly compacted true to the correct levels and grades. Permissible tolerance will be as under.

Longitudinal Section	+6mm for every 6 meters
Cross Section	+3mm from the entire designed section

Seal Coat (Premix)

In this paving bitumen (cut back bitumen) as specified earlier will be used at the rate of 1.5kg/square meter of the surface area and stone aggregate 10 mm nominal size conforming to IS:383 shall be used at the rate of 1.1 cu. m for 100 sq. meter of the surface area.

The paving bitumen shall be heated as described earlier and applied on the surface. Over this stone grit will be spread uniformly when the bitumen is still hot. The surface will be rolled as described earlier.

Table for Premix Carpeting

Grade	Temperature to which it shall be heated
Cut Back Bitumen	163˚C to 171˚C
Paving Asphalt 30/40 or 80/100 heated and then mixed solvent atmospheric temperature at the rate 70gm/kg of asphalt	149˚C to 177˚C

Demolition shall be carried out in such a manner as to cause as little inconvenience as possible to the workers and flow of work. The Contractor shall take all safety measures for the people working on site. Demolition shall not affect the stability of the adjoining structural elements. The Contractor must provide all requisite shoring, strutting, needling or other supports to wall, roof etc. The Contractor shall alter, adopt and maintain all such necessary temporary works as may be necessary from time to time and finally clear away and make good all disturbed. Sound old bricks arising from demolition, if cleaned and approved by the Consultant shall be reused in foundations and walls below ground level. If approved by the Engineer, steel structural members shall be reused after straightening. The Contractor shall be solely responsible for the safety of its labourers and shall be liable for all deaths and damage at site. Failure of The Contractor to comply with any of safety and regulatory matter shall not pass the liability upon the Owner. Should the Owner have to pay any money in respect of claims or demands as aforesaid, pursuant to an order of a court/tribunal or any Government or local authority the amount so paid and the costs incurred by the Owner shall be charged to and be paid by The Contractor to the Owner and The Contractor shall not be at liberty to dispute or question the right of the Owner to make such payments. However, intimation of any such payments made by the Owner shall be made to The Contractor.

5.2 Specification for Materials - Civil Specification

In general Indian Standards (IS) specifications shall apply for quality of materials, works & workmanship unless specified.

1. EXCAVATION

1.1. Excavation in any kind of soil for foundations of walls, columns, piles, pile caps, raft, ducts, lift pit, basement, plinth beams, pipe trenches, etc. The rate to include shoring, strutting, refilling the trenches, foundation pits, plinth filling with selected excavated soil, ramming, watering, consolidating with mechanical roller in 15 cm layers, removing and stacking simultaneously the excavated stuff as directed and/or for filling up pits, trenches, plinths, etc. within the site, spreading spoils in layers on site as directed and compacting to achieve 98% Proctor density. Payment on the basis of net dimensions shown on drawing. Rates shall include extra space for shuttering or working. Plinth filling for an average height less than or equal to 75 cm shall be measured under this item.

1.1.1. Removal of Top soil with cutting depth not more than 300mm including carting and spreading excavated earth within a radius of 400M as directed, Watering, ramming, leveling in 200 mm layers, etc complete.

1.1.2. Removal of Top soil with cutting depth not more than 300mm including clearing jungle & uprooting of rank vegetation etc complete. The excavated earth is to be kept ready for carting away. (Carting away will be measured & paid Separately)

1.2. Same as item 1.1 for excavation in disintegrated and soft rock. On encountering such excavations, which The Contractor intends to claim under this item, he shall immediately inform the Clerk of work about his intention to do so and take the Engineer's prior approval.

1.3. Same as item 1.1 for excavation in hard rock. Excavation in hard rock requires blasting. The rate to include blasting with required tools, plants, explosives and accessories and breaking large rock pieces to suitable sizes staking etc. as directed.

1.4. Rate to include for carting away surplus materials from site up to any lead. Payment on the basis of truck measurement.

1.5. Filling for average height more than 750 mm in plinth, in plot, embankments, etc. with selected excavated earth (from other areas included in this Tender) brought from within the site including ramming, watering to optimum moisture content, compacting in not exceeding 200 mm layers using mechanical vibro-rollers, etc. complete. Compaction shall be carried out up to 98% Proctor density. Actual measurement of compacted fill for the total depth shall be considered.

1.6. Filling in plinth, in plot, embankments or any other area within the site with approved, selected earth / selected quarry waste brought from outside site, including freight, transportation, loading, unloading, taxes, royalty, screening, etc. The approved, selected earth / quarry waste shall be as per the requirements specified for embankment construction in "Specifications for Road & Bridge Works" Revision 5 of Ministry of Shipping, Road Transport & Highways. Actual measurement of compacted fill shall be considered.

1.6.1. As per item 1.6 but filling including for ramming, watering, consolidating in 200 mm layers.

1.6.2. As per item 1.6 but filling includes for ramming, watering to optimum moisture content, compacting in 200 mm layers using mechanical power roller of 8-10 t. capacity, etc. complete. Compaction shall be carried out up to 98 % as per table 300-2 of "Specifications for Road & Bridge Works" Revision 5 of Ministry of Shipping, Road Transport & Highways.

1.6.3. As per item 106 but for plot filling / earthwork including ramming, watering to optimum moisture content, compacting in 200 mm layers using mechanical power roller of 8-10 t. capacity, etc. complete. Compaction shall be carried out up to 98 % as per table 300-2 of "Specifications for Road & Bridge Works" Revision 5 of Ministry of Shipping, Road Transport & Highways.

1.7. As per item 106 but for sand.

1.8. Rate to include supply of rubble as per General Specifications and of approved quality, lay rubble packing with interstices filled with approved murrum or stone dust, or sand watered and rolled to compaction in line, level, gradient, etc. complete. Finished dimensions shall be measured.

1.9. Pre-construction anti-termite treatment to buildings shall be with emulsified insecticides as per IS: 6313 (part II) (latest revision). The Contractor shall carry out the work through an approved agency and provide a guarantee for seven years on a stamp paper from an approved agency. Only plinth area shall be measured for payment.

1.10. Bailing out of storm water normally is assumed to be included in the excavation rate. Rate in this item is to include use of pumps continuously as required for bailing out of underground seepage water and discharge through pipes up to a lead of 100 m or otherwise as directed. Payment will be on the basis of horse-power rating of the pump/pumps, multiplied by the no. of hours in use. A record of the use of pump/pumps with respective rating and hours of operation will be maintained. Authorization of the pumping shall be obtained from the Clerk-of-Works to avoid unnecessary expense and damage to the soil structure.

1.11. As per item no. 110 but using a complete well point system for bailing out of underground water.

1.12. Excavation in any kind of soil to reduce levels as shown on drawing and where directed. The rate to include mechanical/manual excavation and carting, spreading, watering and compacting the excavated material within a radius of 500 m. spreading and consolidation shall be in 250-300 mm layers. Compaction shall be carried out up to 95 % as per table 300-2 of "Specifications for Road & Bridge Works" Revision 5 of

Ministry of Shipping, Road Transport & Highways. Payment shall be made on the basis of net dimensions shown on the drawing.

1.13. Boring for under-reamed piles as per drawings and specifications. Reinforcement, Concrete and bulb making shall be measured separately. The length of boring shall be measured in meter of actual concrete done.

1.14. Making bulb for under reamed piles as per drawings and specifications. Reinforcement, Concrete and boring for the pile shall be measured separately.

1.15. Excavation in any kind of soil for depth up to 1.50m to reduce levels in borrow areas, pits, ponds etc. as shown on drawing and where directed. The rate to include mechanical / manual excavation and carting and spreading surplus excavated material. Payment shall be made on the basis of net volume of excavation.

1.16. Cutting & stacking of trees including removal of roots up to minimum 1.0mt below existing ground level and refilling the pits with approved soil and compaction in layers, all as per MORTH&H specifications. Include for cutting of trunks/ branches and stacking of serviceable material and disposal of unserviceable material within a lead of 1000 m as per Engineer's direction. Girth of tree shall be measured one meter above existing ground level. Trees which are more than 1.2m high shall be considered for payment.

1.17. Filling in plinth, in plot, embankments or any other area within the site with approved quality coarse aggregates of size 20mm - 40 mm, including freight, transportation, loading, unloading, taxes, royalty, screening, etc. Actual measurement of fill shall be considered.

1.18. Excavating existing bund / mound of earth above ground level. The rate to include for filling with selected excavated soil, ramming, watering, consolidating in 20-25 cm layers, removing and stacking simultaneously the excavated stuff as directed and/or for filling up pits, trenches, plinths, etc. within a radius of 100M. Rate to include for dismantling any electrical / water supply / other services lines buried within the existing Bund. Payment on the basis of net dimensions excavated.

2. CONCRETE

Generally all Concrete work shall be as per IS 456 and measured in M3. No allowance is made for thickness of members. Characteristic concrete strength (28 days) for items in 204 shall be M20 or 200 kg/sq cm. For higher strengths such as M25 (210), M30 (211), etc., additional rate over the rate for M20 is required. The rate shall also include mix design for various strengths and cubes shall be taken from fresh concrete and tested as per the relevant IS code. No extra amount will be paid for admixtures to improve workability or to influence setting time or gain early strength, except for water proofing admixtures for which item is separately mentioned. The rates shall include for providing of all materials, mixing, placing, forming pockets for holding down bolts, placing inserts as shown in drawing at correct location, level, necessary changes in formwork, reinforcement, etc. complete with curing. All concrete shall be machine mixed and machine vibrated. Formwork and Reinforcement measured separately.

The Contractor shall use minimum cement content **of 240 kg, 280 kg, 340 kg, 380 kg and 410 kg per m3 of M10, M15, M20, M25 and M30** concrete respectively for designed concrete mix. Above minimum cement content is for 20mm nominal size aggregate and medium workability (i.e. limit of slump shall be 25-75mm).

It is mandatory for The Contractor to employ weigh batching plant / plants of adequate capacity at Site throughout the Contract period. All concrete of grade M20 and above shall be produced by Weigh Batching only. Conversation to volumetric system of concrete manufacturing shall not be allowed.

However, The Contractor will be permitted to use Ready mix concrete (RMC) by establishing automatic batch mixing plant on site or procuring it from such a plant from the vicinity of the plot. In such a case, he shall be allowed to replace maximum 20% cement (by weight) with fly ash (as per IS. 3012). The minimum cement content mentioned above shall be considered as total of cement and fly ash for RMC. Design mix of the Concrete shall be approved by the Engineer prior to usage of concrete at Site. The Contractor shall be required to get all ingredients tested as per relevant IS Codes at intervals as specified by the Engineer. Apart from the test certificates of RMC Supplier, Cube tests & slump tests shall be performed at site. Such cubes shall be sampled & tested as per relevant IS Codes in the laboratory established at site by The Contractor. All batches of RMC supplied to the Site shall be accompanied by Manufacturer's certificate containing time of mixing, time of leaving the Manufacturer's site and mix proportion of that particular batch. The Owner / the Engineer shall have right to visit and inspect the concrete Manufacturer's premises at any stage of the Work. Rate to include for all equipment like pumps, concrete carrying trucks, etc., materials, labour, etc. complete. Measurement shall be on the basis of net quantity of concrete worked out from the dimensions/ details given in the drawing.

2.1. The rate to include providing and laying plain cement concrete with 20mm and down size graded stone aggregate, machine mixed, consolidation, finishing, curing, etc. complete, as base or sub base for masonry walls, piers, R.C.C. foundations, base for concrete floor, etc. The proportion of the mix for concrete shall be by volume.
2.2. Brickbat cement concrete will be as per 201 except that 40mm and down size broken brickbats of well-burnt bricks are used as aggregates in place of stone aggregate.
2.3. M20 concrete in Raft, pedestals foundation, columns, beams, brackets, walls, fins, pardis, gutters, pile, pile caps, floor slabs, weather sheds, lintels, trenches, shelves, stair/steps etc.
2.4. M20 concrete in machine foundations comprising footings, rafts, pedestals, columns, walls, beams, slabs, stairs, brackets, etc. complete below plinth or above plinth at any level.
2.5. Supply and lay precast concrete pavers 600 x 600 x 75 mm as aprons. The rate shall include for forming pavers in M15 concrete, 50mm thick sand bed lay in proper line and level, jointing with 1:3 cement sand mortar, curing, etc. complete.
2.6. The rate to include for non-shrink cement grout in 1:2 cement mortar under steel column bases, machinery bases, around foundation bolts, holding down bolts, etc. and including forming sides wherever necessary.
2.7. M15 concrete in Raft, pedestals foundation, columns, beams, brackets, walls, fins, pardis, gutters, pile, pile caps, floor slabs, weather sheds, lintels, trenches, shelves, stair/steps etc.
2.8. M20 precast drain cover as per drawing including form work. M 20 perforated precast drain cover including Form work, reinforcement etc. for various thicknesses.
2.9. Extra for use of plasticizer or other additive of approved make as per Manufacturer's proportion over item No 2.3, 2.4 and 2.22.
2.10. The rate to include for supplying and fixing in position approved make PVC water stoppers of Caliplast or equivalent make for expansion & construction joint etc. as directed.
2.11. M20 concrete for shaft of water tank up to plinth.
2.12. M20 concrete for shaft, stair, columns, tie beams, slab, parapet etc. complete up to 15 m height from plinth. Rate to include for changing in formwork and reinforcement for necessary opening as per the drawings.
2.13. M20 concrete for water tank container of any shape having bottom height of up to 30 m. from plinth.
2.14. Extra over item no. 2.4 for Providing and laying reinforced cement concrete structural slab using Tremix system or equivalent including Poker vibration, Surface vibration, Vacuum de-watering, Power

floating, trowelling, topping, making concrete joints (if required), etc. complete. Reinforcement/shuttering will be measured separately.

2.15. Extra over the rate of concrete for supplying and using Concrete Penetrating Corrosion Inhibitor (CPCI) as admixture. CpCi shall be used as admixture into wet concrete along with batch water during the mixing of cement, sand and aggregates. The CPCI shall be both a Cathodic & anodic inhibitor & free from toxic nitrites / chromates and shall migrate over a distance in concrete to prevent corrosion of steel re-bars. Non-migrating contact inhibitors are excluded. The CPCI shall be nontoxic with minimum pH value of 9.5.

2.16. The dosage & method of usage shall be as per the specifications of the approved Manufacturer. The CPCI shall be FerroGard-901 of Sika Qualcrete Ltd., or other such approved equivalent having minimum 2 years' proven performance & field validation history in Indian conditions.

2.17. Same as item no. 204 but for Ready Mixed Concrete (RMC) of specified grade including supply of cement. This is a fixed rate item & any variation in cement rate during the Contract period shall not be considered).

2.18. Dismantling the R.C.C. (plastered or un-plastered) beams, slabs, lintels, columns, pardis, walls, platforms, etc. at any level including finishing the broken surface to match with the surrounding, removing the debris as directed up to a lead of 1 km., cutting the reinforcement if any, etc. complete as directed by the Engineer.

2.19. Same as item No.251 but dismantling and disposing machine foundations only.

2.20. Chipping and removing of concrete cover for exposing reinforcement including cleaning the exposed reinforcement and concrete surfaces and making necessary arrangement for tying new reinforcement with exposed reinforcement at any level. Rate to include for removing the debris as directed up to lead of 1 km.

2.21. The rate to include for providing and laying M20 cement concrete with 20mm and down size graded stone aggregates, machine mixed, consolidation, immediate finishing, curing, etc. complete at basement level of around 8.0m from plinth level. The concrete shall be laid over dry and clean surface. It also includes necessary shuttering for forming drain, sump, etc. as shown on drawing.

2.22. Providing gunniting treatment to ribs, slabs, beams, column etc. at any height including removing spalled concrete from members by light hammering, chiselling etc. cleaning the reinforcement of loose scale, rust etc. by means of wire brush, applying rust remover and rust convertor such as Rusticide SS or approved equivalent, tying additional reinforcement if required (measured separately), gunniting with 1:3 cement sand mortar (up to 40 mm thickness) in two course if required with air pressure of 40 to 50 psi in the nozzle, including scrapping of undulations of gunited surface using mason's trowel.

2.23. Repairing RCC members like fins, slabs, columns, beams etc. at any height including removing cracked / worn out concrete cleaning of reinforcement by means of wire brush, applying rust remover, preventer, tying additional reinforcement (measured separately) applying bond coat 'Conbond' or equivalent, concreting with M20 grade concrete using suitable plasticizer, necessary formwork and finishing to match with the adjoining surface, curing with curing compound etc. complete as per instructions of Engineer.

2.24. Providing and applying 'Conbond' or other approved equivalent epoxy based bonding agent on chipped / exposed surfaces of concrete/ brickwork at any height. Include for cleaning of existing surface with blower and applying bonding agent as per Manufacturer's instructions. Measurement shall be on the basis of width x height of the area over which the bonding agent is applied.

2.25. Supply and fix at any height precast concrete spiral stair of approved shape. The rate shall include for forming steps in M20 concrete, lay in proper line and level, formwork, joining with 1:3 cement sand mortar, curing, reinforcement (measurement separately) etc. complete.

2.26. Construction of test pile/s group as per attached drawings. Rate shall include boring, reinforcement, concreting etc. all complete as per specification and approved drawing.

2.27. Conducting initial Vertical load & Lateral load test on test pile by reaction method using anchor piles as per specification or else otherwise specified in IS-2911 (latest revision). Rates shall include installation of all applicable test set-up, conducting load test, submission of test report, dismantling of test set-up all complete as per approved drawing.

2.28. Integrity testing of Pile using Low Strain/ Sonic Integrity Test/ Sonic Echo Test method in accordance with IS 14893 including surface preparation of pile top by removing soil, mud, dust & chipping lean concrete lumps etc. and use of computerized equipment and high skill trained personal for conducting the test & submission of results, all complete as per direction of Engineer-in-charge.

3. FORMWORK

Rate to include for formwork, centering, boxing, shuttering, propping, including special nuts, bolts etc.; in perfect line, level, plumb and, if required, to provide camber, slope and removal thereof. Forms shall be watertight and thoroughly cleaned before placing concrete. Colorless oil or grease of approved quality shall be applied to forms before placing steel. Rate to include for any shape including chamfers, residues, grooves, drip moulds etc.; as directed. Mode of measurement shall be in (m2) sq. m regardless of shape, size and thickness of members.

3.1. Rate to include for sawn timber or steel or plywood of approved make formwork and preparation of concrete surfaces to receive plaster or any other finishes. Concrete members for which formwork is to be provided under this items are columns, foundations, pedestals, beams, pardis, fins, gutters, stairs, lintels, walls, shelves, weather shed, slab, etc. up to plinth level.

3.2. These items are for elements having ‘exposed’ RCC finish. Since there will not be any plaster to cover concrete members for which formwork is to be required under this item and since no correction or patch work can be done, work shall be more precise to yield accurate dimensions of members in line, level and plumb. The surfaces shall be neat, clean and smooth and free from any blemish. No definite texture or pattern is required for fair finish in 302, whereas for 303 such will be the case. Formwork shall be in laminated shuttering plywood (plastic coated) or steel - as required. Same shuttering material shall be used for standard sizes as well as for residual sizes. Only new material shall be used. Include for neat cleaning and rendering of the exposed concrete surface after de-shuttering as directed by the Engineer.

3.3. Extra rate for circular shuttering of any radius is to be required over item no. 301 at any height. No extra for lift shall be paid.

3.4. Extra rate for providing staging to form work for slab of more than specified height more than 4.5m for each stage

3.5. Fair finish form work shall be in plywood, sawn timber or steel as required for shaft, container walls, stairs, slab, beams, columns, parapets, etc for all concrete work including staging, scaffolding, etc. either using slip form or lift form or any other method approved by the Engineer, to get more precise and accurate dimensions of members in line, level and plumb.

3.6. Forming pockets, cut-outs to receive foundation bolts, anchor bolts, railing post, etc. in RCC work and the same shall be filled with sand

3.7. Supplying and fixing in position approved quality pre-moulded joint filler or Shalitex / capcell HD 100 / Armacell board or other approved equivalent confirming to IS 1838 in expansion joints between beams, columns, slab, machine foundations, etc. Rate to include for cutting, fixing, keeping in position, wastage, etc.

3.8. Supplying and laying polysulfide sealant in expansion joint, around door and window frames, etc. at any height - of approved make like GE/ PIDILITE / Choksi Chemicals or other approved equivalent. Include for proper cleaning of the joint, primer, edge tape, etc. as per Manufacturer's instructions.

3.9. Providing and laying 175 mm wide 1.2 mm thick aluminium strip to cover vertical / horizontal expansion joint with fixing screws at fixed end and sliding end with slotted holes, etc. complete as per drawing or as directed.

3.10. Providing and laying 150 mm wide 1 mm thick strip of SS-304 to cover vertical / horizontal expansion joint with fixing screws at fixed end and sliding end with slotted holes, etc. complete as per drawing or as directed by engineer in charge.

4. REINFORCEMENT

4.1. The rate shall include for Supply, cutting, straightening, bending, lapping, placing, binding, fixing in proper position, at any height with 16 gauge annealed binding wire, necessary chairs for keeping the reinforcement in position and wastage, cement mortar cover blocks at proper positions to maintain necessary cover as shown in drawings. As the length of reinforcement required in various structural members may be more than the standard length of reinforcing bars available in the market, The Contractor shall carry out the lapping / welding of reinforcement as specified by the Engineer at no extra cost. Welding rods, labour and machine shall be The Contractor's supply. Reinforcement shall be bent in accordance with the procedure stipulated in IS: 2502. Standard weight shall be measured and paid for the net length of the bar. Material and Labour cost of laps & chairs will not be paid.

4.2. Mild Steel reinforcement conforming to grade I of IS:432 or equivalent having minimum characteristic strength fy = 250 N/mm².

4.3. TMT High yield strength deformed bars conforming to IS: 1786 and IS: 1139 with a minimum 0.2% proof stress of 415 N/mm².

4.4. TMT High yield strength deformed bars conforming to IS: 1786 and IS: 1139 with a minimum 0.2% proof stress of 500 N/mm².

4.5. Rate to include for supply, cut and lay in position, supporting where necessary, welded wire mesh for concrete work. Include for lap of 150 mm net and wastage.

5. BRICK MASONARY

The rate shall include for supply of all materials, labour, necessary scaffolding and plant etc. and for embedding electrical conduits, boxes, holdfasts of doors, windows, sanitary and water supply pipes, toothings, forming opening, racking out joints, curing etc. complete.

The rate shall include for masonry work of any shape e.g. wall, pilaster, projection, columns, steps, curved or tapered walls, drip courses, parapet, load walls, etc. as per drawing. All materials, joints, bond, mortar, sampling, testing, placing, scaffolding and curing etc shall conform to IS: 1905 IS: 5454, IS: 3495 & IS: 13757. Minimum crushing strength for burnt clay brick shall be 35 kg/cm² and for fly ash bricks shall be 75kg/cm² for fly ash bricks unless otherwise specified. Bricks shall be procured from an approved supplier only.

5.1. height as per instructions including finishing the broken surfaces to match with the surroundings, removing the debris as directed up to a lead of 1 km., cutting the reinforcement, if any, etc. complete as directed by the Engineer.

5.2. Same as item No 5.15 but dismantling and disposing only.

5.3. Same as item No 5.15 but dismantling and disposing rubble masonry.

5.4. Same as item No 5.15 but dismantling and disposing Reinforced brickwork.

6. PLASTERING

Rates to include for supply of labour, materials, plant, necessary scaffolding, compacting, curing etc. complete as directed at any level, height, position and floor. Rates shall also include for racking and/or brush hammering to form key for plaster and for spatter dash treatment as and where necessary. Rates also include for rounded angles, chamfered angles, grooves and for making good after all trades.

The Contractor shall get the approval of sample plaster (1m x 1m) from the Engineer before proceeding for the work.

6.1. Providing and laying 15 mm to 20 mm thick steel trowelled cement finish plaster in 1:4 cement mortar with neeru (Lime putty screened and then gauged with minimum 60 % cement by volume evenly applied and trowelled smooth to produce a perfectly smooth and even surface grey in colour) finishing and corners/jams in cement finish including scaffolding, curing, making grooves, pattas, drip moulds etc. complete as directed.

6.2. Providing & laying 20 mm thick double coat sand faced plaster with backing coat of 1:4 cement mortar with rough finish and second coat in 1:2 cement mortar evenly applied and trowelled of uniform grains and shade of coarse sand in two coats, including drip moulds, pattas, grooves, watering etc. complete as directed.

6.3. Providing and fixing hexagonal chicken mesh at the junction of concrete and brick work or at junction of two different materials. Rate to include for cutting the mesh in width of 150mm or more, wastage etc. complete.

6.4. 20 mm thick smooth steel trowelled waterproof plaster in 1:4 cement mortar with waterproofing agent as per Manufacturer's instructions to the surfaces as directed.

6.5. Flush and ruled pointing on rubble un-coursed stone masonry with mortar 1:3 (1 cement: 3 fine sand) including cleaning the surrounding surface of rubble, curing, wastage, etc.

6.6. Flush and ruled pointing on concrete block walls with cement sand mortar 1:3 (1 cement: 3 fine sand).

6.7. Flush and ruled pointing on brick masonry walls with cement sand mortar 1:3 (1 cement: 3 fine sand).

6.8. Providing and laying 20 mm thick steel trowelled cement finish Mala plaster in two coats. First coat in 1:4 cement mortar with rough finish and second coat in 1:2 cement mortar evenly applied and trowelled smooth (to produce a perfectly smooth and even surface gray in colour) with finishing at corners/jambs including scaffolding, curing, making grooves, pattas, drip moulds etc. complete as directed.

6.9. Providing and fixing single polished Jaislemer yellow stone of uniform and stored out for colour in single piece for name plate for as per drawing including providing necessary cement slurry, cement mortar (1:2) bedding, jointing in cement slurry mixed with pigment of approved shade, curing, rubbing, polishing and also including required adhesives, fixtures like bolts, screws etc. as directed.

6.10. Providing & laying Bansi Pahadpur stone in cladding for plain and curved surfaces, laid over cement mortar bedding of 1:3 proportion, having required adhesives, fixtures like bolts, screws etc. to plain or slope. The tiles tamped to bring mortar cream up to surface, including rounding of junctions, any pattern or design as per drawing and direction, including curing, cleaning with water, wastage, etc. complete.

6.11. Providing & laying Red Dholpuri stone in cladding for plain and curved surfaces, laid over cement mortar bedding of 1:3 proportion, having required adhesives, fixtures like bolts, screws etc. to plain or slope. The tiles tamped to bring mortar cream up to surface, including rounding of junctions, any pattern or design as per drawing and direction, including curing, cleaning with water etc. complete.

6.12. Providing & laying Khantu stone in cladding for plain and curved surfaces, laid over cement mortar bedding of 1:3 proportion, having required adhesives, fixtures like bolts, screws etc. to plain or slope. The tiles tamped to bring mortar cream up to surface, including rounding of junctions, any pattern or design as per drawing and direction, including curing, cleaning with water and 2 coats of silicon mixed with water in 1:9 shall be applied with brush on Khantu stone after finishing etc. complete.

6.13. Providing and making coving at junction of wall and floor with M15 concrete with fine polished finish. Measurement shall be on the basis of actual length of coving provided.

6.14. Providing and making coving at wall to wall junctions with cement mortar 1:4 and finished smooth as directed. Measurement shall be on the basis of actual length of coving provided.

6.15. Providing and making coving at wall to ceiling junctions with plaster of paris with PVC fiber reinforcement and finished smooth as directed. Measurement shall be on the basis of actual length of coving provided.

6.16. Same as item no. 9.8, but single coat Mala plaster (steel trowelled finish) in 1:4 cement mortars and having thickness of 12 mm to 15 mm.

6.17. Same as Item No. 9.10 but with slate stone.

6.18. Providing and fixing 15 mm thick Universal NI plaster substitute to both cement sand and POP plaster, to be applied directly on brick/ blocks/RCC surface in one coat conforming to IS: 2542 part-1(1976) to obtain a smooth silky finish .The rate shall be inclusive of expanded metal mesh to be provided at the junction of wall and RCC columns and beams. The rate shall also be inclusive of 1mm thick aluminium angle bead to be used at external angle to get straight line finish and protection from normal impact.

6.19. Providing and fixing at any height dry cladding system with 30mm thick gang saw cut red sand stone with (machine cut edges) of uniform colour and size up to 1mX1m, fixed to structural steel frame work and/or with the help of cramps, pins etc. and sealing the joints with approved weather sealant as per Architectural drawing and direction of Engineer-in-charge. (The steel frame work, stainless steel cramps and pins etc. shall be paid for separately.)

6.20. Providing and fixing structural steel framing on walls at all heights using M.S. square / rectangular tube in the required pattern as per Architectural drawing including cost if cutting, bending, welding etc. The frame work shall be supported in wall with the help of MS brackets/lugs of angle iron/flat etc. which shall be welded to the frame and embedded in the brick wall with cement concrete block 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20mm nominal size) of size 300X230X300mm including cost of necessary centring and shuttering and with approved expansion hold fasteners on CC/RCC surface including drilling necessary holes. Approved cramps/ pins etc. shall be welded to the frame work to support stone cladding, the steel work will be given priming coat Zinc primer as approved and painted with two or more coats of epoxy paint. The frame work shall be fixed in true horizontal & vertical lines/planes. (Only structural steel frame work shall be measured for the purpose of payment, stainless steel cramps shall paid separately and nothing extra shall be paid.)

6.21. Providing and fixing adjusting stainless steel cramps of approved quality and of required shape and size adjustable with nut bolts and washer (total weight not less than 260 grams) for dry stone cladding fixed on frame work at suitable location including making necessary recesses in stone slab, drilling required holes etc. complete as per direction of the Engineer-in-charge.

6.22. Removing the existing cement plaster from RCC surface and brick walls carefully of any thickness and at any height without creating dust nuisance and removing the debris etc. complete as directed.

6.23. Providing and laying stone pitching composed of sound igneous rock having rocks firmly wedged with stone chips driven into joints, so that finished surface presents an even face with joints of a nominal width of 25 mm over compacted sand bedding and filling joints with cement mortar (1:4) including curing etc. complete.

6.24. Providing & apply stonecrete plaster on vertical surface in line level as per requirement of “Vyara” make or approved equivalent. The plaster is to be cleaned by mild acid wash if necessary and then coated by two coats of approved, water based UV resistant coating after sufficient curing and drying. The coating

must be done in a manner that no patchiness is seen on the surface. Rates to include for supply of labour, materials, plant, necessary scaffolding, compacting, curing etc. complete as directed at any level, height, position.

7. PAINTING

Rate shall include for supply of materials, equipment, skill labours, necessary scaffolding and removal thereof, supply of brushes etc. as required. The work shall include for cleaning of surfaces, removal of dirt, dust, filling in crevices at any level to complete the work as directed. Samples shall be got approved before execution of work. Even though the number of coats specified against item of work, any additional coat shall be given without any extra cost to bring surface to the desired finish.

7.1. Providing and applying two coats of white or colour wash to walls, ceiling etc. at any level include for adding glue of Pidilite co. or equivalent as per their specifications with brush as directed.

7.2. Providing and applying two coats of oil bound distemper of approved make and shade over a coat of cement primer including scaffolding etc. complete at any level.

7.3. As per 7.1 but applying two coats of white wash to A/C roofing sheets, cladding etc. as directed. The measurement shall be on the basis of net roof area painted, irrespective of the corrugations.

7.4. Providing and applying three coats of flat enamel paint of I.C.I. or equivalent approved make over primer coat on ceilings, false ceiling boards, plastered surfaces, etc. Rate to include for preparing surfaces by applying putty where required etc. complete at any level as directed.

7.5. As per 7.4 but for wood work surfaces.

7.6. Providing and applying oil water polishing for solignum polish with necessary pigment including finishing and making the surfaces smooth at the required degree of fineness and matt ness etc. complete at any level as directed.

7.7. Providing and applying three coats of cement based paint "Snow-cem" or equivalent approved make and shade over a coat of cement primer including scaffolding, watering etc. complete at any level as directed.

7.8. Providing and applying three coats of approved make enamel paint to the steel sections of doors and windows with one coat of metal primer, one under coat and two finishing coat.

7.9. Providing three or more finishing coats of premium plastic emulsion paint of (ICI -velvet touch or ASIAN-Royale) approved make and shade to walls and ceilings applied evenly to give approved uniform finish. Allow for preparation of surface and a coat of primer as specified by the Manufacturer.

7.10. Providing and applying three coats of acrylic based exterior paint “Snowcryl” or equivalent approved make and shade including scaffolding, watering etc. complete at any level and any surface as directed.

7.11. Same as item 7.7 but with three coats of acrylic based weather proof exterior paint like ‘APEX’ or equivalent.

7.12. Providing and applying aliphatic acrylate coating for anti-corrosive & anti - carbonation application over concrete surface at any level. No. of coats, method of surface preparation & usage of the coating system etc. shall be as per the specifications of the approved Manufacturer. The coating to be Monopol - 456 of Krishna Conchem Products Pvt. Ltd. or other such approved equivalent having approved shade and minimum 2 years’ proven performance & field validation history in Indian conditions. Measurement for the payment purpose shall be on the basis of net area painted.

7.13. Providing and applying aliphatic acrylate coating for anti-corrosive & anti - carbonation application over concrete surface at any level. No. of coats, method of surface preparation & usage of the coating system etc. shall be as per the specifications of the approved Manufacturer. The coating to be Polycon S 100 of Caltech India or other such approved equivalent having approved shade and minimum 2 years’ proven

performance & field validation history in Indian conditions. Measurement for the payment purpose shall be on the basis of net area painted.

7.14. Providing and applying solvent based colourless Silicone paint 'Nitocote SN522' of Fosroc or other approved equivalent make over exposed concrete surfaces with minimum 5 years' guarantee as per Manufacturer's instructions at any height. Measurement shall be on the basis of net area painted.

7.15. Providing and applying two coats of Heritage surface texture - lacquered / granuled / flaked, of desired shade of Bakelite Hylam or other approved equivalent on exterior surfaces at any height. Finish giving an even shade, including thoroughly brushing the surface free from mortar droppings and other foreign matters, applying a coat of primer and putty and sand papered smooth. The surface texture shall be applied on mala finish plaster (measured separately).

7.16. Providing and applying two coats of low solvent based epoxy resin coating Sikafloor®-105 or other approved equivalent as per approved shed over a primer coat as per the Manufacturer's instructions at concrete floors. Rate to include for labour, wastage, preparation of surface as per Manufacturer's instructions, etc. Complete. Payment shall be made on the basis of net plan area painted.

7.17. Providing and applying Two coats of Acrylic based anti-fungal paint 'APEX' or equivalent for interior surfaces using two coats of wall putty and two coats of primer (all of Asian or other approved equivalent make) as per Manufacturer's specifications including scaffolding, wastage, etc. complete at any level as directed.

7.18. Extra over item no. 10.1, 10.2, 10.3 for lacquer polishing in place of enamel paint.

7.19. Providing and applying two coats of epilux No.4 (BERGER or Equivalent) epoxy paint with powder coating epoxy paint with as per the Manufacturer's specifications and as directed.

7.20. Providing & applying min 1.5 mm thick white cement Putty of Birla or other approved make to achieve a smooth surface to serve as base for the paint on plastered surface, including cleaning, staging, and necessary tools and make the surface as per manufactures specifications etc complete.

7.21. Providing and applying 2.5 mm thick road marking strips (retro-reflective) of specified shade/color using hot thermoplastic material by fully/semi-automatic thermoplastic paint applicator machine fitted with profile shoe, glass beads dispenser, propane tank heater and profile shoe heater, driven by experienced operator on road / R.C.C surface including cost of material, labour, transport, cleaning the road surface of all dirt, seals, oil, grease and foreign material etc. complete as per direction of Engineer -in charge and accordance with applicable specifications.

7.22. Providing and applying two coat of Acraylic body Texture Coat of DURA SHIELD - DURA STONE of approved shade to walls & ceilings applied evenly by means of trowel / brush application to give approved uniform finish at any height. Allow for surface preparation, one coat of primer & one coat of clear lacquer, scaffolding complete as per manufacturer's specifications. Rate shall be paid on the basis of surface area applied.

7.23. Providing & applying gangway marking strips with aromatic PU coating such as FK 666 of Cipy or approved equivalent on surfaces including cost of material, labour, transport, cleaning the surface of all dirt, seals, oil, grease and foreign material etc. complete as per direction of Engineer in charge and accordance with applicable specifications.

7.24. As per 7.4 but using Semi-Gloss Enamel paint.

7.25. Providing and applying Textured paint of Asian or equivalent approved make and shade including scaffolding, wastage etc. complete at any level as directed by engineer in charge.

8. FLOORING

Rate shall include for supply of all material , labour, plant, fixing in position, providing falls for proper drainage, bedding, scaffolding, compacting, polishing if required, curing etc.; complete. The rate shall include for work in any position, height and floors. The rates shall include for cutting, fitting and making good up to desired satisfaction of the Engineer. Work under this item shall be measured in M^2.

All tiles/ flooring material shall be for first grade quality.

8.1. Providing and laying 50 mm thick I.P.S. flooring with under layer of 38 mm thick 1:2:4 cement concrete with 20 mm graded stone aggregate in alternate panels not more than 10 sq. m area and 12 mm thick 1:1 cement mortar with a suitable mineral pigment, as directed. The topping shall be mixed and laid in panels conforming to IS: 2114. The rate to include for forms, machine mixing, curing, preparing grooves and finishing etc.; complete.

8.2. As per item 701 but for replacing mineral pigment in top 12 mm layer by metallic floor hardener (Ironite or approved equivalent) as per Manufacturer's specifications.

8.3. Rate to include for providing 20mm thick grano topping over freshly laid R.C.C. slab as per IS:2571 with mixing of improved Rockite or equivalent in cement as per Manufacturer's specification and compacting, finishing, curing, etc. complete as directed.

8.4. Rate to include for supplying and laying 25mm thick mosaic tiles in flooring in average 30/50mm thick 1:2 lime mortar and in skirting or dado in average 20MM thick 1:2 Cement mortar bedding. Rate for desired size and colour make from good quality marble chips in grading No.3, 4 and 5 in desired proportion. Include for bedding topped with cement slurry closed joints and joints pointed with matching, colour cement slurry, including curing, machine polishing, washing and wax polishing as directed. Rate to include wastage also.

8.5. As per item 8.4, but providing on walls as dado/skirting including making jari and finishing the same. Dado/skirting shall not be projecting more than 12mm from plastered surface.

8.6. 40 mm thick marble chips flooring rubbed and polished to granolithic finish of approved colour under layer 31 mm thick cement concrete 1:2:4 (1 cement, 2 coarse sand, 4 graded stone aggregate 12.5 mm nominal size) and top layer 9 mm thick with white, brown or white and brown marble chips of size from 4 mm to 7 mm nominal size laid in cement marble powder mix

8.7. 3:1 (3 cement, 1 marble powder) by weight in proportion of 4:7 (4 cement marble powder mix: 7 marble chips) by volume including cement slurry rounding of edges and glass/PVC strips (treads) (40 mm x 4 mm) nosing of steps etc. complete. Rate to include for using white cement only.

8.8. Same as per item 8.4, but supplying and laying marble flooring with ordinary polish.

8.9. Same as per item 8.7, but with mirror polish.

8.10. Providing and laying in position 6 mm thick glazed tiles of first quality Johnson or Somani Pilkinton or approved equivalent ceramic tiles or marble tiles in floors, skirting, dado, sills, jambs and channel in cement slurry over minimum 12 mm thick 1:4 cement mortar bedding. Rate to include for laying in proper position, slope and level, closed jointed and painted with white cement including curing, acid cleaning etc. complete as directed.

8.11. Providing and laying 25 mm thick rough Kotah stone of approved quality with selected and sorted for uniform colour in floors, platforms, ottas, sills etc. as directed. Rate to include for 1:6 cement mortar bedding, properly jointed and curing etc. complete.

8.12. Providing and laying green polished kotah stone of approved quality having size not larger than 600 mm, selected and sorted for uniform colour in floors, dado, ottas, jambs, parapet top, etc. as per design with nominal pattern, edge moulding and as directed. Rate to include for necessary bedding in 1:6 cement

mortar, jointing, polishing with oxalic acid (3 or more coats as required), curing, daily moping with water & kerosene for at least 15 days, etc. complete.

8.13. Same as per item 8.11 but for providing 25 mm thick polished Kotah stone skirting on walls including making jari and finishing the same. Include for making 8 mm size groove in plaster just above the stone and finishing the skirting flush with the wall plaster.

8.14. Providing and laying in position 25 mm thick polished Kotah stone of uniform colour and sorted out for green colour in single piece for steps, risers and landing of staircase and window sills as per drawing including providing necessary cement mortar 1:2 bedding with cement slurry, forming grooves as per details, rounded edges, curing, polishing with oxalic acid (3 coats or more as required), daily moping with water & kerosene for at least 15 days, etc. complete.

8.15. Providing and fixing 25 mm thick green single polished kota stone of uniform size and colour in single pieces for platforms, sinks, shelves (double polished), morry, etc. in dado or fascia including necessary edges machine cut (uniform thickness), rounded edges, necessary cement mortar bedding, cement slurry, cement jointing, polishing with oxalic acid (3 coats or more as required), daily moping with water & kerosene for at least 15 days & providing hole for sink etc. complete.

8.16. Same as per item 8.7, but supplying and laying granite in flooring and walls.

8.17. Providing and laying dressed and single polished "Dholpur" red stone 40 mm thick in flooring, skirting in required sizes, shapes as directed. Rates to include for necessary cement slurry, 1:4 cement mortar bedding, jointing in cement slurry mixed with pigment of approved shade, forming grooves, pointing, curing etc. complete.

8.18. Rate to include for immediate finish with Cement slurry and Steel trowel to concrete surfaces of slabs, lofts, shelves etc in line and level complete.

8.19. Supplying, laying and fixing well burnt first quality Manglore tiles on slopping slab with 12mm bedding of C:M 1:2. Rate to include ridge pieces, wastage laps valley piece etc. complete. Rate shall be paid on the basis of surface area of basic element.

8.20. As per item No. 8.6 but using grey cement.

8.21. Marble chips skirting/dado 21mm thick with under layer 15mm thick cement plaster rubbed and polished to granolithic finish of approved colour, top layers 6mm thick with white, brown or white & brown marble chips of sizes from smallest to 4mm nominal size laid in cement marble powder mix 3:1 (3 cement, 1 marble powder) by weight in proportion of 4:7 (4 cement marble powder mix: 7 marble chips) by volume (including risers). Rate to include for using white cement only.

8.22. As per item no. 8.20 but using grey cement.

8.23. As per item 8.14 but using polished cuddappa stone.

8.24. As per item 8.14 but using polished Chittor stone.

8.25. Providing and laying over well compacted ground, 50 mm to 65 mm thick rough red stone of approved quality as directed. Rate to include for compaction of soil and 1:6 cement mortar bedding, properly jointed and cured etc. complete.

8.26. Brick on edge paving with 1:6 cement mortar as sub base of flooring in line and level including curing, providing falls for proper slop etc. complete as per drawing and design.

8.27. P.V.C. Tiles - Supply and lay P.V.C. tiles of approved make, colour and pattern with thickness not less than 1.6mm. Use adhesive in accordance with Manufacturer's recommendations. Remove undulations in screed before laying tiles. Include for all cutting and fitting around socket outlets and other fittings. Also include two coats of water/wax emulsion polish as per Manufacturer's recommendations.

8.28. Supplying, laying and fixing well burnt first quality Mangalore tiles on sloping structural steel roof. Rate to include for ridge pieces, valley pieces, wastage, laps etc. complete. Rate shall be paid on the basis of surface area of basic element. Structural steel members measured separately.

8.29. Providing & fixing in position at any height 6 mm. thick broken glazed tiles in size 12 mm to 20 mm, of odd sizes and shapes laid in approved crazy pattern (with one or more colour in pattern, as directed) for floor/ dado having plain or curved surfaces, in cement mortar 1:3 proportion with cement, floating, joints finished with white or approved colour cement including tamping, watering, curing, cleaning with oxalic acid, etc. complete as per the Engineer's instructions.

8.30. Providing and fixing double polish kota flooring 25 mm to 40 mm thick over 25 mm cement mortar (1:2) bedding and cement slurry, size of kota stone 60 cm x 60 cm using 25 mm white marble/jaislemer stone strip or as detailed drawing or as per direction of the Engineer's, joining with grey cement slurry mixed with pigment for matching the shade of the stone, curing, rubbing, machine polishing, wax polishing etc. complete as directed.

8.31. Providing and fixing double polish green kota stone flooring 25 mm to 40 mm thick over 25mm cement mortar (1:2) bedding and cement slurry, size of kota stone 60 cm x 60 cm as per detailed drawing or as per direction of the Engineer's, joining with grey cement slurry mixed with pigment for matching the shade of the stone, curing, rubbing, machine polishing, wax polishing, etc. complete as directed.

8.32. Providing & fixing rough dressed kota stone of 25 mm to 40 mm thick over 25 mm cement mortar 1:2 bedding and cement slurry, size of kota stone of not exceeding 600 mm as directed, joining with grey cement slurry mixed with pigment.

8.33. Providing and laying 38 mm to 50 mm thick cc (1:2:4) for Indian Pattern Stone flooring as and where directed, with 50 mm kota stone strip as joint, with top smooth or chequered finish with necessary construction joints, curing etc. complete.

8.34. As per item no 8.1but using white cement of approved make.

8.35. As per item no 8.1 but 60mm thick with two layers of 24 gauge chicken mesh.

8.36. Providing and fixing single polished Jaislemer yellow stone combined with marble stripes with pattern as per drawing or as per direction of the Engineer's, (Approximate area of Jaislemer 80% and marble 20%) in flooring, dado 25mm thick over 25mm cement mortar (1:2) bedding and cement slurry, joining with grey /white cement/ slurry mixed with pigment for matching the shade of the stone, curing, rubbing, polishing and finish as directed.

8.37. Same as per item 8.35 but for skirting including making jari and finishing the same.

8.38. Providing and laying in position 20 to 25 mm thick single polished Red Dholpur stone of uniform and sorted out for colour in single piece for steps, risers and landing of staircase as per drawing including providing necessary cement slurry, 1:4 cement mortar, bedding jointing in cement slurry mixed with pigment of approved shade, forming grooves, pointing, curing etc. complete.

8.39. Providing and laying Paver blocks of KARNAVATI or other approved equivalent (minimum Comp. Strength 300 kg/cm2) of approved shape and colour as per architectural pattern. (25% Coloured and 75% grey). Special pieces to make straight edges at corners / edges shall be provided and laid. No cutting / in-situ concrete shall be allowed at site. Include for 50mm thick sand bedding below the paver and filling the joints between paver block with sand filling by light duty vibrator plate roller. Measurement shall be on square meter basis of the finished paved area.

8.40. Providing and laying in position average 9 mm to 10 mm thick homogenous, full body vitrified tiles of first quality with polish first grade finish (P-1), Bell, Johnson or Restile make, in floors, sills, jambs , of approved make, colour and size , in cement slurry over minimum 15 mm thick 1:4 cement mortar bedding.

Tiles shall be without any chamfer at the edges (joint less type), shall have scratch hardness of min. 7 on Mho's scale and shall meet chemical resistance standards of relevant ASTM/ DIN. Rate to include for laying in proper position, slope and level, grouting / painting of joints with white cement and matching pigment, curing, acid cleaning etc. complete as directed.

8.41. Same as per item 8.39 but providing on walls with 6 mm thick backing, including making jari and finishing the same. Include for making 8 mm size groove just above the tiles and finishing flush with the wall plaster.

8.42. Same as item 8.39 but for 75 to100 mm high skirting. Rate to include for 8 mm groove in the plaster just above the skirting and making the skirting flush with the plaster.

8.43. Extra over for providing mirror finish polish on kota / marble flooring using 500 to 2000 grit emery, polishing in six stages and final finishing with 2000 emery grit, tin oxide and felt pads. Work to be carried out with vibration free polishing machine having rubber mounted wheels.

8.44. Extra over for providing mirror finish polish to kota / marble skirtings using 500 to 2000 grit emery, polishing in six stages and final finishing with 2000 emery grit, tin oxide and felt pads.

8.45. Same as item 8.14 but with approved quality 20 mm thick Granite.

8.46. Providing & laying 3 mm thick 4 pack self-levelling Epoxy floor such as Nitoflor SL 2000 of Fosroc or approved equivalent over R.C.C. floor as per Manufacturer's instructions. Include for preparing the surface, application of primer and epoxy resin, base and hardener, quartz filler material, making groove in the joints of R.C.C. floor and sealing them with epoxy, etc. complete. Measurement shall be on the basis of plan area covered.

8.47. Providing & making coving with epoxy mortar and finishing with three coats of epoxy paint applied over prepared surface by applying primer & epoxy putty - all of Fosroc or other approved make and as per the Supplier's instructions. Measurement shall be on the basis of actual length of coving provided.

8.48. Supply and lay Acid Resistant tiles of approved make and of thickness not less than 10mm. confirming to IS 4457 -1967. Tiles to be laid over completely cleaned surface, free from dirt and dampness and over a back-coat of Potassium silicate based mortar as per Manufacturer's instruction. After the bedding mortar is properly set, the joints shall be completely filled up with Epoxy mortar as per Manufacturer's recommendations. Include for all wastage, cutting and fitting around socket outlets and other such fittings, cleaning of tiled surface after joint filling etc. complete.

8.49. Same as item no 8.11 but, providing joints of size 5mm x 10mm and filling with epoxy mortar of approved make and as per Manufacturer's specifications.

8.50. Providing, making & fixing polished Kota stone coving of specified height and breadth, machine cut from Kota stone cube. The farthest point of coving's height and breadth shall be connected by an arc of circle having radius 30 mm to 35 mm, jointed with epoxy mortar, corner pieces, mirror polishing, etc. complete. Measurement shall be on the basis of actual length of coving provided.

8.51. Removing existing flooring including polished Kota stone / IPS / tiles, bedding etc. complete. Include for removing the debris as directed by the Engineer up to a lead of 200m.

8.52. Providing and laying glass mosaic tiles "BISAZZA" or other approved equivalent having colour and design as approved. Lay over smooth plaster (measured separately) with "BAL" or other approved adhesive as per Manufacturer's instructions. Include for Jointing with white cement slurry mixed with pigment of approved shade, forming grooves, pointing, curing, wastage etc. complete. Measurement as the basis of net area of tiles laid.

8.53. Providing and fixing "SUPER TILES" or other approved equivalent 25mm thick Paving tiles with desired shade and pattern including cement mortar bedding of 30mm average thickness in CM 1:6, floating

of cement slurry mixed with pigment to match shade of tiles, jointing, curing, cutting to match required dimensions at site, finishing, transportation, wastage, etc. complete. Measurement as the basis of net area of tiles laid.

8.54. Supply and lay HDF (High density Fiber Board) AC5 / IC3 series laminate flooring and skirting of Pergo / Tarkett or other approved equivalent make for Use class 33/23 and having inbuilt sound proof backing and thickness of 9mm. Include for laying the wooden floor over alkali resistant PVC Film of 1000 gauge and 2 to 3 mm thick armour of approved brand as per Manufacturer's instructions. The edge of tongue and groove of planks shall be duly impregnated with paraffin. Rate shall also include for PVC capping at skirting, all wastage, cutting and fixing all layers, cleaning etc. complete. Measurement shall be on the basis of net area of wooden floor / skirting laid.

8.55. Same as item no. 8.13 but using 'Jaislemer' yellow stone.

8.56. Extra over item no. 8.15 & 8.44 for "rivers wash" finish to the Stone.

8.57. Providing and laying in position PALLADIO Ceramic tiles in floors, skirting, dado, sills, jambs and channel in cement slurry over minimum 20 mm thick 1:4 cement mortar bedding. Rate to include for laying in proper position, slope and level, closed jointed and filled with pigmented cement/grout of matching colour including curing, etc. complete as directed.

8.58. Providing and fixing 100 mm wide Jaislemer stone for window sill in cement slurry over minimum 20 mm thick 1:4 cement mortar bedding.

8.59. Supplying & installing false flooring (raised access flooring) over the sub floor including all panels, stringers, pedestals, fixing hardware, cutting, wastage, labour, etc. complete for finished floor height up to 400 mm above sub floor. Floor tile / panel shall be 600 mm x 600 mm x approximately 35 mm thick (100 % interchangeable) having in fill of light weight cementitious materials / phenol bonded particle board, with factory pressed high pressure antistatic decorative laminate of 1 mm thickness. The pedestals/ jacks shall be of 25 mm dia. Zinc plated M.s. pipe with top & bottom plates, threaded top and 2 nuts for level adjustment. Jacks / pedestals shall be securely fixed with the sub floor with steel screws & adhesive. The stringers supporting the panels shall be of MS rectangular pipes. General arrangement shall be made as per drawings and complete floor adjusted to suit the room dimensions. Payment shall be on the basis of net plan area of the floor.

8.60. Providing & laying Nitoflor Hardtop (at 4 kg/m2) of Fosroc /sika, chapdur or other approved equivalent non-metallic monolithic surface floor hardening compound over fresh concrete (vacuum dewatered surface) as per the manufacturer's instructions. Moh's hardness of the aggregates of the compound shall not be less than 8. Include for all labour, wastage, curing, finishing, etc. complete.

8.61. Providing & applying concrete densifier such as "Ashford Formula" or approved equivalent over concrete surface as per the manufacturer's instructions. Include for all labour, wastage, curing, finishing etc. complete in all respect. Payment shall be on the basis of net plan area of the floor.

8.62. Providing & laying 2 mm thick ESD (Anti-static) flooring such as Floorkote ESD of Cipy or approved equivalent over floor as per manufacturer's specifications & instructions. Rate to include for the following

8.62.1. Cleaning of surface - Scrubbing, Acid itching, alkaline wash & water wash. Remove all residues by using the solvent / degreaser.

8.62.2. Measuring dampness of the grade slab, over which the anti-static flooring is being applied.

8.62.3. Priming - Apply two component, low viscous epoxy primer having 1:1 volumetric ratio of resin and hardener to provide a DFT of around 200 microns.

8.62.4. Copper tape - supply & fix 50-100 microns thick, self-adhesive (conductive type) copper tape to ensure quick transfer of charge.

8.62.5. Conductive primer - Supply & apply epoxy based conductive coat, Floorkote ESD having a volumetric ratio of resin and hardener in 4:1, to yield a DFT of 100 microns, Self-levelling top coat: Providing and applying EPU based conductive self-levelling top coat containing anti stats to yield a thickness of 1700 microns.

Testing: After completion of the application, test the surface resistivity of the floor to achieve a range of 1 x 105 Ohms to 1 x 108 ohms.

Include for all labour, treating the construction joints of the floor, wastage, tools, tackles,etc. complete. Measurement shall be on the basis of plan area covered.

9. WATER PROOFING

Unless otherwise specified, The Contractor shall carry out water proofing treatment in basements, terrace, water retaining structures, sunken portion/ floors of bath, W.C. and kitchen etc. through an approved firm like India Water Proofing Company.

The Contractor shall provide a guarantee for Ten years on a stamp paper in an approved form. While tendering, The Contractor should specify the type of treatment proposed to be provided and the details of the specialist agency, which will carry out the treatment.

Any defects/leakages noticed during the guarantee period shall have to be rectified within a week time free of cost by the Contractor including reinstating the surface to its original condition and finish.

The rates shall include drying and cleaning the surface free of dust. The rates shall include for providing water proof lime/cement concrete terracing of adequate thickness to give desired slope for drainage of rain water from terrace. The actual area treated shall be measured and paid for. No extra shall be paid for any fillets, grooves or rounding.

9.1. Water proofing for basement including walls, floors, lift pits, etc. to prevent ingress/dampness from outside water.

9.2. Providing & laying cement water proofing of average 125mm thickness for terraces using cement mortar 1:5, arranging brickbats according to the slope, adding suitable water proofing chemical for water tightness and again providing on top cement mortar 1:4 including addition of water proofing chemical, finishing the top with neat cement @ 2.75 kg/ m2 and preparing the rough surface as per the direction. The treatment shall be carried out up to 300 mm height of parapet wall (75 mm. deep groove to be provided for this purpose in the parapet wall) with 75 mm round fillet at junction of terrace and the parapet wall.

9.3. Rate to include supply and use of water proofing additive Accoproof or equivalent of approved make in cement concrete or cement mortar as directed.

9.4. Supplying and laying damp proof treatment using bitumen felts in accordance with IS: 1609 (latest edition).

9.5. Supplying and applying water proofing treatment for basement including walls, floors, lift pits, etc. at any depth and also on walls above plinth by using acrylic based polymer modified cementitious material like “Tapcrete - 151” of CICO or other approved equivalent coating in two coats as per Manufacturer's requirements and as directed by the Engineer. Include for preparation of surface, wastage, curing, etc. as specified by the Manufacturer. Measurement shall be on the basis of net area water proofed.

9.6. Providing & laying Chemical Water proofing in sunken slabs of bath, W.C., terrace etc. Provide 15 mm thick 1:3 cement mortar plaster with acrylic based water proofing compound ‘Hydro shield’ of ConTech Chemicals or other approved equivalent on vertical surfaces. Provide 40 mm thick IPS using 1:2:2 cement : sand : grit

with acrylic based water proofing compound 'Hydro shield' of ConTech Chemicals or other approved equivalent on floor of the Sunk with a 75 mm fillet at junction of vertical surface and the floor.

9.7. Providing and laying Tar felt water proofing treatment over sloping roofs (AC/GI/Timber) as per IS: 1346(1976) or latest. The rate shall also include covering bolts using bitumen felt washers.

9.8. Providing and laying Box Type Water proofing outside furnace foundation as per following specifications.

Horizontal surface:

About 20 mm thick layer of cement mortar 1:4 mixed with approved waterproofing compound to be spread over good quality lean concrete. 6 mm down stone aggregates to be spread at random and to be embedded in the layer already provided. Rough quarry finished Kotah stones (450mm x 300 mm, 25 mm thick) shall then be laid over the bed mortar leaving a gap of Approx. 10 to 12 mm between stones. The joints so formed shall be grouted manually with cement slurry mixed with approved quality water proofing compound and coarse material. A final layer of approx. 18 mm thick cement mortar 1: 5 shall then be laid. Raft to be cast over this layer.

Vertical Surface:

Kotah stone slabs (20 mm thick) shall be placed on the face of wall leaving a gap of about average 12 mm between wall and inside face of the stone. The outer of the stone to be covered with 1:5 cement mortar (12 mm thick) after the gaps are filled with cement slurry and mixed with water proofing compound and coarse aggregate. Rough plaster shall be finished smooth.

Joint at intersection of horizontal and vertical surface will be finished with vata in rich mortar with coarse aggregates.

9.9. Filling in sunken slabs of toilets, kitchen, terrace or any other area with approved quality light weight material in layers, watering, ramming, etc. as directed. Include for freight, transportation, loading, unloading, taxes, royalty, screening, mixing, etc. Actual measurement of compacted fill shall be considered.

9.10. Supplying and laying chemical water proofing treatment to the sloping / flat floor at any height with product of Krishna Concare / CICO/ Choksi Chemicals as per Manufacturer's instructions & having layers –

9.10.1. A seal coat of acrylic resin based emulsion like "Sealer"

9.10.2. Self-priming coat of acrylic emulsion polymer modified cementitious material like Hydracrete - ACR

9.10.3. A polypropylene mesh of 0.5mm to 1.0 mm thickness

9.10.4. Two coats of Hydracrete – ACR

Include for preparation of surface, backing, curing and making fillets at the edges /corners, grooves, etc. Net area water proofed shall be measured.

9.11. Same as item no.9.10 above but at sloping / vertical walls and without polypropylene mesh.

9.12. Providing and laying 4 mm thick APP modified polymerized bituminous membrane at any height with mineral finish by gas torching. Rate to include bitumen primer coat at 0.25 kg/m2, minimum overlaps of 100 mm on sides & ends etc. as per

9.13. Manufacturer's Specifications. Rate to include 50 mm thick screed 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate) as protective layer. Rate shall be paid on the basis of net surface area applied.

9.14. Supplying and applying integral penetrating crystalline waterproofing treatment like "Penetron by Penetron USA" or other approved equivalent having speed of penetration of 31 cms in 56 days and resistance to 16 bar hydraulic water head for basement including walls, raft, lift pits, etc. at any depth as per

Manufacturer's requirements and as directed by the Engineer. Complete work shall be carried out by the authorized applicator as per the manufacturer's approved method of waterproofing. Rate to include cleaning of surfaces by water jet, preparation of surfaces, Providing and Sprinkling Penetron Plus (dryshake) @ 0.5 kg./ smt. on mud mat before casting raft, treating cold joints, wastage, curing, plugging existing cracks & surface damage etc. as specified by the Manufacturer. Measurement shall be on the basis of net area water proofed.

9.15. Removing existing water proofing layers including bitumen, brickbat coba etc. from terrace, stair cabin etc. lowering the dismantled materials, stacking and storing the reusable materials, removing the debris as directed up to a lead of 1 km., if any, etc. complete as directed by the Engineer.

10. DOORS & WINDOWS

10.1. Providing and fixing in position composite door and window frames in finished 120 x 63 mm size section from best approved quality seasoned "Teak Wood" including double grooves on both sides, two rebates for shutters / grill, plaining, sand papering, making the edges rounded, hold fast, screw, nails, gluing materials, concrete lugs all as per drawing and direction. Rate to include for painting all timber faces in contact with wall surfaces with applying two coats of approved wood preservative and anti-insecticide paint before fixing in position and one under coat and two coats of enamel paint of approved make to exposed faces. Rate shall be paid on the basis of area of opening.

10.2. As per 10.1 but for Teak Wood door shutters with styles 100 mm wide and 35 mm thick, lock rail 175 mm x 35 mm, bottom rail 150 mm x 35 mm and top rail 100 mm x 35 mm and T & G boarding of 100 mm wide x 20mm thick with oxidized steel hinges 3 nos. of heavy quality of 4" size per leaf, aluminium fixtures, fitting and lock of heavy quality as directed, including teak wood panels with necessary moulding in rails and styles as per drawing. Rate shall be paid on basis of area of opening. Rate shall also include for one undercoat and 2 coats of enamel paint of approved make.

10.3. As per 10.1 but with Teak Wood window shutters with 75 mm x 30 mm thick styles, intermediate top and bottom rails of 75 mm x 30 mm including moulding in rails and styles as per drawing and 4MM thick clear transparent glass of approved make, oxidized steel hinges minimum 2 nos. of 3" size per leaf with aluminium oxidized fixtures, fittings of best quality as per drawing. (Grill measured separately). Rate shall be paid on basis of area of opening. Rate shall also include for one undercoat and two coats of enamel paint of approved make.

10.4. Rate to include for 40 mm thick solid cored approved quality flush door faced with 4 mm thick water proof plywood of approved make to receive paint with 16 mm teakwood lipping tongued into door edges all round, single or double leaves. Also include for three 100 mm butt hinges and necessary fixtures like rubber door stop, stopper, and mortise lock with two keys, etc. complete. Include for one under coat and two coats of enamel paint of approved make.

10.5. Providing and fixing Teak Wood first quality hand rail in position including plaining, tappering, moulding, gluing, and screwing in position. Rate shall be paid for visible finished section in cubic metre. Rate shall also include for one undercoat and two coats of enamel paint of approved make.

10.6. Steel openable glazed windows and ventilators of 'AGEW make or equivalent make conforming to IS: 1361 with standard "Z" steel frame and shutter with 4 mm thick clear glass, fixing, screws, lugs, hinges, stays, holders etc. with all necessary approved fixtures complete. Rate to include for 10 mm square M.S. burglar bars at spacing not exceeding 125 mm welded with window frames and two coats of enamel paint over one coat of Zinc Chromate primer.

10.7. As per 10.6 but for fixed glass louvers windows and ventilators.

10.8. Supplying and fixing in position glazed, openable, double or single leaf anodized aluminium doors with aluminium frame of Indal/ Jindal / Hindalco make, having weight of aluminium sections as approximately 8 kg/ m2 of opening area (excluding the weight of beading for glass/ panel fixing), size and shape as per details, including supplying and fixing necessary hold fasts, all fixtures and fastenings of anodized aluminium as per requirement with 6 mm thick MODI/Saint Gobain float glass, EPDM special gasket felt and aluminium beading, with all accessories like SS handle, 125 mm long SS hinges, flush tower bolts, concealed cylindrical lock (Dorset/Kitch make), etc., labour and materials complete as per details and direction of the Engineer. Include for rough ground on top and sides of the door and approved quality silicone sealant at joints and on all sides. (Measurement on the basis of out to out dimensions of the frame).

10.9. As per item no. 10.8 but with exterior grade Novapan for infill panels (6 mm thick compact panel)

10.10. Supplying and fixing openable, sliding anodized aluminium windows with aluminium frame of Indal/ Jindal / Hindalco make, having weight of aluminium sections as approximately 4 kg/ m2 of opening area (excluding the weight of beading for glass/ panel fixing) , size, shape and design as per details including all fittings and fixtures with 6 MM thick plate glass fixed with special EPDM gasket and wool felt (Include for rough ground on top and sides of the window and approved quality silicone sealant at joints) on all sides. Aluminium beading of approved make with all materials and labour etc. complete.

10.11. Supplying and fixing 40 mm thick cement concrete jali made from 1:3 cement mortar, weld mesh and having at least 25% openings.

10.12. Push and pull type rolling shutter made of 18 gauge black lathe, with providing and fixing M.S. pressed side guide, door suspension shaft, rolling spring, enclosing hood, brackets, bearings, locking arrangement and other necessary accessories for proper working etc. complete with hand operated system. Rate to include for one coat of Zinc Chromate primer and two coats of approved enamel paint. Rate shall be paid for opening size only in sq.mt.

10.13. Same as item no 10.12 but, for providing mechanically / electrically operated rolling shutters.

10.14. Providing and fixing of General Purpose Hollow metal steel door (Two Hours fire rated) with vision panel made of Pressed Galvanized steel Single /Double leaf to required sizes of "Shakti Met-dor" or approved equivalent which consists of frame, shutter, infill and finish as detailed below and conforming to IS 277. Door frame shall be Single rebate profile of size 100 x 57 mm made out of 1.65mm thick galvanized steel sheet (18 gauge). Frames should be metered and field assembled with self-tabs. Frames should be provided with back plate bracket and anchor fasteners for installation on a finished plastered masonry wall opening. Once frame installed should be grouted with cement slurry if recommended on the clear masonry opening. Door leaf should be 46mm thick fully flush double skin door with vision lite. Door leaf shall be manufactured from 1.2mm minimum thick galvanized steel sheet. The internal construction of the door should be rigid with steel stiffeners/ pads and reinforcement. The infill material shall be resin bonded honeycomb core. All doors should be factory prepped for receiving appropriate hardware and provided with necessary reinforcement for hinges, locks, and door closers. The edges should be interlocked with a bending radius of 1.4mm. For pair of doors astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite wherever applicable should be as per joinery details with a screw on glass beading on the inside. The glass should be 5mm clear toughened glass. All doors and frames shall be finished with etched primer coating, stove zinc phosphate primer and thermosetting polyurethane aliphatic grade paint of approved colour. The door leaf and frame shall have passed minimum 250 hours of salt spray test. Rate should include supply and installation of door and hardware such as door closer, SS Hinges, 2 nos of Ss Handles, one Mortice lock (both side key operation Cylinder) etc. complete as per manufacturer's specification and as directed by engineer in charge.

10.15. Supplying and fixing teak wood double or single leaf doors including bedding/moulding as per detailed drawings. Shutter made of 12mm thick particle board (IS: 3097) fixed in 35mm thick teak wood frame having 100 mm wide top rail and stile with bottom rail of 200 mm width and lock rail of 150 mm width including painting 2 coats with enamel paint of ISI approved specifications cover one coat of approved primer so as to give an even shade after making the surface clean and smooth. Rate shall also include for one number anodized aluminium tower bolt of best quality having 10 mm dia. rod of minimum 225 mm long, one no. Anodized aluminum Aldrop without locking arrangement to be fixed inside of the door, one number anodized aluminium aldrop of 250 mm length and 15mm thickness or rod of best quality, two numbers anodized aluminium handles of 150 mm length, three numbers ISI approved iron butt hinges 100 mm size for one leaf, one number anodized aluminum door stopper and six numbers M.S. hold fast of size 150 mm x 40 mm x 6mm embedded in cement concrete blocks of 175 mm x 100 mm and width as per the thickness of wall in ratio of 1:3:6 complete in all respects.

10.16. Supplying and fixing PVC doors “SINTEX " brand or equivalent made from plastic family for use in bath rooms/toilets etc. possess water proof, weather proof, termite proof, etc. properties. Rate shall include for PVC door frame, non -corroded hinges, handle, locking arrangement, etc. complete in all respects.

10.17. Supplying and fixing of an approved quality "Z" section steel frame for door confirming to iS: 1361. Rate shall include for one under coat and two coats of enamel paint of approved make. Rate shall be paid on the basis of area of opening.

10.18. Fabricating and fixing of M.S. sliding gate as per drawing made from M.S. C.R. sheet (gauge as shown on drawing) welded with frame work of angles, flats etc. Rate shall include for M.S. pipe guide, brackets for hanging gates, rails, pulleys, ball bearings, nuts, bolts, washers etc. complete. Rate shall include for one under coat of Zinc Chromate primer and two coats of enamel paint. Measurement shall be on the basis of length of section as per drawings and standard weight as per IS. Pulley and bearing weight shall be considered as per Manufacturer/actual data.

10.19. Same as item no. 106 but, for supplying & providing 5mm thick clear glass in place of 4mm thick clear glass.

10.20. Same as item no. 10.6 but, for supplying & providing 4mm thick toughened glass in place of 4mm thick clear glass of ordinary quality.

10.21. Supplying and fixing 10mm square M.S. burglar bars and welded with steel window frame as shown on the drawing.

10.22. Only fixing Doors, Windows, ventilations.

10.23. Providing & fixing 4mm thick clear glass, fixing, screw, lugs, hinges, stay, holders etc. with all necessary approved fixtures complete. Window frame, shutters with two coats of enamel paint over one coat of Zinc Chromate primer.

10.24. Supplying and fixing fixed glazed, aluminium anodized windows of Jindal / Hindalco make, having weight of aluminium sections as approximately 5 kg/ m2 of opening area (excluding beading for glass/ panel fixing), size, shape and design as per details including all fittings and fixtures with Double glass (insulated glass unit made of 8/10/12 mm thick float glass + 12 mm air gap with aluminium spacer frame duly molecular sieve + 5 mm thick float glass) fixed with special EPDM gasket felt and aluminium beading of approved make with all materials and labour etc. complete. Include for rough ground on top and sides of the window and approved quality silicone sealant at joints and on all sides externally and internally.

10.25. Supplying and fixing fixed type glazing of 8 mm thick clear float glass with anodized aluminium framing of Jindal / Hindalco make, having weight of aluminium sections as approximately 5 to 6 kg/ m2 of opening area (excluding beading for glass/ panel fixing), size, shape and design as per details including all

fittings and fixtures. Include for fixing of glass with special EPDM gasket felt and approved aluminium beading with all materials and labour. Include for rough ground on top and sides of the framing and approved quality of fire proof silicone sealant at joints of glass and on all sides externally and internally.

10.26. Same as item no. 10.25 but for fixed type aluminium louver frame with 4 mm. thick glass louvers.

10.27. Providing and fixing hydraulic door closure of required size and approved make, conforming to IS 3564.

10.28. Providing and fixing aluminium floor mounted hydraulic spring type door closure of approved quality and make. Rate to include cutting of floor for fixing the spring, making it good, etc. complete.

10.29. Supplying and fixing 50 micron thick Polyester films such as Sun Control Garware films over glazing (measured separately) as per Manufacturer's instructions. Film shall be such that it will reject about 70 % solar energy shall reduce harmful UV radiation by 97 % and shall eliminate 70 % of sun glare.

10.30. Same as item no. 10.26 but for aluminium louver frame with aluminium louvers of Jindal or Hindalco.

10.31. Providing 50 mm thick Heavy duty aluminum Flush door with 18 SWG powder coated Aluminum sheet on each face and with high density Puff insulation in the hollow space between. The frame work of door shutter shall be fabricated from 2mm tk. powder coated aluminum sections & door frame shall be of 2.75mm thick powder coated sections having rounded edges as per Pharmaceutical industry's requirements. Rate to include for 200 mm long x 10 mm dia. S.S. handle, heavy duty cylindrical door lock (Yale or equal), heavy duty door closer (Dorma or equal), tower bolt, special EPDM gasket, S.S. heavy ball type hinges and all necessary accessories, etc.

10.32. Same as 10.31 but having view panel above sill level of two 4 mm thick clear float glasses flush on both side and fixed with 3 M or St. Gobain adhesive tape and silica gel between two glasses for moisture entrapping.

10.33. Supplying and fixing flush, fixed double glazed powder coated aluminum windows with minimum 2 mm thick sections formed to double rebate profile of 50 mm thickness and to be flush with plastered wall. Design as per details including provision of perforations in the frame & silica gel between the two glasses to prevent absorb the moisture. Glass shall be fixed with 3 M or St. Gobain adhesive tapes. Include for rough ground on top and sides of the window, special EPDM gasket and approved quality silicone sealant at joints and on all sides externally and internally.

10.34. Supplying and fixing anodized aluminium fixed windows with aluminium frame of Indal/ Jindal / Hindalco make, having weight of aluminium sections as approximately 4 kg/ m2 of opening area (excluding the weight of beading for glass/ panel fixing) , size, shape and design as per details including all fittings and fixtures with 5 MM thick reflective glass fixed with special EPDM gasket and wool felt (Include for rough ground on top and sides of the window and approved quality silicone sealant at joints) on all sides. Aluminium beading of approved make with all materials and labour etc. complete.

10.35. Deleted.

10.36. Providing & fixing automatic door seal of standard make at bottom of door shutter.

10.37. Same as 10.31 but 24 SWG Powder coated GI sheet flush door

10.38. Same as 10.32 but 24 SWG Powder coated GI Sheet flush door having view panel above sill level.

10.39. Same as 10.24 but with fix single glass windows.

10.40. Same as 10.3 with PVC Mosquito proof zali in place of glass and making shutter using 50 mm x 30 mm timber section.

10.41. Supply & fix fixed / openable/ slide glazed windows and ventilators at any height with steel frame of rectangular / square hollow sections of approved make and with 5 mm thick clear glass, fixing, screws, lugs,

hinges, stays, holders etc. with all necessary approved fixtures complete. Rate to include for two coats of enamel paint over one coat of Zinc Chromate primer.

10.42. Same as 10.41 but using existing window / ventilator frame dismantled (dismantling measured separately) from existing locations, including minor repairing of frame, if necessary. Only frame will be used from the existing window / ventilator. Include for all other materials including supply of 5mm thick glass, paint, etc. and labour required to complete the item.

10.43. Same as 10.17 but using rectangular / square hollow steel sections of approved make in place of Z section.

10.44. Adjustment in rate of item nos. 10.8, 10.9, 10.10, 10.24, 10.25, 10.26, 10.30 & 10.39 for variation in weight of aluminium section (including anodizing) per m2 of opening area - as compared to the weight of aluminium section mentioned in a particular item.

10.45. As per item no. 10.8 but with 3 mm thick aluminium composite panel fixed with 3M on each side of the shutter, in place of glass.

10.46. Dismantling existing doors/ windows of any type at any level. Rate to include for carefully removing the shutters of door/windows and dismantling of the frame and grill of the door / window thereafter. Include for minor dismantling of wall / floor required to dismantle the frame, repairing the damaged surface of wall /floor good again to make it match with the existing surrounding surface, cleaning of debris, etc. complete. Dismantled frame, shutter and grill shall be the property of Owner and the Contractor shall deposit the same to Owner's store. Measurement on the basis of out to out dimensions of the frame dismantled.

10.47. Supply and Installation of wooden door of duly sandwiched type filled with 75 mm thick fiber glass wool of CR - 300 density 48 kg/ m3 with hinge and of stoppers.

10.48. Providing and fixing in position Shakti-Met or equivalent hollow metal with powder coated fire resistant door (two hour fire resistance) of 46 mm thickness and confirming to IS 3614 (Part 2) having frame made from 1.6 mm thick galvanized iron sheet and having fully flush type single/double shutters of pressed G.I. sheet, 1.25 mm thick confirming to IS 277. Shutter/s to be provided with fire rated 6 mm thick clear vision glass. The vision glass to be provided in rectangular standard dimensions of 200 mm X 300mm.The stile edges of frame and shutter/s to be lock seamed with no weld marks. The infill material in shutters shall be resin bonded honey comb Kraft paper with thermal insulation. Door frames and shutters shall be finished with etched primer coating, stoved zinc phosphate primer and thermosetting polyurethane aliphatic grade paint of approved colour. Rate to Include for pre punched hinge plates, 3 nos., 100 mm long SS butt hinges per shutter, fixing the frame with holdfast/ anchor fasteners, SS 304 'D' type handles, tower bolt, Dorset cylindrical lock, vision panel, panic bar etc. complete as per manufacturer's recommendation and as directed.

10.49. Same as item No. 10.49 but general purpose steel door of "SHAKTI-MET" or equivalent with epoxy paint instead of polyurethane paint on the frame & the door shutters.

10.50. Same as item No. 10.30 but aluminium louvers fixed over M.S. frame. M.S. frame shall be measured separately.

10.51. As per item no. 10.8 and 10.9 but for aluminium door partly glazed and partly panelled.

10.52. Supplying and fixing in position partly glazed partly panelled, anodized aluminium partitions with aluminium frame of jindal / Hindalco make, having weight of aluminium sections as approximately 8 - 10 kg/ m2 of surface area (excluding the weight of beading for glass/ panel fixing), size and shape as per details, including supplying and fixing necessary fixtures and fastenings of anodized aluminium as per requirement with 6 mm thick MODI/Saint Gobain float glass, EPDM special gasket felt and aluminium beading, with all accessories, labour and materials complete as per details and direction of the Engineer. Include for approved

quality silicone sealant at joints and on all sides. Measurement on the basis of out to out dimensions of the frame.

10.53. Providing & supplying Aluminium frame with pre-laminated exterior grade 25 mm thick flush door with aluminium with 16 mm thick teak wood leaping on all sides, S.S. hinges, bolts, SS Handel, mortise lock, SS door stopper of Dorma/Doreset make or approved equal etc. complete. Aluminium anodized section of Jindal or Hindalco brand having weight of aluminium sections as approximately 4 kg/m2 of opening area (excluding beading for glass/panel fixing) size shape and design as per detail. Rate to include all fittings and fixtures, silicon sealant, sheet metal screw with PVC roll plug at 450 c/c for aluminium frame for fixing with RCC/Brick/cement board partition/cement blocks etc. complete as per direction of engineer in charge.

10.54. Providing and fixing aluminium louvers of HUNTER DOUGLAS Sun Louvre 84R panel Exterior (86 X 16) with Stringer SL 4 (86 X 33) (combined) with finish 7063 trance silver colour installed in vertical manner including the carrier rail & any other material like, s. s. screws, nuts etc. required to attach to the surface.

10.55. Providing & installing 10 mm thick toughened glass with Patch fitting for any open area with ozone glassage series patch fitting panels, Dorma patch fitting solution or any other equivalent including the price of all materials like screws, fire proof silicon sealant to join glass etc. complete. Rate is also included for drilling in any surfaces like masonry or RCC etc.

10.56. Supplying and fixing in position black anodized (20 micron) aluminium door frame of Jindal / Hindalco make, having weight of aluminium sections as approximately 3 kg/m2 of opening area (excluding the weight of door shutter, beading for glass / panel fixing), size and shape as per details, including supplying and fixing necessary screws as per requirement, labour and materials, complete as per details and direction of the Engineer. Door shutter with fixtures measured separately. Include for rough ground on top and sides of the door and approved quality silicone sealant at joints and on all sides. (Measurement on the basis of out to out dimensions of the frame).

10.57. Supplying and fixing fixed anodized aluminium windows with aluminium frame of Indal / Jindal / Hindalco make, having weight of aluminium sections as approximately 4 kg/ m2 of opening area (excluding the weight of beading for glass/ panel fixing), size, shape and design as per details including all fittings and fixtures with 6 MM thick clear float glass fixed with special EPDM gasket on all sides. Rate to include 6 mm thick clear glass, all fittings and fixtures, silicon sealant, sheet metal screw with PVC roll plug at 450 c/c for aluminium frame for fixing with RCC/Brick etc. complete as per direction of engineer in charge.

10.58. Supplying & Fixing Motorised Perforated (2 nos-1m wide in each d) Pre colour coated GI Rolling Shutter of “Gandhi Automation” or approved equivalent with top cover, made from non-perforated G.I. strips (1.0mm) with interlocking lath sections, complete with side guides, bottom, brackets made from M.S. sheet, with strong suspension and fitting accessories in best workmanship with two coats of polyurethane paint of approved colour over one coat of grey epoxy primer. The rolling shutter with automation system comprising compact Gear operator with inbuilt limit switches, control panel & manual chain override in case of power failure and push button. Rate shall be paid for opening size only in sq.mt.

10.59. Supplying & fixing aluminium fixed louver frame with aluminium louvers of Indal / Jindal / Hindalco (Up to 8 kg/m2). Rate to include all fittings and fixtures, silicon sealant, sheet metal screw with PVC roll plug at 450 c/c for aluminium frame for fixing with RCC/Brick etc complete as per direction of engineer in charge.

10.60. Providing and Fixing uPVC Tilt & Turn fully open able windows of “Rehau or approved equivalent” (inward) profiles. The material must be pristine white high impact modified window grade UPVC and must be colorfast and conform to EN 12608:2003 code. So the profiles must conform to the requirements of EN 12608:2003. Rate to include all Material, Labour, all fittings & fixture, specials etc. required to complete. Specification & workmanship as per manufacturer’s instruction & direction.

11. ROOFING & CLADDING

11.1. Supplying, laying and fixing of 6 mm thick grey corrugated asbestoses "Everest Brand" or equivalent sheets in roof with G.I. "J" or "U" or cranked bolts of 8 mm dia. with G.I. and bitumen washers, nuts including cutting, lap, wastage, breakage etc. complete. Measurement shall be on net area. The Contractor shall carry out the work for laying and fixing of roofing/cladding sheets as per Manufacturer's instructions. Side lap shall be 1.5 times the dimension of corrugation.

11.2. As per 11.1 but for side cladding and louvers.

11.3. Supplying, laying and fixing of 1.6 mm thick (approx.) fibre reinforced plastic (FRP) translucent corrugated sheets in roof with G.I. "J" or "U" or cranked bolts of 8 mm dia. with G.I. and bitumen washers, nuts including cutting, lap, wastage, breakage etc. complete. Measurement shall be on net area. The Contractor shall carry out the work for laying and fixing of roofing/cladding sheets as per Manufacturer's instructions. Corrugations to match with A.C. corrugated/ Trafford sheet or G.I. corrugated sheet or Aluminium corrugated or profile sheets.

11.4. Supplying and fixing in proper position of asbestos cement ridges corner pieces, apron pieces etc. including cutting, lap, wastage, breakage etc. complete as directed. Measurement shall be on net length.

11.5. Supply and fix A.C. half round gutter including fixtures, nozzles, drop-end with spigot or sockets, stop end, union clips, clamps etc. complete as directed. Rate for using Everest Brand or approved equal.

11.6. As per item 11.5 but for A.C. boundary wall or Eaves gutters.

11.7. As per item 11.5 but for A.C. valley gutters.

11.8. Supply and fix A.C. rain water pipe including fixing brackets, clamps, collar, shoe etc. complete.

11.9. Supply, fabricate and fix in proper position, galvanized iron 18 gauge sheet gutter as per drawing include for drop end, stop end, clamps, two coats of bitumen paint (inside) etc. complete.

11.10. Rain water pipes formed from 18 gauge galvanized iron sheet. Include for fixing, brackets, clamps, splay cut at end, etc. complete. Also include for bending or diverting in case pipe fouling with steel member while bringing down from gutter.

11.11. Rate to include for supply, fabricate and erect in proper position, with required slope of 3mm thick Black iron sheet Rain water gutter as per the Section shown in the drawing. Rate to include for supplying and applying one coat of Zinc Chromate primer and two coats of enamel paint on outer surfaces and two coats of bitumen paint on inner surface. Also include for stop ends, drop ends, clamps, etc. complete.

11.12. Supplying, cutting, laying and fixing in position 0.71mm (22 gauge) industrial troughed aluminium sheets "JINDAL" Brand or equivalent (Stucco finish) for roofing including bolting, riveting, temporary scaffolding, if required, etc. complete as per specifications and as directed. Rate shall also include for laps, wastage, aluminium fasteners such as hook bolts, seam bolts, washers, nuts, pressure sensitive butyl sealing tape on all the joints to assure water tightness. Measurement shall be on net area. The Contractor shall carry out the work for laying and fixing of roofing/cladding sheets as per Manufacturer's instructions.

11.13. Rate to include for supply & fixing in position GRAVENT ventilation system having throat size 200 mm type RGV200 0f 2500 long Manufactured in M.S. plates with approved epoxy anti-corrosive paint. Rate to include for providing and fixing its valances and mounting strips etc. as complete installation with end caps.

11.14. Fixed wire glass glazing, supply a fix 6mm thick wire glass in north light trusses. Include for fixing screws, lugs, special metal sash putty of approved make, wastage etc. structural steel T bars, runners etc. measured separately.

11.15. Supplying, laying & fixing of 22 B.W.G. galvanized corrugated iron sheets of approved quality and make in roof with 8mm dia. in G.I. J or U bolts with G.I. limpet, bitumen washers, nuts, laps, wastage, including cutting, etc. complete as per ISI specifications. Measurement shall be on net area.

11.16. As per item 11.15 but for side cladding.

11.17. Supplying, making, laying and fixing in proper position of 22 B.W.G. galvanized iron sheets in ridges including cutting, laps, wastages, etc. complete. Measurement shall be on net length.

11.18. As per item 11.17 but for apron piece, corner piece, flashings, louvers etc.

11.19. Extra over item 11.1/11.15 & 11.3 for providing & laying asphalt impregnated hessian cloth 100 mm wide interposed in the overlapping of sheets. Extra rate shall include for cost of over lapping of sheets by one and half corrugations.

11.20. As per item no. 11.12 but using 0.56mm (24 gauge) for side claddings.

11.21. Supplying, making, cutting, laying and fixing in proper position 0.71mm (22 gauge) aluminium sheets in ridges, north light curve, apron piece, corner piece, flashing, louvers etc. including laps, wastage, etc. complete as directed. Measurement shall be on net length.

11.22. Providing and fixing of G.I. 40mm x 5mm flat (as wind tie) over Galvalume sheeting at ridge level and eaves level as shown in drawing. Include for drilling holes, cutting, bolting, wastage, etc. Measurement shall be on the basis of net length of the tie provided.

11.23. Providing, laying and fixing of PVC "Supreme" brand or equivalent rain water down take pipe line of 6 kg/cm2 pressure rating, as per lay-out, details and requirement including all necessary specials such as bends, Ys, Ts, offsets, plugs, reducers, pipe clamps, backing pieces, etc. and jointing with solution as per Manufacturer's instructions etc. complete.

11.24. Removing existing A.C./FRP/G.I / Galvalume sheet roofing/ cladding sheets from its original position from any height and stacking the same as directed by the Engineer.

11.25. Removing existing A.C./FRP/G.I / Galvalume sheet ridges, corner pieces, apron pieces, gutters, etc. from its original position from any height and stacking the same as directed by the Engineer.

11.26. Supplying and fixing in proper position asbestos cement Extractor in roof including fixtures complete. Rate for Everest Brand or approved equivalent.

11.27. Providing and fixing P.V.C pipelines of best quality including necessary bends, joints, hinged clamps inspective plugs leads joints, with necessary test etc. complete.

11.28. Supplying, laying and fixing at any height of 0.5MM thick Pre coated colour G.I Corrugated sheets (hi-rib) of approved make in roof with G.I. "J" or "U" or cranked bolts or self-tapping screws of 8MM dia. with G.I. and bitumen washers, nuts, including cutting, lap, butyl tape sealer, wastage, breakage etc. complete. Sample and shade of the sheets shall be got approved from the Engineer prior to the procurement. Measurement shall be on net area covered. The Contractor shall carry out the work for laying and fixing of roofing/cladding sheets as per Manufacturer's instructions.

11.29. Supplying, laying and fixing at any height of 0.5mm thick Pre coated colour G.I. sheet in proper position of ridges, corner pieces, apron pieces etc. including cutting, lap, wastage, breakage etc. complete as directed. Measurement shall be on net length.

11.30. Supplying and fixing 2 mm thick clear Translucent polycarbonate sheet of GE, Lexan, Sabic or other approved make and design (corrugations to match with roofing/ cladding sheets) in skylights/ roof at any height with step flange including fixing with brass screws / self-tapping screws / Gi J bolts of 8 mm dia. with G.I. & EPDM/ neoprene washers & nuts as per Manufacturer’s instructions, neoprene gaskets, silicone neutral grade sealant, etc. complete. Measurement shall be on the basis of net area of the polycarbonate sheet.

11.31. Supplying & fixing ‘vergola’ type natural Air vent turbine ventilator (Roof Extractors) along with the FRP base frame suitable for mounting on the BlueScope corrugated sheet / Pre coated GI sheet/ GI sheet/ Galvalume sheet. The Exhauster shall have rigid roll formed curved vanes mounted on rotor shaft & bearing

assembly. It shall be weather proof and storm proof and corrosion protection design. Throat size -32 dia. to deliver 4300CFM (7310CMH) at wind velocity of 10kM/HR.

11.32. Supplying, laying and fixing at any height 50mm thick (24kg/m3 density) glass fibre insulation of 'KIMMCO' or other approved equivalent make (bonded with thermosetting resins) having single side facing of reflective vapour barrier of Kraft laminate(FSK) below the roofing sheets (above the purlins) OR on the sides of the cladding sheets. Include for providing G.I. mesh (1.6 mm x 75 mm x 75 mm) below the entire area of insulation. Fixing as per manufacturer's instructions.

11.33. Fixing only of Roofing / cladding using any kind of sheets such as A/C, Alum. GI, FRP, etc.

11.34. Fixing only of Roofing / cladding accessories such as ridges, apron piece, corner piece, flashing, louvers etc. as directed using any kind of material.

11.35. Removing existing wire/ plane glass from its original position at any height and stacking the same for re-use (re-fixing measured separately) as directed by Engineer- in- Charge. Include for disposing the breakage / wastage out of the Site. Measurement shall be on the basis of net area of the Glass dismantled.

11.36. Supplying, laying and fixing at any height Hi-rib silicone modified polyester coated (RMP Coated) galvalume sheets of min. 550 MPa yield strength steel in roof or wall cladding with G.I. "J" or "U" or cranked bolts or self-tapping screws of 8 mm dia. with

G.I. and EPDM/ neoprene washers, nuts, including cutting, laps, butyl tape sealer, wastage, breakage etc. complete.

The sheets shall be of AZ150 class (aluminium zinc coating of 150 grams per sq. metre) with coated alloy of 55% Aluminium, 43.5% Zinc and 1.5% Silicon and of approved colour with top surface coated with 20-25 microns of coating (including 5 micron epoxy primer) and bottom service coat with 10-15 microns. Sheet material & painting shall confirm to ASTM standards ASTM A 792 & ASTM A 755. Sample and shade of the sheets shall be got approved from the Engineer prior to the procurement.

The contractor shall carry out the work for laying and fixing of roofing / cladding sheets as per Manufacturer's instructions. Length of the sheets shall be so supplied that the laps along the length of the sheet are minimized. All Lapping of sheeting panels at sides & ends shall have 6 mm wide x 5 mm thick butyl tape sealer having non-toxic, non-shrinking, non-drying and non-asphaltic properties. Solid or closed cell Ethylene Polypropylene Terpolymer type Foam filler/ closures having same profile as sheeting panels shall be provided at eaves, ridge & other locations.

Measurement shall be on net area covered.

11.37. Supplying, laying and fixing at any height of 0.5 mm thick Pre colour coated Galvalume sheet accessories as per the properties described in item 1140 above in proper position of ridges, corner pieces, apron pieces etc. including cutting, lap, wastage, breakage, butyl sealer, neutral curing silicone rubber sealant, etc. Complete as directed. Measurement shall be on net length.

11.38. Providing and fixing of 600 mm x 600 mm Concealed Perforated Panel False Ceiling System of "Supersil" or approved equal at any height. Panels shall have circular / square perforations to have opening of 20% to 30% of total area approximately, as per the design. The panel shall be of 600mm x 600mm size, fabricated from 0.71 mm thick (TCT) aluminium alloy and shall be square edged. Panel shall be powder coated on external surface (subsequent to the perforations) with 60 microns thick powder coating of exterior grade with 15 years warranty against corrosion resistance, colour fastness, water resistance and dullness resistance against sun rays. Suspension system shall consist of GI carriers at max. 600 mm c/c GI pressure clips along the length of the panels. Powder coated 0.5 mm thick GI edge profile shall be fixed on the perimeter of walls and columns. Rate to include for scaffolding, wastage, cutting, etc. Complete.

11.39. Measurement shall be made on the basis of net plan area of the ceiling provided.

11.40. Providing and fixing of 150F Concealed perforated Panel False Ceiling System of "Supersil" or approved equal make at any height. Aluminium plain panel shall be of 150 mm wide x 17 mm deep x 0.71 mm thick having length up to 5000 mm. The panel shall have circular perforations as per design. The panel shall be powder coated on a continuous paint line (subsequent to the perforations) with 60 microns thick powder coating of exterior grade with 15 years warranty against corrosion resistance, colour fastness, water resistance, and dullness resistance against sun rays. When two panels are to be lapped along their length, they shall be joined together by means of panel coupler. The panels shall be fixed to the panel carrier, which in turn shall be suspended from the roof / truss by means of GI suspension angle and GI T leveller for fine adjustment of height. Panel carrier shall be roll formed out of 0.60 mm thick galvanized steel strip to hold the panel in the module of 150 mm and shall be spray painted / stove enamelled black. When two or more carriers are to be joined, they shall be joined together by means of carrier coupler and hold them firmly in place while maintaining the module of 150 mm. Edge profile of standard L-shape roll formed out of 0.5 mm galvanized strips with powder coating shall be provided at edges. Rate to include for scaffolding, wastage, cutting, etc. Complete.

11.41. Providing and fixing aluminium panel type cladding system of "Supersil" or approved equal make on curved surfaces at any height. Panels shall be fabricated from 1 mm thick (TCT) aluminium alloy in the curved shape and / or required taper / trapezoid, as per the design. Panels shall be maximum 1200mm long x 600 mm wide and shall be plain on the sides and square edged at top & bottom. Panels shall be powder coated on external surface only with 60 microns thick powder coating of exterior grade with 15 years warranty against corrosion resistance, colour fastness, water resistance and dullness resistance against sun rays. Vertically, panel shall be snapped in to 0.45 mm thick GI carrier / 1.2 mm thick pressure clip. Carrier / Clip will be installed in proper vertical curvature with the help of T leveller, spring steel suspension clip and GI hold on hanger. Joints, wherever required, shall be filled with silicone sealant of approved make & shade. It may be necessary to measure "as built" dimensions of the roof structure before taking up the execution of this work. Rate to include for scaffolding, wastage, cutting, etc. Complete.

11.42. It is mandatory that a sample (CCCk up) of at least 30 sq. m. area shall be made exactly as per the design for approval by the engineer before taking up the actual work. Measurement shall be made on the basis of net area of the cladding provided.

11.43. Same as 11.28 but, using approved quality PUF insulated sandwiched roof/ cladding panel. Roof/ cladding panel shall have 50 mm thick PUF (40 kg/m3 density) insulation sandwiched between 0.5 mm thick pre colour coated G.I. sheet of approved corrugation as exterior face and 0.5 mm thick pre colour coated G.I. sheet of approved corrugation as interior face.

12. STRUCTURAL STEEL WORK

12.1. Supplying, fabricating, erecting, aligning and fixing in proper position mild steel portal frames, plate girder, gantry girder, trestles, trusses, columns, purlins, ties, bracing, sag bars, grills, etc. complete made of plates, angles, I / C beam and such other hot rolled sections confirming to IS 2062 and of approved make at site. Rate shall include for splices and supplying all ISI mark materials such as welding rods, bolts, nuts, etc. and like labour for the work of straightening, cutting, drilling holes, necessary plants/equipment for assembling, bolting, welding, erecting, etc. complete as directed. Rate shall include for one coat of Zinc Chromate primer and two coats of approved enamel paint after thorough cleaning of surfaces with wire brush / sandpaper and as per the Paint Manufacturer's instructions, removing all loose rust, dust and other such foreign materials before application of Paint

12.2. Fabrication shall be in a perfectly workmanship like manner and as provided in Section V and VI of IS 800 and IS 7215. Welding shall be carried out by qualified & approved welders. Electrodes for welding, the

procedure, selection, test and inspection shall conform to provisions in IS 816, IS 822, and IS 833. Erection / hoisting shall commence only after passing of fabricated parts by the engineer-in- Charge.

12.3. Measurement of steel shall be on the basis of length of the sections as per drawings and standard weight as per IS code. Weight of bolt / welding shall not be considered for payment.

12.4. Rate to include for supplying, fabricating, welding, aligning, and fixing insert in positions, etc. complete as per drawings. Include for necessary changes required in form work. Other details same as per item no. 12.1.

12.5. Supply and fix in position holding down bolts with 70 mm threaded portion with nuts, washers and M.S. plate complete as shown in drawing. Bolts shall be fixed in the pockets in position. Include for 100 dia. M.S. pipe sleeve having half of the bolt length. Bolt together with sleeve shall be placed and fixed securely in position and level as shown while pouring of foundation/pedestal concrete.

12.6. As per 12.1 but for chequered plate.

12.7. As per 12.1 but for grill over compound wall.

12.8. As per 12.1 but for sliding gate including rollers, guide rails etc. complete. Rate shall include for M.S. pipe guide, brackets for hanging gates, rails, pulleys, ball bearings, nuts, bolts, washers, one under coat of Zinc Chromate primer and two coats of enamel paint, etc. complete. Measurement shall be on the basis of length of section as per drawings and standard weight as per IS. Pulley and bearing weight shall be considered as per Manufacturer/actual data.

12.9. As per 12.1, but for wicket gate as per drawing including hinges etc. complete.

12.10. As per 12.1, but for window grills as per drawing including all necessary fittings and fixtures.

12.11. As per item no. 12.1 for providing composite aluminium-pigmented metal primer and two finished coats of aluminium paint over the mild steel surfaces where there is direct contact with aluminium roofing/cladding sheets likewise purlins, cladding runners, etc.

12.12. Other surfaces of purlins, runners, etc; which are not in contact with aluminium sheets, shall be painted as per item no. 12.1.

12.13. As per item no. 12.3 but with 75mm dia. M.S. pipe sleeve as shown on drawing. Bolt fixing while pouring of foundation concrete.

12.14. Supplying, cutting and fixing in proper position welded wire mesh as shown on drawing including spot welding to structural steel members complete. Rate shall include for one coat of Zinc Chromate primer and two coats of approved enamel paint. Item shall be measured in Sq.mt. Structural steel members measured separately.

12.15. Supplying, fabricating, bending, erecting, aligning and fixing in proper position M.S. black sheet (H.R.) for the purpose of rain water gutter, cladding, flashing, apron, etc. as shown on the drawings. Rate shall include for supplying all materials such as ISI mark welding rods, bolts, nuts, etc. and like labour for the work of straightening, cutting, drilling holes, necessary plants/equipment for assembling, bolting, welding, erecting, laps, wastage, etc. complete as directed. Rate shall include for one coat of Zinc Chromate primer and two coats of approved enamel paint after thorough cleaning of surfaces. Measurement of sheet shall be on net area (sq. m) basis.

12.16. As per item No.12.1 but for roof ventilation work at ridge level as shown on drawing.

12.17. Supplying, cutting, fixing in proper position medium class M.S. pipe as shown on drawing.

12.18. Removing existing fabricated structural steel like portal frames, trusses, gantry girders, trestles, storage bins/silos, stairs, railings, columns, purlins, ties, bracing, sag bars, grills, fabricated girders, welded wire mesh, etc. having welded/bolted/riveted joints from any height and handling/stacking the same as directed by the Engineer. Rate shall include for using necessary plants/equipment for cutting the sections

and like labours, etc. Dismantling scheme shall be got approved from the Engineer prior to taking up this particular work.

12.19. Item same as 12.1 but for supplying, fabricating, erecting, aligning, fixing in position etc. complete for furnace grillage and other furnace steel work as shown on the drawings. Rate does not include any Zinc Chromate primer or enamel paint.

12.20. Providing & applying one coat of Zinc Chromate primer over structural steel work after thorough cleaning of surface.

12.21. Providing & applying two coats of approved first quality synthetic enamel paint over structural steel work.

12.22. Providing & applying two coats of heat resistant Shalimar or equivalent paint after applying required primer over structural steel surfaces.

12.23. As per Item no.12.1 but with Cold rolled sections like Z / C section, Hollow sections etc. conforming to IS: 811.

12.24. Erecting, aligning and fixing in proper position mild steel portal frames, plate girder, gantry girder, trestles, storage bins, trusses, columns, purlins, ties, bracing, sag bars, grills, etc. complete at site. Rate shall include for supplying all materials required for erection such as ISI Mark welding rods, bolts, nuts, etc and like labour for the work of straightening, cutting, drilling holes, necessary plants/equipment for assembling, bolting, welding, erecting, etc. complete as directed. Rate shall include for one coat of Zinc Chromate primer and two coats of approved enamel paint after thorough cleaning of surfaces with shifting, loading, unloading, and transporting the sections within a lead of 15 km radius from site.

12.25. Measurement of steel shall be on the basis of length of the sections as per drawings and standard weight as per IS code.

12.26. Strengthening of existing framed/ unframed structural steel members like trusses, ties, beams, columns, gussets, battens, lacings, bracings, brackets, etc. at any height by welding / bolting additional steel sections/ plates with the existing members as per details. Rate to include for supplying all fasteners & consumables such as bolts, welding rods, nuts etc., necessary plants & equipment, cleaning of existing corroded surfaces etc. complete.

12.27. Measurement shall be made on the basis of unit weight of new sections/ plates used in the strengthening.

12.28. Strengthening work same as item no.12.22 but using standard tubular sections like pipes, etc. of approved make.

12.29. Structural steel work same as item no.12.1 but using standard tubular sections like circular pipes, rectangular/ square hollow sections, etc of approved make and confirming to IS 1161/ IS 4923.

12.30. As per item no 12.1 but Epoxy paint instead of enamel paint.

12.31. Item same as 12.1 but for supplying, fabricating, erecting, aligning, fixing in position etc. complete for Storage bins, silos steel work as shown on the drawings. Rate does not include any Zinc Chromate primer or enamel paint.

12.32. Painting to structural steel - Providing & applying one coat of Epilux 610 Epoxy primer (Berger make) and two coats of Epilux 4 chemical resisting paint (Berger make) over the structural steel members, framed/ unframed at any height. Include for complete cleaning of the surface with wire brush / sandpaper and as per the Paint Manufacturer's instructions, removing all loose rust, dust and other such foreign materials before application of Paint. Standard weight as per IS code shall be considered for payment purpose. Weight shall be calculated as per relevant IS code.

12.33. Providing and fixing in position anchor fasteners in concrete of 'HILTI' or other approved make and fixing them in position at correct locations, lines and levels as per Manufacturer's specifications and as directed and instructed by the Engineer. Include for drilling hole in concrete with drilling machine and making good the surface of concrete / masonry after inserting the fasteners. Rate to Include for necessary drilling, cleaning, scaffolding, tools/ tackles, wastage, etc. complete.

12.34. Providing and Fixing Chemical rebar 'HILTI' or other approved equivalent. Rate shall include for drilling hole in concrete / masonry with drilling machine, cleaning, grouting and fixing reinforcement for required length, injecting the hole by approved epoxy resin hardener etc. complete and making good the surface of concrete / masonry after inserting the rebar. Rate shall also include for necessary drilling, cleaning, scaffolding, tools/ tackles, removal of wastage, etc. complete. 'HILTI' or other approved equivalent. Reinforcement will be measured separately. No additional payment shall be made for extra drilling at location where reinforcement is encountered.

12.35. Taking core from existing concrete beam/column/slab/wall etc. at location specified by the Consultant. Before drilling reinforcement shall be located by rebar locator. No. Reinforcement should be cut unless approved by the Consultants. Rate shall include for diamond core machine HILTI or approved equivalent, required scaffolding, water, etc. complete.

12.36. As per 12.1, but for G.I. gratings. Providing and fixing grating as per IS specifications over internal drainage or external drainage work (i.e. Storm water drain) or on cable trench etc. complete as per drawing and specification and as directed by Engineer in charge.

12.37. As per item no 12.24 but Epoxy paint instead of enamel paint.

12.38. Extra over item no. 12.1 & 12.24 for providing two coats of aliphatic polyurethane paint of ASIAN 1K PU or other equivalent with zinc phosphate primer, in place of enamel paint over Zinc Chromate primer.

12.39. Providing, laying & installing composite metal deck sheet of 0.6 mm thick (minimum yield strength of Fy = 350 N/ sq mm). Rate to include cutting to required size securing to floor beams with appropriate SDST screws, shear connectors / studs etc. complete as per specification and as directed by Engineer in charge. Actual measurement of plan area should be considered for payment.

12.40. FRP Gratings: Providing and fixing 1-1/2" thick FRP gratings (HLC Gratings by Kemrock or equal) over internal drainage or external drainage work (i.e. storm water drain) or on cable trench etc. Rate to include cutting to required size, wastage complete as per specification and as directed by Engineer in charge. Actual measurement of plan area shall be considered for payment.

13. ROAD WORK

Generally, all the Road work shall be as per the "Specifications of Road & Bridge Works", 5th Revision, of Ministry of Road Transport & Highways unless specified otherwise in the relative item description. These specifications are called MORT&H specifications hereafter. The rate for individual item shall include for making temporary alternative arrangements for traffic during execution of that particular item, carrying out the work in part widths / part lengths as directed, all the required tests for quality control, establishment of a fully equipped Laboratory at Site for testing, all royalties, fees, leads and lifts for all the materials.

13.1. Same as Item no 1.1 but for/in roadway (i.e. in carriageways and / or footpath) in soil of any types, including hard murrum up to specified depths. Any excess excavation shall be backfilled with suitable, approved material and thoroughly compacted in an approved manner. Payments to be made on net measurement.

13.2. Sub-grade Compaction

13.3. Compact subgrade by power driven road roller of 8 to 12 tone or 2 to 4 tone vibrating roller with minimum 5 passes. Relative compaction required at subgrade is 98% of maximum compaction at optimum moisture content as per IS-2720(Part-8). Rates to include for trimming subgrade to the levels, watering, longitudinal and cross falls as specified, making good any undulation developed during rolling by earth and rerolling of that particular part.

13.4. Supply, lay and pack stones shoulder to shoulder with the grater dimension vertical and the flatter short side at bottom, to form a layer not less than the specified thickness. Rates to include for placing smaller stones in the interstices and hammering house until voids are filled sufficiently for compaction, rolling with 8 to 10 t roller until stones are thoroughly keyed and no further movement takes place, spreading, brushing and compacting stone screening etc. complete. The specified thickness shall be attained after compaction.

13.5. Supply, lay and pack coarse aggregate 53mm size and downgrade as per Grading Ill of Table 400-7 of MORT&H Specifications, to depth of 110mm thick (loose) and consolidating the same to 75mm thickness by means of 8 t to 10 t rollers. Include for placing screening / good murrum/smaller sized aggregate as per the requirements in the interstices until the layer is thoroughly keyed and no further movement takes place on movement of compaction equipment and making the layer water bound macadam all as per MORT&H requirements.

13.6. Supply, lay and pack coarse aggregate 63mm size and downgrade as per Grading II of Table 400-7 of MORT&H Specifications, to depth of 110mm thick (loose) and consolidating the same to 75mm thickness by means of 8 t to 10 t rollers. Include for placing screening / good murrum / smaller sized aggregate as per the requirements in the interstices until the layer is thoroughly keyed and no further movement takes place on movement of compaction equipment and making the layer water bound macadam all as per MORT&H requirements.

13.7. Supply, lay and pack coarse aggregate 90mm size and downgrade as per Grading I of Table 400-7 of MORT&H Specifications, to depth of 145mm thick (loose) and consolidating the same to 100mm thickness by means of 8 t to 10 t rollers. Include for placing screening / good murrum / smaller sized aggregate as per the requirements in the interstices until the layer is thoroughly keyed and no further movement takes place on movement of compaction equipment and making the layer water bound macadam all as per MORT&H requirements.

13.8. Bitumen Base Course - Provide minimum 50 mm thick base course with 25 mm single size aggregates coated with 4% to 5% by weight, of straight run bitumen having penetration grade 80/100. Contractor to include in his rates drying of aggregates, mixing with bitumen at 140 to 160 degree C until mix of uniform composition is achieved spreading while hot and rolling to provide specified thickness.

13.9. Bitumen Wearing Course - Provide minimum 25 (compacted thickness) mm thick wearing course with 12 mm single size aggregate coated with 5 to 6% by weight, of straight run bitumen having penetration grade 60/70. Include drying of aggregates, mixing with bitumen at specified temperature, spreading while hot, and rolling by 8 to 10 t roller to provide specified thickness.

13.10. Edging - Supply and lay stone/brick /Concrete edging of specified height and shape at the edges of road surface. Include excavation, backfilling, compaction, bedding of 75mm thick PCC 1:2:4, cutting and jointing in 1:4 cement mortar, curing, wastage etc. complete.

13.11. Providing, laying and jointing NP2 grade concrete Hume pipe conforming to IS-458 in line and level as shown on drawings.(or as directed) at any depth. Rate shall include for 75 mm thick sand bedding, laying in slope, jointing with cement mortar (1:2), collar, curing etc. complete. Only excavation in pipe trenches and backfilling/spreading surplus material and PCC at top of pipe shall be measured separately.

13.12. Providing and laying paver quality cement concrete M35 (flexural strength of 40 kg/cm2) in unreinforced, dowel jointed pavement with broom finish in accordance with item no. 602 of MORT&H specifications including form work, compacting by internal and surface vibrators, finishing, curing, etc. complete as specified and as directed. Minimum cement content shall be 350 kg/m3 of concrete. The Contractor will be permitted to use Ready mix concrete (RMC) by establishing automatic batch mixing plant on site or procuring it from such a plant from the vicinity of the plot. In such a case, he shall be allowed to replace maximum 20% cement (by weight) with fly ash (as per IS. 3012). The minimum cement content mentioned above shall be considered as total of cement and fly ash for RMC. Rate to include cost of admixtures, if required, to improve the workability. Design mix of the Concrete shall be approved by the Engineer prior to usage of concrete at Site.

13.13. Dressing the transverse & longitudinal joints of concrete slabs with polysulfide sealant confirming to BS 5212 (Part 2) including cleaning the joints and ramming, etc. all as per item no. 602.2.8 & 602.11 of MORT&H specifications.

13.14. Providing and fixing in position pre-moulded joint filler board 20 mm thick confirming to I.S. 1838 for expansion joints, put to the required depth and 25 mm below the camber and as directed including punching of holes to accommodate the dowels, etc. all as per item no. 602.2.7 of MORT&H specifications.

13.15. Providing and fixing in position high yield strength deformed steel in tie bars of 12 mm dia. and 70 cm long, wherever directed including applying bitumen, handling, fixing straightening, necessary cutting, wastage, saddles to keep bars firmly in position etc. complete in all respect as per item no. 602.6.6 of MORT&H specifications.

13.16. Providing and fixing in position mild steel in dowel bars of 25 mm dia. 50 cm long and placed as directed including handling, fixing, straightening, necessary cutting, and wastage saddles to keep bars firmly in position etc. complete as per item no. 602.6.5 of MORT&H specifications. No extra payment will be made for applying bitumen / grease to dowel bars, warping waterproofing paper etc. as per drawing of expansion joint complete as directed.

13.17. Providing and laying minimum 125 micron thick polythene sheet as per item no.602.5 of MORT&H specifications, including overlaps (to be not less than 30 cm) etc. complete as specified and as directed.

13.18. Cutting construction and dummy joints of the concrete slabs by mechanical saw cut means up to 75 mm depth and 5 mm width as directed by the Engineer.

13.19. Providing 100 mm long PVC pipe around the dowel bars (25mm dia. approx. length 500 mm coated with bitumen paint), left at the end of expansion joints, duly greased inside the pipe and around the pipe and the pipe duly worked with glass wool/ compressible sponge at the end as directed.

13.20. Supply, lay and compact well graded material on prepared sub grade for granular sub base as per grading Ill of table 400-1 of MORT&H specifications and consolidating the same to specified thickness. Include for placing screening / good murrum / crushed stone as per the requirements in the interstices, watering, rolling, etc. complete as per item 401 (granular sub base) of MORT&H specifications to achieve a surface which is well closed, free from movement under compaction equipment and free from ridges, cracks or loose materials. The measurement shall be on cubic meter basis of the net area executed.

13.21. Same as 1419 but granular sub base as per grading I of table 400-1 of MORT&H specifications.

13.22. Supply, lay and compact clean, crushed, graded aggregates & granular material, premixed with water to a dense mass over prepared sub-base and consolidating it to specified thickness in accordance with item 406 (wet mix macadam) of MORT&H specifications. Include for spreading, compaction and drying to achieve a surface which is well closed, free from movement under compaction equipment and free from ridges,

cracks or loose materials all as per MORT&H requirements. The measurement shall be on cubic meter basis of the net area executed.

13.23. Tack coat - Supply and apply evenly a tack coat of rapid setting bituminous emulsion as per IS-8887 over the prepared sub base at the specified rate and as per item 503 of MORT&H specifications. Include for preparation of the surface by removing any dirt, loose and foreign materials etc. all as per MORT&H requirements. The measurement shall be on square meter basis of the net area executed.

13.24. Provide base course of Dense Graded bituminous macadam with grading 1 of table 500-10 having specified thickness and as per item 507 of MORT&H specification. Provision of paving bitumen (penetration grade 60/70) in the mix shall be at minimum 4.5% of the weight of the total mix. The measurement shall be on cubic meter basis of net area executed.

13.25. Supply, lay and compact lime stabilized soil over prepared surface to improve the sub grade. Addition of lime shall be at the rate of 5% of the dry weight of the soil. CBR value of the lime stabilized soil shall not be less than 10 for seven days curing & four days soaking. Rate to include for pulverization of excavated sub grade (excavation measured separately), mixing, watering, rolling, curing for 14 days, etc. complete, generally in accordance with item 402 of MORT&H specifications.

13.26. Supply & lay Bituminous Concrete of specified thickness on previously prepared bituminous course with modified bitumen confirming to PMB 40 as per item 509 of MORT&H specification. Provision of bitumen in the mix shall be at 5% to 7% of the weight of the total mix. The measurement shall be on cubic meter basis of net area executed.

13.27. Providing and laying 20mm thick premix asphalt carpet (Close-graded premix surfacing) Type B including using aggregate size 15 down size, bituminous binder material 60/70 grade @ 2 Kg per Sqm and rolling etc. complete as per clause no 512 of MoRTH specifications.

13.28. Provide & apply prime coat with approved bitumen emulsion having kinematic viscosity of 30-60 centistokes over prepared sub base at the rate of 0.75kg per square meter and as per item no. 502 of MORT&H specifications. Include for preparation of the surface by removing any dirt, loose and foreign materials, etc, all as per MORT&H specifications. The measurement shall be on square meter basis of net area executed.

13.29. Providing and laying 75 mm thick (compacted) premixed asphalt carpet using asphalt for tack coat at the rate of 3 kg / 1 sq. m. using crushed stone aggregates as per the gradation and bitumen at the rate of 3.28% by weight of total mix for plant and laid by paver finisher including consolidation by Power road roller and providing and operation plant, machineries and equipment, cost of fuel, oil, lubricant and labour charges etc. complete.

13.30. Providing and laying concrete kerb constructed with suitable kerb casting machine and of specified height, shape & size as per attached drawing, over 100 mm thick PCC in 1:4:8 at the edge of road surface. Rate to include for excavation, backfilling, cutting for gap/recess, providing precast element at the gap for outlet of road side water, immediate cement finish on cast in situ kerb, curing, etc. complete.

13.31. Same as item no, 14.10 but for NP3 pipes.

13.32. Providing & laying dry lean concrete sub base over previously prepared surface as per item no. 601 of MORT&H specifications and as per specified thickness. Include for spreading, compaction, curing and drying to achieve a surface which is well closed, free from movement under compaction equipment and free from ridges, cracks or loose materials all as per MORT&H requirements. The measurement shall be on cubic meter basis of the net area executed

13.33. Same as item no, 14.10 but for NP4 pipes.

13.34. Providing and laying premix seal coat 15 mm thick of asphalt (type B) of grade 80/100 at 0.70 Kg/Sq.M. and spreading grit, brushing, rolling, etc. complete as per clause No 513 of MoRTH specifications and as directed by Engineer In Charge.

13.35. Supplying and laying 50mm thick Bituminous macadam course including using aggregate size 45 down size, bituminous binder material 60/70 grade @ 5 Kg per Sqm. and rolling etc. complete as per clause no 505 of MoRTH specifications

5.3 Specification for MEP, Plants / Equipment and landscaping

Item No	Description of Item
	LANDSCAPING WORKS
1	Providing material and labour for Preparing the existing land / soil and removal of unserviceable soil, stone, unwanted vegetation and disposing of the same as directed.
2	Supplying and stacking of selected garden soil including leveling & dressing with all lead and lift unwanted vegetation and disposing of the same as directed.
3	Providing material and labour for Preparing the land by filling fertile / selected garden soil, including levelling & fine dressing and mixing manure / bio tech fertilizer / fertilizer and termite treatment as per requirement
4	Providing material and labour for Planting of hedge with sleeted hedge plant like Golden, Duranta, Red Bhaji or selected plant @ 45CM apart and maintenance up to six months
5	Providing material and labour for Planting of selected shrub trees like Ticoma, Nerium or other selected plant including preparing pit of size 30x30x30cm and filling with selected garden soil including manure, fertilizer and maintenance up to six month
	PLUMBING- WATER SUPPLY-DRAINAGE WORKS
A	**SANITARY INSTALLATIONS**
6	Providing and fixing water closet squatting Pan (Indian type W.C. Pan) size 580mm including Earthwork, bed concrete, foot rest, trap,GI inlet, Brass flush cock and Block tap. Vitreous China. (I) Long pattern = White colour. (Jaguar, Hindware,Cera, Parrywar Roca, Neycer Make)
7	Providing and fixing wash down water closet (European type W.C.Pan / Anglo Indian) with integral “P” or “S” traps including jointing the trap with soil pipe in canal mortar 1:1 (1-Cement:1-fine sand) providign and fixing seat cover W.C.) 32mm dia galvanized steel tube flush pipe etc.comp. Providing and fixing 12.5 Litres low level flushing cistern (Jaguar, Hindware,Cera, Parrywar Roca, Neycer Make.)
8	Providing and fixing Urinal of approved quality including connection with trap and with integral longitudinal flush pipe.(A) Squatting plate pattern white earthenware 550mm x 300mm. (Jaguar, Hindware,Cera, Parrywar Roca, Neycer Make.)
9	Providing and fixing flat back wash basin of 550 x 400mm size including C.I. or M.S. brackets fixing in wall C.P. brass work of 32mm diameter,,. fisher union of 32mm, pillar cock of 15mm dia, PVC waste pipe, PVC connection, brass stopcock of 15mm diameter etc. complete. Jaguar, Hindware,Cera, Parrywar Roca, Neycer Make.
10	Providing and fixing pillar tap capstan head, screw down high pressure with screws, shanks and back nuts. .(A) 15mm (Jaguar, Hindware,Cera, Parrywar Roca, Neycer Make.)
11	Providing and fixing Kitchen sink with C.I. or M.S. brackets, painted white including cutting holes in walls and making good the same including C.P. brass waste coupling and M.I. fisher union of 32mm dia and rubber plug for sink, PVC flexible waste pipe 32mm Dia . © Vitreous China Sink.(i) 600mm x 450mm x

	150mm size, etc complete as directed by engineer-in charge. (Jaguar, Hindware, Cera, Parrywar Roca, Neycer Make)
12	Providing and fixing 600mm x 450mm Beveled edge mirror (Modiguard/ Atul/ Saintgobain/ Asahi India Safety/Modi Float make) of superior glass mounted on 6 mm thick A.C. Sheet or plywood (Kitply, Anchor, Greenply, Duro, Century make) sheet and fixed to wooden plugs with C.P. Brass screws and washers
13	Providing and fixing 600mm x 120mm glass shelf with C.P. Brass brackets and guard rail complete fixed to wooden plug with C.P. brass screws
14	Providing and fixing screw down bib taps of following size. (B) Brass chromium plated screws down Bib Tap. (i) 15mm dia.Jaguar, Hindware, Cera, Parrywar Roca, Neycer Make.
15	Providina and fixing screw down stop tap of 15 mm dia
16	Providing and fixing cast iron spigot and socket soil, waste and ventilating pipes & fittings of the following nominal size (B) 75mm dia.
17	Providing and fixing cast iron spigot and socket soil, waste and ventilating pipes & fittings of the following nominal size © 100mm dia.
18	Providing and fixing cast iron (Spun) Nahni trap of the following nominal diameter of self-cleaning design with C.I. screwed down or hinged grating including cost of cutting and making good the walls and floor 100mm inlet and 50mm outlet.© 100mm dia.
19	Providing and fixing in position cowel went to pipes (ii) 100mm dia.
20	Providing and fixing in position cowel went to pipes (i) 75mm dia.
21	Providing, laying and jointing in true line and level 160 diameter U.P.V.C (Type B) conforming to IS 13592-1992 with one end plain and other end socketed with rubber ring, & fittings conforming to ISI 14735-1999 of approved make for drainage system pipe line, pipe shall be jointed with each other with rubber lubricant, pipe shall be fixed on wall using of PVC clamp of the size 160 mm diameter x 210 mm length x 196 mm height at every 2000 mm center to center or shall be concealed in walls as directed including necessary fittings such as bends, shoes etc. including testing of pipes and joints and jointed with adhesive solvent cement including cost of all materials. Make Astral, Finolex, Dutron, Prince.
22	Providing, laying and jointing in true line and level 110 diameter U.P.V.C (Type B) conforming to IS 13592-1992 with one end plain and other end socketed with rubber ring, & fittings conforming to ISI 14735-1999 of approved make for drainage system pipe line, pipe shall be jointed with each other with rubber lubricant, pipe shall be fixed on wall using of PVC clamp of the size 110 mm diamater x 149 mm length x 145 mm heigh at every 2000 mm center to center or shall be concealed in walls as directed including necessary fittings such as bends, shoes etc. including testing of pipes and joints and jointed with adhesive solvent cement including cost of all materials. Make Astral, Finolex, Dutron, Prince.
23	Providing & fixing jet spray/health faucet for 15mm dia. with 1.5 mt. PVC tube etc. complete.
24	Providing and fixing PVC SWR Nahni Trap IS 14735 for drain with jali of the following nominal diameter of self-cleansing design with C.I. Screwed down or hinged grating including the cost of cutting and making good the walls. (A) 100mm diameter
25	Providing and fixing to wall ceiling and floor 6.00 Kg / F Cm2 working pressure polythene pipes of the following outside Dia, Low density, complete with special flange compression type fittings, wall clips etc. ceiling and floor (D) 40mm
26	Providing and fixing to wall ceiling and floor 6.00 Kg / F Cm2 working pressure polythene pipes of the following outside Dia, Low density, complete with special flange compression type fittings, wall clips etc. ceiling and floor (E) 50mm

27	Providing & supplying 75mm outer diameter 6Kg / Sqm low density capacity PVC Pipe with necessary fitting etc. comp.
28	Providing and fixing PVC pipe of 6 Kg / F / Sq.M. Water pressure polythene pipe of 110mm inside dia. high density complete including fixing by clamps to wall including making food the wall ceiling and floor etc. comp.
B	**WATER SUPPLY**
29	Providing and fixing concealed center point to wall ceiling & floor CPVC (SDR 13.5) PIPE having National Sanitation Foundation (NSF) seal for potable water of following dia. nominal bore tube fittings and clamps including making good the wall, ceiling and floor etc. complete.[A] 15 mm. Make Astral, Finolex, Dutron, Prince.
30	Providing and fixing concealed center point to wall ceiling & floor CPVC (SDR 13.5) PIPE having National Sanitation Foundation (NSF) seal for potable water of following dia. nominal bore tube fittings and clamps including making good the wall, ceiling and floor etc. complete. [B] 20 mm. Make Astral, Finolex, Dutron, Prince.
31	Providing and fixing concealed center point to wall ceiling & floor CPVC (SDR 13.5) PIPE having National Sanitation Foundation (NSF) seal for potable water of following dia. nominal bore tube fittings and clamps including making good the wall, ceiling and floor etc. complete. [C] 25 mm. Make Astral, Finolex, Dutron, Prince.
32	Providing and fixing concealed center point to wall ceiling & floor CPVC (SDR 13.5) PIPE having National Sanitation Foundation (NSF) seal for potable water of following dia. nominal bore tube fittings and clamps including making good the wall, ceiling and floor etc. complete. [D] 32mm.Make Astral, Finolex, Dutron, Prince.
33	Providing and fixing concealed center point to wall ceiling & floor CPVC (SDR 13.5) PIPE having National Sanitation Foundation (NSF) seal for potable water of following dia. nominal bore tube fittings and clamps including making good the wall, ceiling and floor etc. complete. [E] 40mm. Make Astral, Finolex, Dutron, Prince.
34	Providing and fixing concealed center point to wall ceiling & floor CPVC (SDR 13.5) PIPE having National Sanitation Foundation (NSF) seal for potable water of following dia. nominal bore tube fittings and clamps including making good the wall, ceiling and floor etc. complete. [F] 50mm. Make Astral, Finolex, Dutron, Prince.
35	Providing erecting fixing double coated Syntex or equivalent P V C (ISI) Mark water Tank of required capacity each with all necessary fitting & connection etc. complete on terrace.
36	Providing and fixing Gun metal check or non-return full way wheel valve.(A) 15mm dia.
37	Providing and fixing Gun metal check or Non return full way wheel valve © 25mm dia.
38	Providing and fixing Gun metal check or Non return full way wheel valve (D) 32mm dia.
39	Providing and fixing Gun metal check or Non return full way wheel valve (E) 40mm dia.
40	Pro. & fix. Gun metal check or non-return full way wheel valve (i) 50mm dia. M. R. Gun metal wheel valve 50mm dia.
41	Providing and fixing ball cock of approved quality as directed (A) Copper metal 25mm dia.
42	Providing and fixing ball cock of approved quality as directed (B) Copper 50mm dia.
43	Providing and fixing C.I. double acting air valve of approved quality with bolts, nuts, rubber insertions etc. complete (The tail pieces, tapers etc if required will be paid separately)- 50 MM
44	Providing and fixing enclosed type water meter (bulk type) conforming to IS : 2373 and tested by Municipal Board complete with bolts, nuts, rubber insertions etc. (The tail pieces if required will be paid separately)80 mm.
C	**DRAINAGE**

45	Providing and laying (to level or slopes) and jointing with stiff mixture of Cement Mortar in proportion 1:1 Salt glazed stoneware pipes including testing of pipes and joints complete.(B) 150mm dia. (up to 10 ton)
46	Providing and laying cement concrete 1:4:8 (1-Cement:4-coarse sand:8- crushed stone aggregate 40mm nominal size) and curing complete excluding cost of formwork in (A) foundation and plinth S.W. pipes including bed concrete as per standard design
47	Filling available excavated earth (excluding rock) in trenches, plinth sides of foundations etc. in layers not exceeding 20cm. in depth, consolidating each deposited layer by ramming and watering
48	Pro. & fix. stoneware gully trap with C.I. grating brick masonry chamber & water tight C.I. cover with frame 300 x 300mm (inside) etc. with standard weight P type square mouth trap 10 x 100mm (with cost of cement)
49	Providing sock pit of 5.00 Cu.M. volume including excavating and filling brick bats with dry masonry work at top for 45cm. Height including covering the top with stone including providing vatas in C.M. 1:3 with finishing curing etc. complete as directed.
50	Providing material and labour for Constructing brick masonry chamber for underground C.I. Inspection chamber and bends with bricks having crushing strength not less than 35Kg. / Cm2 in C.M. 1:5 C.I. cover with frame (Light duty) 455mm x 610mm internal dimensions, total weight of cover with frame to be not less than 38 Kg. (Wt of cover 23 Kg. and Wt. of frame 15Kg.) R.C.C. top slab with 1:2:4 mix (1-Cement:2-coarse sand:4-graded stone aggregate 20mm size) foundation concrete 1:5:10 inside plaster 15mm thick with cement mortar 1:3 finished smooth with a floating coat of neat Cement on walls and bed concrete etc. complete. (I) Inside dimensions 455mm x 610mm and 450mm deep for single pipe line.
51	Providing material and labour for Constructing brick masonry chamber for underground C.I. Inspection chamber and bends with bricks having crushing strength not less than 35Kg. Cm2 in C.M. 1:5 C.I. cover with frame (Light duty) 455mm x 610mm internal dimensions total weight of cover with frame to be not less than 38Kg. (Wt. of cover 23 Kg.) and Wt. of frame 15Kg.) (R.C.C. top slab with 1:2:4 mix (1-cement: 2- coarse sand: 4-graded stone aggregate 20mm size) foundation concrete 1:5:10 inside plaster 15mm thick with cement mortar 1:3 finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete. (ii) Inside dimensions 500mm x 700 mm and 450mm deep for pipe line with one or two inlets. (up to 10 ton)
52	Providing laying (to level or slopes) and jointing reinforced concrete Light duty non-pressure pipes I.S. class NP2 of the following internal diameter with collars and butt ends prepared for collar joints including testing of joints complete.(B) 150mm (up to 10 ton)
53	Providing laying (to level or slopes) and jointing reinforced concrete Light duty non-pressure pipes I.S. class NP2 of the following internal diameter with collars and butt ends prepared for collar joints including testing of joints complete.© 250mm (up to 10 ton)
54	Providing laying (to level or slopes) and jointing reinforced concrete Light duty non-pressure pipes I.S. class NP2 of the following internal diameter with collars and butt ends prepared for collar joints including testing of joints complete.(D) 300mm (up to 10 ton)
D	**PLANTS & EQUIPMENTS:-**
	NSR ITEMS
55	Supplying and erecting approved make Instantaneous type mini water heater with 3ltr.capacity copper container housed in S.S. / fibre body insulated with glass wool / puff insulation and 3 Kw heating elements, adjustable thermostat 300 C to 850 C with set to operate at 850 C (+ /-60 C) auto reset indication lamps, thermal cut-out, safety valve fusible plug etc. (B)ABS plastic casing & puff insulation.(Make: Spherehot/ Racold/ Venus/ Voltas/ Usha Lexus/ Almonard /Bajaj)

56	Providing & fixing of Open Wall Hot & Cold Mixture , with all accessories to complete the item (Jaguar, Cera Make)
	DOMESTIC WATER RISER PUMPING SYSTEM
57	Supplying & fixing submersible pump set suitable for bore of 100 mm. dia. or more having three phase motor capacity not more than 5 H.P. with following capacity . (a) (25 stage) 120 to 125 LPM discharge at 155 to 120 mtrs. Head respectively suitable for 50 mm dia. Delivery pipe Cat.III Make
58	Supplying & erecting approved make motor control cubical panel [Star delta] made from 16G CRCA sheet duly epoxy powder painted inside and outside with hinged doors and locking with suitable size of ON - OFF isolator (AC 3 / 23 duty) main fuses. Digital volt and current meter (in a single unit) with micro controller based control unit and current sensing single phasing preventer electronic overload protection, over voltage (Programmable) protection and under voltage (Programmable) protection, prod less dry run protection programming facility for setting of all parameter like overload current, high voltage limit, low voltage limit, dry run limit with digital indication on seven segment LED display for any fault like over load, high voltage, low voltage, dry running single crimped, electronic star delta timer, feather touch start / stop push buttons to be erected on angle iron frame. Grouted on wall the contactors will be of L& T, Siemens, BCH make only) (a) DOL up to 5.0 H.P.
	DEWATERING WATER DRAIN PUMPS:-
	BORE WELL
59	Supplying submersible pump set suitable for bore of 150 mm. dia. or more having three phase motor capacity not more than 7.5 H.P. with following capacity .(a) (12 stage) 280 to 240 LPM discharge at 90 to 104 mtrs. head respectively suitable for 50mm dia. delivery pipeCAT. III
60	Supplying & erecting approved make 3 phase motor control cubical panel (Star - Delta) made from16 G. CRCA sheet duly painted with epoxy powder painted inside and outside with hinged doors and locking arrangement, consisting of suitable size of ON- OFF isolator (AC - 3/23 duty) main fuses, single phasing preventer cum water level. Guard (Complete unit), Toggle switch to bypass Single phase preventer cum WLG, indicating lamps for R- Y- B phases, over load relay, Automatic water level controller, Ammeter & Voltmeter each with two way selector switch incoming wires duly socket Crimped, Panel to be erected on angle iron frame grouted on wall as directed. Star Delta & main contractor, overload relay, thermal / Electronic Star delta cutoff timer, start - stop push buttons. The isolator overload relay & contactors of L& T, Siemens or Cuttler Hamer make only. Panel to be erected on angle iron frame ground on wall. (a) S/D up to 7.5 H.P.
61	Providing and erecting water cooler having storage capacity 80Ltr. & cooling capacity 40 Ltr.per hour @ an ambient temp of 450 C. The outlet temp. of the water should drop by 150 C within an hour, The water cooler should be comprising of hermetically sealed compressor, fan motor, condensing unit, water tank surrounded by evaporating coil, thermostats, relay etc. complete with necessary inlet & outlet connection. The body of water cooler will be made from Stainless Steel.
62	Supplying & erecting 5 stage single reverse osmosis water purification system with M.S. powder coated frame, pre filter housing with 'O' ring presediment filter GAC filter, carbon filter suitable buster DC pump capacity 80 psi, mention with 40 Osg inline type post carbon filter auto low & high pressure switches with following size of storage tank & LPH capacity & erected as directed with one year comprehensive maintenance guarantee. [B] 25 Ltr / Hr with 30 Ltr. S.S. Pressure Tank
	ELECTRICAL WORKS

63	**Point Wiring** Providing material and labour for Point wiring for Light / Bell with 2-1.5 sq.mm & earth wire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multi strand copper wires, in following type of pipe to be erected concealed in/ on surface on wall/ceiling complete with 6A Modular type switch / bell push & accessories and earth continuity of following type, erected on PVC / Metallic box, single mounting base frame covered with textured/metallic front plate modules erected on / in wall / ceiling as per pipe erected, with necessary Lamp holder/ceiling rose / H.D.Connector as directed. (a) with medium class Rigid PVC pipe and accessories- (Make Polycab, Finolex, Anchor, Havells, RRKabel, L&T)
64	Providing material and labour for Point wiring for secondary light point with 2-1.5 sq.mm & earthwire of 1.5 sq.mm (green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multi strand copper wires, in following type of pipe to be erected concealed in / flushed on wall/ceiling, complete with earth continuity and necessary connection with primary light with accessories erected on Metal / PVC box covered with 3 mm thick PC(Polycarbonet) / Acrylic sheet for open / concealed wiring with necessary Lamp holder / ceiling rose / H.D.Connector as directed. (a) with medium class Rigid PVC pipe and accessories (Make Polycab, Finolex, Anchor, Havells, RRKabel, L&T)
65	Providing material and labour for Point wiring for Two Way Controlled Light Point with 2-1.5 sq.mm & earth wire of 1.5 sq.mm (green) both are of .ISI marked 1.1 KV grade FRLS PVC insulated multi strand copper wires, in following type of pipe to be erected concealed in / flushed on wall/ceiling ,complete with 6A Modular type switches and following type of accessories erected on PVC / Metallic box, single mounting base frame covered with textured / metallic front plate modules erected on / in wall / ceiling as per pipe erected with necessary batten/angle holder or ceiling rose or H.D.Connector as directed. (a) with medium class Rigid PVC pipe and accessories (Make Polycab, Finolex, Anchor, Havells, RRKabel, L&T)
66	Providing material and labour for Point wiring for FAN with 2-1.5 sq.mm & earthwire of 1.5 sq.mm (Green) both are of .ISI marked 1.1 KV Grade FRLS PVC insulated multi strand copper wires, in following type of pipe to be erected concealed in / flushed on wall/ceiling complete with 6A Modular type switch and hum free EME four or more step type electronic fan regulator with separately mounted and accessories with earth continuity of following type erected on PVC / Metallic box, single mounting base frame covered with textured/metallic front plate modules erected on / in wall / ceiling as per pipe erected with necessary ceiling rose / H.D.Connector as directed. (a) with medium class Rigid PVC pipe and accessories (Make Polycab, Finolex, Anchor, Havells, RRKabel, L&T)
67	Providing material and labour for Point wiring for Looped Plug with 6A Modular type switch & 5 pin socket erected on PVC / Metallic box, single mounting base frame covered with textured / metallic front plate modules erected on / in wall / ceiling with following type accessories
68	Providing material and labour for Point wiring for Individual Plug with earth wire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multistrand copper wires, in following type of to be erected concealed in / on surface of wall / ceiling complete with Modular type switch & 5 pin Plug erected on PVC / Metallic box covered with appropriate front plate modules erected on / in wall / ceiling as per pipe erected with following type of accessories. [I] For 6A Plug with 2-1.5 sq.mm Cu. Wire (a) with medium class Rigid PVC pipe and accessories (Make Polycab, Finolex, Anchor, Havells, RRKabel, L&T)

69	Providing material and labour for Point wiring for Individual Plug with earthwire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multistrand copper wires, in following type of to be erected concealed in / on surface of wall / ceiling complete with Modular type switch & 5 pin Plug erected on PVC / Metallic box covered with appropriate front plate modules erected on / in wall / ceiling as per pipe erected with following type of accessories. [II] For 16A Plug with 2-2.5 sq.mm Cu. Wire (a) with medium class Rigid PVC pipe and accessories
70	Providing material and labour for Point wiring for Individual Plug with earth wire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multi strand copper wires, in following type of to be erected concealed in / on surface of wall / ceiling complete with Modular type switch & 5 pin Plug erected on PVC / Metallic box covered with appropriate front plate modules erected on / in wall / ceiling as per pipe erected with following type of accessories. [III] For 16A Plug with 2-4 sq.mm Cu. Wire (a) with medium class Rigid PVC pipe and accessories
71	Providing and erecting ISI mark Medium class RIGID PVC PIPES of following size complete to be erected on/in wall or ceiling erected with necessary PVC fittings & Junction boxes fixed with adhesive solution & Clamps with following dia of pipes, in approved manner as directed - 25 mm rigid PVC pipe Finolex, BEC, MK make.
72	Providing and erecting ISI mark Medium class RIGID PVC PIPES of following size complete to be erected on/in wall or ceiling erected with necessary PVC fittings & Junction boxes fixed with adhesive solution & Clamps with following dia of pipes, in approved manner as directed- 32 mm rigid PVC pipe Finolex, BEC, MK make.
73	Providing and erecting ISI mark Medium class RIGID PVC PIPES of following size complete to be erected on/in wall or ceiling erected with necessary PVC fittings & Junction boxes fixed with adhesive solution & Clamps with following dia of pipes, in approved manner as directed- 40 mm rigid PVC pipe. Make: Finolex, BEC, MK
74	**MAINS : (not for Point wiring)** Providing and erecting Mains with ISI marked, 1.5KV grade electrolyte multi stranded, annealed copper conductor with heat resistant PVC insulated conforms to IS 694, IEC - 227 erected in existing pipe of following size (Specifically for control panel, relays, power switchgears, motor starters & control wiring) with required size of copper lugs, nuts and bolts if required. (l) One wire 95.00 sq. mm and (f) One wire 10.00 sq. mm (4 nos. of 95 sq mm Cu. FRLS flexible wires with 2 nos 10 sqmm Cu. FRLS) Make: Polycab, Finolex, Anchor, Havells, RR Kabel.
75	Providing and erecting Mains with ISI marked, 1.5KV grade electrolyte multi stranded, annealed copper conductor with heat resistant PVC insulated conforms to IS 694, IEC - 227 erected in existing pipe of following size (Specifically for control panel, relays, power switchgears, motor starters & control wiring) with required size of- (f) One wire 10.00 sq. mm. (d) One wire 4.00 sq. mm (2 nos. of 10 sq mm Cu. FRLS flexible wires with 1 nos 4.0 sqmm Cu. FRLS) (Make Polycab, Finolex, Anchor, Havells, RRKabel, L&T)
76	Providing and erecting Mains with 1.1 KV grade FRLS PVC insulated ISI marked stranded Copper conductor wire in following type of pipe to be erected in / on wall / ceiling with 2.5 sq. mm copper conductor FRLS PVC insulated stranded wire of green colour for earth continuity of following size. (a) With medium class Rigid PVC pipe and accessories. (b) 2 wire 6 sq. mm (Make Polycab, Finolex, Anchor, Havells, RRKabel, L&T)

77	providing and erecting Mains with 1.1 KV grade FRLS PVC insulated ISI marked stranded Copper conductor wire in following type of pipe to be erected in / on wall / ceiling with 2.5 sq. mm copper conductor FRLS PVC insulated stranded wire of green colour for earth continuity of following size. (a) With medium class Rigid PVC pipe and accessories. (a) 2 wire 4 sq. mm (Make Polycab, Finolex, Anchor, Havells, RRKabel, L&T)
78	Providing and erecting Mains with 1.1 KV grade FRLS PVC insulated ISI marked stranded Copper conductor wire in following type of pipe to be erected concealed in /flushed on wall/ceiling, with 1.5 sq. mm copper conductor FRLS PVC insulated stranded wire of green colour for earth continuity of following size. (a) with medium class Rigid PVC pipe and accessories.(b) 2 wire 2.5 sq. mm (Make Polycab, Finolex, Anchor, Havells, RRKabel, L&T)
79	Providing and erecting Mains with 1.1 KV grade FRLS PVC insulated ISI marked stranded Copper conductor wire in following type of pipe to be erected concealed in /flushed on wall/ceiling, with 1.5 sq. mm copper conductor FRLS PVC insulated stranded wire of green colour for earth continuity of following size. (a) with medium class Rigid PVC pipe and accessories.(a) 2 wire 1.5 sq. mm (Make Polycab, Finolex, Anchor, Havells, RRKabel, L&T)
80	**Distribution Board** Supply, Assembling, grouting, leveling Connecting & testing, commissioning of D.B of IP 43 of specified make. **Distribution Board-VTPN** Supply, Erecting, testing and commissioning of only VTPN D.B. with space for FPMCCB / FPMCB as incoming and 12 TPMCB / SPMCB as outgoing per phase (i.e. 12 way VTPN D.B.) Make: Make: ABB, L&T, Siemens, Schneider, Electric, Legrand,GE, Hager.
81	Supply, Erecting, testing and commissioning of only VTPN D.B. with space for FPMCCB / FPMCB as incoming and 12 TPMCB / SPMCB as outgoing per phase (i.e. 8 way VTPN D.B.) Make: ABB, L&T, Siemens, Schneider, Electric, Legrand,GE, Hager.
82	**Distribution Board-TPN** Supply, Erecting, testing and commissioning of only TPN D.B. PPI type with space for FPMCB as incoming and space for DPELMCB and 12 SPMCB as outgoing per phase (i.e. 16 way per phase D.B.)Make: ABB, L&T, Siemens, Schneider Electric, Legrand,GE, Hager.
83	Supply, Erecting, testing and commissioning of only TPN D.B. PPI type with space for FPMCB as incoming and space for DPELMCB and 8 SPMCB as outgoing per phase (i.e. 12 way per phase D.B.) Make: ABB, L&T, Siemens, Schneider, Electric, Legrand,GE, Hager.
84	Supply, Erecting, testing and commissioning of only TPN D.B. PPI type with space for FPMCB as incoming and space for DPELMCB and 4 SPMCB as outgoing per phase (i.e. 8 way per phase D.B.) Make: ABB, L&T, Siemens, Schneider, Electric, Legrand,GE, Hager.
85	Supply, Erecting, testing and commissioning of only TPN D.B. PPI type with space for FPMCB as incoming and space for DPELMCB and 2 SPMCB as outgoing per phase (i.e. 6 way per phase D.B.) Make: ABB, L&T, Siemens, Schneider, Electric, Legrand,GE, Hager.
86	**Distribution Board-SPN** Supply, Erecting, testing and commissioning of SPN D.B. PPI type with space for DPELMCB as incoming and 12 SPMCB as outgoing per phase (i.e. 16 way D.B.) Make: ABB, L&T, Siemens, Schneider, Electric, Legrand,GE, Hager.
87	Supply, Erecting, testing and commissioning of SPN D.B. PPI type with space for DPELMCB as incoming and 8 SPMCB as outgoing per phase (i.e. 12 way D.B.) Make: ABB, L&T, Siemens, Schneider, Electric, Legrand,GE, Hager.

88	Supply, Erecting, testing and commissioning of SPN D.B. PPI type with space for DPELMCB as incoming and 4 SPMCB as outgoing per phase (i.e. 8 way D.B.) Make: ABB, L&T, Siemens, Schneider, Electric, Legrand,GE, Hager.
89	**MCB** **All MCB's, ELMCB's, ELCB's should be of 10 KA only** Providing material and labour for Miniature circuit breaker single pole 6A to 32A suitable to operate on 240 V A.C. system and having breaking capacity 10 KA to be erected in existing box. confirming to IS 8828/1996 with ISI Mark (Make: MDS(Legrand), Schnieder, Siemens , GE,ABB,Hager)
90	Providing & erecting 240 V MCB double pole switch for motor & inductive load (C Curve) having 10 KA breaking capacity & confirms to IS : 8828 in existing box having following capacity, (A) 6 to 32 Amp. (Make: MDS(Legrand), Schnieder, Siemens , GE,ABB,Hager)
91	Providing & erecting approved make 240 V MCB double pole switch for motor & inductive load (C Curve) having 10 KA breaking capacity & confirms to IS : 8828 in existing box having following capacity, (B) 40 Amp.(Make: MDS(Legrand), Schnieder, Siemens , GE,ABB,Hager)
92	Providing material and labour for Approved make ELCBs / RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 6 KA and suitable for operation on single phase 240 V. having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component. For following Max. Rating erected as directed (i) 25 Amps.DP. (Make- Standard, ABB, C&S , Indo-Asian)
93	Providing material and labour for Approved make ELCBs / RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 6 KA and suitable for operation on single phase 240 V. having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component. For following Max. Rating erected as directed (ii) 40Amps. DP. (Make- Standard, ABB, C&S , Indo-Asian, hager, siemens)
94	Providing material and labour for Approved make ELCBs / RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 6 KA and suitable for operation on single phase 240 V. having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component. For following Max rating erected as directed (iii) 63 Amps. DP. (Make- Standard, ABB, C&S , Indo-Asian hager, siemens)
95	Providing material and labour for Approved make MCB/ELCBs / RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 6 KA and suitable for operation on three phase 415V. Having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component. For following Max. Rating erected as directed 6 to 32 A TP MCB (Make- Standard, ABB, C&S, Indo-Asian hager, siemens).
96	Providing material and labour for Approved make MCB/ELCBs / RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 6 KA and suitable for operation on three phase 415V. Having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component. For following Max. Rating erected as directed 40 A TP MCB (Make- Standard, ABB, C&S, Indo-Asian hager, siemens).
97	Providing and supplying approved make MCB/ELCBs / RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 6 KA and suitable for operation on three phase 415 V. having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component. For following Max. Rating erected as directed 63 A TP MCB (Make- Standard, ABB, C&S , Indo-Asian hager, siemens).

98	Providing & supplying approved make 415 V MCB Four Pole for Motor & Inductive Load (C Curve) having 10KA breaking capacity & confirms to IS :8828 in existing box having following capacity (a) 6 to 32 Amp. (Make: MDS(Legrand), Schnieder, Siemens , GE,ABB,Hager)
99	Providing & supplying 415 V MCB Four Pole for Motor & Inductive Load (C Curve) having 10KA breaking capacity & confirms to IS :8828 in existing box having following capacity (b)40 Amp. (Make: MDS(Legrand), Schnieder, Siemens , GE,ABB,Hager)
100	Providing & supplying 415 V MCB Four Pole for Motor & Inductive Load (C Curve) having 10KA breaking capacity & confirms to IS: 8828 in existing box having following capacity ©63 Amp. (Make: MDS(Legrand), Schnieder, Siemens , GE,ABB,Hager)
101	Providing and fixing following rating and breaking capacity MCCBs in existing cubicle panel board including drilling holes in cubicle panel make connections etc or as directed .125 Amp. FP MCCB (16 KA) with Spreader Link (Make: L&T, Siemens, Scheneider, ABB, GE, and Legrand.
102	Providing & erecting Dual type Channel Timer in the existing cubicle panel boards/ Distribution boards or as directed. (Make: Theben / L&T/Mitsubishi/ Siemens).
103	Providing & erecting, 25 Amp Double Pole Dinrail Mounted Contactor in the existing cubicle panel board including drilling holes in cubicle panel make connections etc. or as directed (make:- Siemens, MG, Mitsubishi, MDS, L&T)
104	Providing & erecting 40 Amp Double Pole, Dinrail Mounted Contactor in existing cubicle panel board including drilling holes in cubicle panel make connections etc. or as directed(make:- Siemens, MG, Mitsubishi, MDS, L&T)
105	Providing & erecting 25 Amp Four Pole Dinrail Mounted Contactor in existing cubicle panel board including drilling holes in cubicle panel make connections etc. or as directed(make:- Siemens, MG, Mitsubishi, MDS, L&T)
106	Providing & erecting 40 Amp Four Pole Dinrail Mounted Contactor in existing cubicle panel board including drilling holes in cubicle panel make connections etc. or as directed (make:- Siemens, MG, Mitsubishi, MDS, L&T)
107	Providing & erecting 63 Amp Four Pole Dinrail Mounted Contactor in existing cubicle panel board including drilling holes in cubicle panel make connections etc or as directed (make:- Siemens, MG, Mitsubishi, MDS, L&T)
108	Supplying, Erecting, Testing and Commissioning of IP65 Polycarbonate enclosure for DP MCB. Make:Havells, Henzel, Schenieder, Siemens, Anchor.
109	SITC of IP65 Polycarbonate enclosure for FP MCB
110	Providing & erecting 125 Amp. MCCB (16 KA) with the Enclosure & Both Side Cable end Box with the Rotary Handle with Spreader Link with On off Indicating Lamp
111	Providing & erecting 160 Amp. MCCB (16 KA) with the Enclosure & Both Side Cable end Box with the Rotary Handle with Spreader Link with On off Indicating Lamp
112	Providing & erecting 16A x 250 Volt single phase Power socket outlet point having IP rating of IP: 65 at convenient location with MCB.for outdoor duty.
113	Providing and erecting 32A x 250 Volt single phase Power socket outlet point having IP rating of IP: 65 at convenient location with MCB.for outdoor duty.

114	Providing and Erecting 32A x 415 Volt three phase Power socket outlet point having IP rating of IP: 65 at convenient location with MCB.for outdoor duty.
115	**Cable Trench** Providing material and labour for Making trench in soft soil of suitable width of 90 cms deep for laying cable or locating the fault all over the run and backfilling the same and making the surface as normal ground.
116	Providing material and labour for Covering of cable with second class bricks or cement tiles laid cover the cable crosswise & also on both sides with covering of 7. 5 Cms. layer of sand above & below cable (16 bricks per meter)
117	Providing material and labour for Construction of brick masonry pulling chamber 450 mm x 450 mm inside clear size and depth up to 0.6 meter with 350 mm thick masonry in cement mortar proportion 1:5, cement finish cement plaster in CM proportion of 15 mm thickness from inside with 150 mm thick PCC at bottom with top slab minimum 200 mm thickness in M20 grade with reinforcement. The rate shall be inclusive of providing and fixing frame and 450 mm dia cover of FRC for the Heavy Duty. Rate also inclusive of excavation and back filling & clearing the site by removing debris & Shifting of the debris & making site good As per the Instruction of the Engineer In charge complete in all respect.
118	Supply, Installation, Testing, Laying, Commissioning of following 1100 volt grade XLPE insulated PVC sheathed aluminum / Copper conductor armored cables as per (IS:7098)(I)-88 ISI marked & specification in trenches, cable trays, ducts, over bed of sand, clamped to wall with suitable clamps including, saddles fixing bolts, connecting testing and commissioning with identification tags at every 10 mtr. & Both ends. With All the fixing accessories, excavation Back filling & Cable protection with Bricks as per the drawing (If required). 25 sq.mm x 4 c Al. XLPE Arm. Cable (Make: Polycab, Finolex, RR Kabel, Havells)
119	Supply, Installation, Testing, Laying, Commissioning of following 1100 volt grade XLPE insulated PVC sheathed aluminum / Copper conductor armored cables as per (IS:7098)(I)-88 ISI marked & specification in trenches, cable trays, ducts, over bed of sand, clamped to wall with suitable clamps including, saddles fixing bolts, connecting testing and commissioning with identification tags at every 10 mtr. & Both ends. With All the fixing accessories, excavation Back filling & Cable protection with Bricks as per the drawing (If required). 10 sq.mm x 4 c Al. XLPE Arm. Cable (Make: Polycab, Finolex, RR Kabel, Havells)
120	Supply, Installation, Testing, Laying, Commissioning of following 1100 volt grade XLPE insulated PVC sheathed aluminum / Copper conductor armored cables as per (IS:7098)(I)-88 ISI marked & specification in trenches, cable trays, ducts, over bed of sand, clamped to wall with suitable clamps including, saddles fixing bolts, connecting testing and commissioning with identification tags at every 10 mtr. & Both ends. With All the fixing accessories, excavation Back filling & Cable protection with Bricks as per the drawing (If required). 6 sq.mm x 3 c Al. XLPE Arm. Cable (Make: Polycab, Finolex, RR Kabel, Havells)
121	Supplying and erecting Flexible PVC insulated multistrand multicore 1.1 kv grade ISI marked copper wires of following size to be erected as directed. e) 1.50 Sq.mm 3 core round PVC sheathed (Make: Polycab, Finolex, RR Kabel, Havells)
122	Supplying and erecting Flexible PVC insulated multistrand multicore 1.1 kv grade ISI marked copper wires of following size to be erected as directed.

	h) 2.50 Sq.mm 3 core round PVC sheathed (Make: Polycab, Finolex, RR Kabel, Havells)
	Cable Termination SITC of Cable end termination of the following XLPE insulated PVC sheathed aluminum/copper conductor armored cables of 1100 volt grade including supplying and fixing of bimetallic Long neck crimping lugs, double compression type Brass glands with earthing.
123	Providing material and labour for Solderless crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete without going tails, insulating tape etc for following size of cables. .25 sq.mm x 4 c Al. cable (make: Dowells, Johnson, Gripwell, Comex, Comed, Hex)
124	Providing material and labour for Solderless crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete without going tails, insulating tape etc for following size of cables. .16 sq.mm x 4 c Al. cable (make: Dowells, Johnson, Gripwell, Comex, Comed, Hex)
125	Providing material and labour for Solderless crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete without going tails, insulating tape etc for following size of cables. .10 sq.mm x 4 c Al. cable (make: Dowells, Johnson, Gripwell, Comex, Comed, Hex)
126	Providing material and labour for Solderless crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner.Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete without going tails, insulating tape etc for following size of cables. .6 sq.mm x 3 c Al. XLPE Arm. Cable (make: Dowells, Johnson, Gripwell, Comex, Comed, Hex)
127	Providing material and labour for Solderless crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete without going tails, insulating tape etc for following size of cables. (A) 1.5/ 2.5/4/6 Sq.mm (make: Dowells, Johnson, Gripwell, Comex, Comed, Hex)
128	Providing material and labour for Solderless crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete without going tails, insulating tape etc for following size of cables 4 / 6 Sq. mm x 3 / 4 core round flexble wire or Similar dia wire (make: Dowells, Johnson, Gripwell, Comex, Comed, Hex)
129	**MAIN LT PANEL** Incoming MCCB 'A'

	(For Supply Company Power supply) 200 amps FP MCCB (25 KA) with following accessories: 1 Sets LED type Phase indicating light shall be protected by 2 amps MCB's. : 3 nos. MCCB ON / OFF / TRIP indicating lights with control MCB's: 3 nos. 3 Nos. of Digital type 0-200 / 5 amps CTR digital ammeter with 3 nos 200 / 5 amps, 15 VA Class I CT's. Digital type 0-500 Volt digital voltmeter with inbuilt selector switch & shall be protected by 2 amp TP MCB's - 1 no. Load Manager of Schneider make PM 210 with RS 485 connectivity with 3 nos. of Class 1, 200 / 5 Amp. CT of 15 VA - 1 no. Incoming MCCB 'B' (For DG Set Power supply) 200 amps FP MCCB (25 KA) with following accessories: 1 Sets LED type Phase indicating light shall be protected by 2 amps MCB's. : 3 nos. ACB / MCCB ON / OFF / TRIP indicating lights with control MCB's: 3 nos. 3 Nos. of Digital type 0-200 / 5 amps CTR digital ammeter with 3 nos 200 / 5 amps, 15 VA Class I CT's. Digital type 0-500 Volt digital voltmeter with inbuilt selector switch & shall be protected by 2 amp TP MCB's - 1 no. Load Manager of Schneider make PM 210 with RS 485 connectivity with 3 nos. of Class 1, 630 / 5 Amp. CT of 15 VA - 1 no.
	Bus Bars 200 amps 4 pole (36 KA) Copper tinned bus bars with color coded heat shrinkable insulating sleeves. ATS : Breaker 'C' 200 amps FP Auto Transfer switch with overlapping neutral of ASCO make 300 series Outgoing All the MCCB outgoing should be provided with RYB - On - Off I/L & 1 no. Digital type A meter with inbuilt selector switch. 100 amps 4 pole MCCB (16 KA) : 4 No. 63 amps 4 pole MCB (10 KA) : 7 No. 32-40 amps 4 pole MCB (10 KA) : 8 No. 32-40 amps 2 pole MCB (10 KA) : 6 No. Notes: ALL THE INCOMING BREAKER & BUS COUPLER SHOULD BE INTERLOCKED WITH EACH OTHER WITH HARD WIRING. 1.5 KVA single Phase UPS of APC make with 1 hr. battery backup should be Provided for this Panel in the Panel BREAKER SHOULD BE CAPABLE TO SWITCHED 'ON' & 'OFF' AUTOMATICALLY AS PER POWER AVAILABILITY. AS PER DETAIL SPECIFICATION. All outgoing feeders shall have suitable range of followings a. Three LED type Phase indicating lamps shall be protected by 2 amps SP MCBs. All breakers shall be electrically/ mechanically interlocked as per schematic diagram. All MCCB's shall be suitable for ICS = ICU breaking capacity. All ACB's shall be suitable for 50 kA (ICU=Ics=Icw for 1 sec.) 415 / 110 V suitable rating control transformer shall be provided for aux. Control supply Wiring with space heater, thermostat and control MCB's shall be provided all vertical sections of main LT panel. All MCCB's feeders shall be provided with built-in microprocessor release unit with earth fault protection and time delay.

	All incoming as well as outgoing feeders shall have pad locking facility. Suitable danger board shall be provided. All bus bar section / backside panels shall have pad locking facility and hinged type door. Panel should be as per SLD & Specifications
130	**APFCR Panel - 50 KVAR** 1) Automatic & Manual mode APFCR panels. It shall provide rated 50 KVAR in suitable nos. of steps & of suitable rating of capacitors, as per specification. The panel shall also comply with following : a) 100 Amps FP MCCB incomer with 16KA breaking capacity to be provided : B) Digital type 0-100 / 5 amps CTR digital ammeter with inbuilt selector switch with 3 nos 630 / 5 amps, 15 VA Class I CT's. c) Digital type 0-500 Volt digital voltmeter with inbuilt selector switch & shall be protected by 2 amp TP MCB's 2) Microprocessor 8 stage IPF controller shall continuously monitor all three phases and displays various Electrical Parameters like voltage, input current, capacitive current, KVA demand,KW, Power Factor, self-diagnostic error code indication with printout facility of the above with RS 232C port. Controller should mounted on the front side of the panel. 3) Thyristor based Zero cross over & Fast response time of 'ON' capacitors 40-60 milliseconds. 4) MCCBs and links of the proper rating to be used for grouping the capacitor banks. 5) Necessary control and firing card with proper wiring and lugs of the required rating to be provided. 6) Heavy duty exhaust fans to be provided for cooling 7) LED indication for number of capacitor banks 'ON'. 8) LED indication of Power Factor lagging or leading. 9) The APFC system shall be provided with following Protections : a) Over voltage. b) Voltage imbalance. c) Over temperature-system should be in standby mode and automatically restart after above condition restored. d) Earth leakage. Capacitor automatic control panel (50 KVAR) as described above & Should be as per SLD. & Specification (Make: ABB, L&T, Siemens, Schneider, Advance Panel, Adlec, Bhopal Switchgear Pvt Ltd, Tricolite, Sudhir, SPE Electotech).

131	**UPS Out Going Panel:** 63 amps FP MCB (10 KA) with following accessories: 1 Sets LED type Phase indicating light shall be protected by 2 amps MCB's. : 3 nos. ACB / MCCB ON / OFF / TRIP indicating lights with control MCB's : 3 nos. 3 Nos. of Digital type 0-63 / 5 amps CTR digital ammeter with 3 nos 63 / 5 amps, 15 VA Class I CT's. Digital type 0-500 Volt digital voltmeter with inbuilt selector switch & shall be protected by 2 amp TP MCB's - 1 no. Load Manager of Schneider make PM 210 with RS 485 connectivity with 3 nos. of Class 1, 63 / 5 Amp. CT of 15 VA - 1 no. Bus Bars 63 amps 4 pole Copper tinned bus bars with color coded heat shrinkable insulating sleeves. Outgoing 6 to 32 amps 4 pole MCB (10 KA) : 7 No. 6 to 32 amps 2 pole MCB (10 KA) : 3 No. Panel should be as per SLD & Specifications (Make: ABB, L&T, Siemens, Schneider, Advance Panel, Adlec, Bhopal Switchgear Pvt Ltd, Tricolite, Sudhir, SPE Electotech).
132	**125 KVA DG AMF Panel :** Providing & erecting approved make AMF control panel suitable for following size of 3 phase, 415 V., 50 cycles, A.C. diesel generating set complete of scope as detailed below: 1) Power module: A pair of electromechanically interlocked contactors (for mains & generator) Overload relay for generator contactor Neutral contactor for mains and generator Power socket for connections. 2) Control and metering module: Line voltage monitor. Generator voltage monitor Ammeter 3 items attempt start facility. Air circuit breakers/MCB/MCCB of suitable rating for auto/manual operation. Auto/manual switch. Emergency stop push buttons. Manual start push button. Frequency meter. Engine hour meter. Two earthing studs. 3) Protection module: The engine shutdown in the unlikely event of Low lube oil pressure High cylinder head temperature. V belt failure. 4) Indicators with alarm Load on generator. 5) Indicators Load on mains Engine fails to start. Emergency stop battery charger. The AMF Panel of following capacity AMF Control Panel for100 KVA/125 KVA3 phase DG Set (Make: Sudhir Gensets, Sterling Generators, Goel Power
133	**Light Fixtures & Fans** Supplying and erecting LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA polyester powder coated and high U.V. & corrosion resistance with diffuser and/or Polycarbonate optics with company mark/name 120 to 300 V,Power Factor more than 0.9, THD < 10 %, CCT 4000 K to 6500K, Uniformity ratio >0.7, Luminaire efficacy> 85 lumens/watt , LED driver efficiency > 85 % CREE / OSRAM / PHILIPS Lumileds / NICHIA / SEOUL/Bridgelux(U.S.A.) make LED used for luminaire. (Each fitting required LM-79 & LM-80 Certificates) (A) Tube Light with integral/ non-integral driver (d) 20-22 Watts, Surge - 4KV,IP-20, 4 feet

134	SITC of 4' LED 1X20watt single piece powder coated CRCA sheet steel LED batten with system lumen output of 1650 lumens. The luminaries should have cool daylight color temperature of 6500K & CRI>80 with 40K burning hours life & 70% lumen maintenance. All Photometrical & Electrical parameters must be compliance of LM79-08 test report from third party equivalent make of Philips TMC501 1X20W LED
135	Providing and fixing 1 x 11 watt mirolta type light fixture with lamp Philips make FMS200/111
136	Supplying and erecting LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA polyester powder coated and high U.V. & corrosion resistance with diffuser and/or Polycarbonate optics with company mark/name 120 to 300 V,Power Factor more than 0.9, THD < 10 %, CCT 4000 K to 6500K, Uniformity ratio >0.7, Luminaire efficacy> 85 lumens/watt , LED driver efficiency > 85 % CREE / OSRAM / PHILIPS Lumileds / NICHIA / SEOUL/Bridgelux(U.S.A.) make LED used for luminaire. (Each fitting required LM-79 & LM-80 Certificates) © Square/ Circular Surface/Recessed Mounted Downlight with provision for spring loaded mounting clips complete. (b) 10-15 watts, Surge-4 KV
137	Supplying and erecting LED street light / Flood light fittings with High power White LEDs wattage of 1Watt and above assembled on single MCPCB, efficiency more than 130 lm/w and corrosion free High pressure die cast aluminum housing with smooth finish powder coated and heat sink extruded aluminum with diffuser and Polycarbonate optics/ lenses with company mark/name engraved or embossed. 120 to 300 V,Power Factor more than 0.95, THD < 10 %, CCT 5000 K to 5700K, Uniformity ratio >0.45, Luminaire efficacy> 85 lumens/watt . LED driver efficiency > 85 %. CREE / OSRAM / PHILIPS Lumileds / NICHIA / SEOUL/ BridgeLux (U.S.A.) make LED used for luminaire. (Each fittings required LM-79 & LM-80 certificates) (B) Flood Light (IP-65), Surge -4KV (c) Above 70 watts to 90 watts
138	Supplying and erecting LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA polyester powder coated and high U.V. & corrosion resistance with diffuser and/or Polycarbonate optics with company mark/name, 120 to 300 V,Power Factor more than 0.9, THD < 10 %, CCT 4000 K to 6500K, Uniformity ratio >0.7, Luminaire efficacy> 85 lumens/watt , LED driver efficiency > 85 % CREE / OSRAM / PHILIPS Lumileds / NICHIA / SEOUL/Bridgelux(U.S.A.) make LED used for luminaire. (Each fitting required LM-79 & LM-80 Certificates) (G) Spot Light , 5W, 425 Lumens, Surge-2KV (a) 5/7 Watts
139	SITC of Up / Down light of Philips make DCP 721 with all kind of accessories, Lamp, Control gear, complet in all respect as per detail specification
140	Supplying and erecting LED street light / Flood light fittings with High power White LEDs wattage of 1Watt and above assembled on single MCPCB, efficiency more than 130 lm/w and corrosion free High pressure die cast aluminum housing with smooth finish powder coated and heat sink extruded aluminium with diffuser and Polycarbonate optics/ lenses with company mark/name engraved or embossed 120 to 300 V,Power Factor more than 0.95, THD < 10 %, CCT 5000 K to 5700K, Uniformity ratio >0.45, Luminaire efficacy> 85 lumens/watt . LED driver efficiency > 85 %. CREE / OSRAM / PHILIPS Lumileds / NICHIA / SEOUL/ BridgeLux (U.S.A.) make LED used for luminaire. (Each fittings required LM-79 & LM-80 certificates) (D) Post Top Lantern LED fitting comprises of Copper dust finish cast

	aluminum spigot and spun aluminum canopy fixed with opal polycarbonate, pipe arrangement for vertical mounting,open construction driver and accessories wired upto terminal block.(a) 40W
141	Supplying & erecting single phase approved make industrial exhaust fan suitable for medium duty ring mounted low noise operation suitable for medium duty having following dia size and maximum speed in RPM [A] 305 mm dia 900 RPM (Make: Usha, Crompton, GE, Bajaj, Havells)
142	Providing & erecting Approved make Power Saving 50 Watt Ceiling Fan with double ball bearing ISI mark with Condenser 230 volt A.C. 50 Hz 1200 mm sweep complete having 3 blades with aluminum blades with , canopy & 30 cms down rod erected with 24/ 0.2, 3 core flexible wire with earthing. (Make shall be approved by Engineer in charge) (Make- Usha, Crompton, Bajaj, Orient)
143	Supplying and erecting 19 / 20 mm. nominal bore Medium Class M.S. Pipe down rod erected duly painted for fan complete with necessary 24/ O.20, 3 core flexible wire with earthing.
144	**Earthing** Supplying & erecting funnel type earthing having earth plate of following size burred in specifically prepared earth pit 3 mtr below ground with 40 kg. charcoal and salt with alternate layers of charcoal & salt, 20mm.dia. G.I. pipe with Funnel with a wire mesh for watering & bricks masonry block, C.I. Cover complete as per para 7.3 of IS 3043 with necessary length of double Galvanised Iron / copper earth wire No 6 SWG bolted with lug to the plate and covered in 12 mm dia. G.I. pipe 2.5 mtr long complete connected to the nearest switch gear with end socket as per direction & duly tested by earth tester confirming to IS (As per drawing) with following specification 60 x 60x 0.315 cms. Copper earth Plate
145	Supplying & erecting funnel type earthing having earth plate of following size burred in specifically prepared earth pit 3 mtr. below ground with 40 kg. charcoal and salt with alternate layers of charcoal & salt, 20mm.dia. G.I. pipe with Funnel with a wire mesh for watering & bricks masonry block, C.I. Cover complete as per para 7.3 of IS 3043 with necessary length of double Galvanised Iron / copper earth wire No 6 SWG bolted with lug to the plate and covered in 12 mm dia. G.I. pipe 2.5 mtr long complete connected to the nearest switch gear with end socket as per direction & duly tested by earth tester confirming to IS (As per drawing) with following specification 45 x 45 x 0.35 cms. C.I. earth plate
146	Supplying & erecting in earthpit of minimum bore dia. 225mm size ASH or approved make Safe Earthing Electrode consisting Pipe-in-Pipe Technology as per IS 3043-1987 made of corrosion free G.I.Pipes having Outer pipe dia of 80 mm having 80-200 Micron galvanising, Inner pipe dia of 40 mm having 200-250 Micron galvanising, connection terminal dia of 14 mm with constant ohmic value surrounded by highly conductive compound with high charge dissipation suitable for following type of applications. For Electrical Installation covering Transformer Neutrals, Lightning arrester Earthing, A.C.Plant & Sensitive Computer System(like Automation, SCADA)i.e. independent Earthing located in other than normal soil i.e. Soft Rock, Marshy Soil etc.. -Length of Pipe: 3 Mtrs. -Back filling Compound :2 nos Bags of 25 Kg.

147	**Earth wire/strips :** Supply and laying cu. earthing strips for interconnecting the earthing stations, panels, DB's etc. in built up trenches, on walls/ceiling, buried in ground generally as specified and shown on drawings complete with : fixing accessories Corrosion protection of buried conductors with bituminous coating and covered with PVC tapes. Providing and erecting HOT deep Galvanized strip iron wire 8 to 16 S.W.G.
148	Supply and laying cu. earthing strips for interconnecting the earthing stations, panels, DB's etc. in built up trenches, on walls/ceiling, buried in ground generally as specified and shown on drawings complete with : fixing accessories Corrosion protection of buried conductors with bituminous coating and covered with PVC tapes.50 x 6 mm cu. Tape
149	Supply and laying cu. earthing strips for interconnecting the earthing stations, panels, DB's etc. in built up trenches, on walls/ceiling, buried in ground generally as specified and shown on drawings complete with : fixing accessories Corrosion protection of buried conductors with bituminous coating and covered with PVC tapes.32x 6 mm cu. Tape
150	Supply and laying of Earth Link: 40mm x 6 mm earth link fixed by necessary screws on wall.
151	SITC of Water Tight Junction Box of Hensel make Cat. No. KG9003IN With necessary clamp for mounting of the J.B. (All the cable / wire connections to the JB shall be with the Water tight Glands only)
152	Providing & erecting main Distribution (MDF) indoor type, back mounted frame.-20 pair Krone type tag block
153	Providing & erecting main Distribution (MDF) indoor type, back mounted frame.-10 pair Krone type tag block
154	**PVC & HDPE Conduits** Supply & laying of 25 mm dia. rigid PVC conduit of 2.0-2.2 mm thick heavy gauge with all accessories.
155	Supply & laying of 40 mm dia. rigid PVC conduit of 2.1 -2.3 mm thick medium gauge with all accessories.
156	Telephone Point Wiring Supply and laying of specified make 0.51 mm dia Tinned copper telephone wire of specified make to be done in prelaid PVC pipe of 25 mm dia/raceway of specified make, but without the cost of pipe or raceway. (the wire is to be drawn from Krone connector of respective area to outlet point) 5 pair telephone wire
157	**Telephone Outlet Point** Providing following type of Modular Type Accessories mounted with pvc / metallic box, single mounting base frame covered with textured / metallic front plate, modules erected with necessary connection. As desired by Engineer In charge Two Pin/RJ-11 Telephone Socket
158	Providing following type of Modular Type Accessories mounted with pvc / metallic box, single mounting base frame covered with textured / metallic front plate, modules erected with necessary connection. As desired by Engineer In charge Modem Jack for Computer Open RJ-45
159	SITC of Cat6 UTP 12 PowerCat 6A Shielded (Diecast Jacks) Patch Panel Loaded with Information Outlets , 1U with lables- CAT-6A standards Patch panel rack mount with lable & quick mounting for Data make of of make Legrand / Molex/ Systimax / Panduit / Siemon
160	SITC OF PowerCat 6A FTP Patch Cord, 1mtr - for Data Points
161	SITC OF 6 core outdoor armoured 50/125 Multimode, OM3 - UniTube

162	SITC OF 24 port , 1U sliding fiber drawer loaded with 2 Number of 6 Pak LC adapter plate with 6 duplex, MM LC adapters (12 fiber) + 1 number of 24 Splice Tray + 24 No of sc / LC Pigtail, MM, 50/125 OM3, 900 micron 1.5 mtrs.
163	SITC OF LC-LC, Duplex, 50/125, OM3 Multimode, 3 Mtrs - LSZH
164	SITC OF HP 2530-24G-PoE+ Switch, 24 10/100/1000 PoE+ ports, 4 SFP Ports, 195W PoE+ (J9773A) + 1 Number of SFP Module of HP Make HP X121 1G SFP LC SX Transceiver, MM, 850nm, 550m (J4858C) or Core Cisco make
165	SITC of 9U cabinet 504.65X600X500 (HXWXD) ack with Two Fans, 1 Cable manager, 5x15 AMP 6 Socket PDU, 1 Shelf and required accessories for Mounting devices with all required accessories make of Legrand / APU / Panduit / WQ
166	SITC of Horizontal Cable Manager 1U make of Legrand cat. No. 634817
167	SITC OF Synergy Wall Plate 4 Port or 2 Port - 86mmx86mm- White include cost for Backbox. Faceplate for Data of Make: MOLEX/SIEMON/SYSTIMAX/PANDUIT
168	**Street Light Pole:** SITC of approved make Conical Poles (Medium Duty) Made from steel. The pole should be made as per IS and shall be coated with hot dip galvanizing as per IS 2629/4759 with required base plate as erected on foundation. The length of poles are as below with Single Arm Bracket / arrangement for the top mounting fixture as per drawing. (B) 4 Mtr. Long 70 mm Top X 130 mm bottom dia, 3 mm thickness. 1) A junction/ looping box with 32 Amps heavy duty connector shall be built into the pole with 4 way connector and 6A MCB 2) 50 mm diameter DWC pipe for each cable entry. Pipe length is up to 3.5 mtr. Per cable 3) Wiring up to the light fixture from the junction box using 3core x 1.5 sq.mm. Flexible copper wires / Fixture of specified make. 4) M20 - Concrete coping with Reinforcement with foundation bolt with base plate with stiffener. 5) Spiral/Coil Type Earthing from the 8 swg Cu. Wire of 2.5 mtr. With the suitable size pipe with clamps and painting. 6) Radium strip of two color at suitable height & Pole Numbering as per Client / Consultant's instruction 7) Excavation & back filling for erection of poles. Debris to be removed from the site to suitable location as per the instruction of the engineer in charge

169	Supplying and erecting, commissioning and testing diesel generating set having continuous rating, 3 phase, 415 volts, 50 cycles A.C. supply comprising of a totally enclosed air/water cooled diesel engine with multi-cylinders developing suitable BHP not less than following capacity at 1500 RPM with 10% overload for one hour in 24 hours with standard accessories like fly wheel, lubricating oil cooler, "A" class governor, heavy duty fuel wheel and lubricating oil filter, oil bath air filler, lubricating oil pressure gauge, end exhaust manifold, standard set of tools with adjustable spanners, screw drivers, feeder gauge, cylinder head to cover, joint cylinder head to exhaust, element lube oil filter, 12/24 volts electric starting equipment complete with standard battery, dynamo, cut-outs, ammeter, necessary wiring, pressure gauge, starter etc and heavy duty Residential type exhaust silencer and vertical hot air duct both logged with asbestos rope, save oil trays, exhaust piping of required length, standard wall/floor mounted fuel with level indicator and piping and drip proof alternator, self-excited, self-regulated, screen protected, with excitation system, capable of delivering the rated system output at 415 volts, 3 phase, 0.8 PF, 50 Hz, 4 wire, running at 1500 RPM, conforming to IS-4722- 1968 with voltage regulation +/- 5% of rated voltage from no load to full load. Both the engine and alternator fitted on a common fabricated steel base plate with antivibration mounting engine and alternator both connected to each other by flexible flange coupling and with floor/wall mounted control panel box comprising of voltmeter ammeter, selector switches, ACB / MCCB / MCB of adequate capacity,
170	Indicator lamps duly wired with HRC fuses. The alternator & control panel shall be connected with provided suitable capacity armoured cable and complete with Acoustic enclosure (canopy) made out of 18 SWG CRCA Sheet, sound absorbing material Rockwool of 64 density & 100 mm thick conforming to IS: 8183 The resin bonded rockwool covered from inside the canopy by perforated sheet with ¾ mm holes, sound level not more than 75 dB at a distance of 1 mtr, as per PVCT norms. Erection, commissioning and satisfactory testing as per requirement with first filling of fuel, oil, etc. with guarantee of complete system for One year. & with obtaining all necessary certificate from Electrical Inspector. The Capacity and Ratings of DG sets are as below. Continuous rating of 125 KVA ,BHP not less than 154 BHP Sudhir Gensets, Goel Generators, Sterling Generators
171	Providing & Fixing the PVC type cable end glands for the unarmoured 150 sq. mm x 3.5 Core Al. Cables (Make:Glands of Hensel / Spelsberg)
172	**Uninterruptable Power supply** Supply, installation, Testing and commissioning of the following rating UPS as per specifications and complete in all respects. Of APC or Emerson or Delta make. SITC of 10 KVA I/p-3 ph, O/p-3 ph. On line UPS with In built isolation transformer & Battery backup as per specification.. a) Shop Drawings. b) As-built drawings (including soft copy) c) O&M Manuals (including soft copy) d) Factory Testing and site testing as stated in scope e) Freight & Insurance f) Freight to job site (final site location) g) Storage & site protection h) 5 % Harmonic filter i) SNMP /OC Web card, Multilink Software, Modbus protocol. j) Complete Supply, Installation, Testing & Commissioning **Battery Back up for 1 Hrs. per UPS** k) 1 hrs. individual back up battery bank warranted for 5 years. l) DC Switchgear

	m) Bypass switchgear n) Battery Racks o) Installation and cabling between Battery and UPS p) Battery Installation & DC Cabling
173	SITC of dual channel power amplifier of 550 watt at 2 ohm & 350 watt at 4 ohm, 215 watt at 8 ohm make crown
174	SITC of necessary cable, cable connectors & accessories make of OEM
175	SITC of equipment rack
176	Supply, Installation, Testing and commissioning of outdoor Low Light , Day & night Application IP Dome camera with 1/3" CCD/CMOS, Progressive Scan, 2 MP Resolution, Dual H.264 streaming, 25 FPS, 3 to 10 mm Varifocal auto iris lens, 0.01 lux, PoE & standard 12VDC/24VAC power input .with mountings and accessories, patch cords etc. including integrated outdoor IP 66 rated housing (C/CS mount type), Connectors, A.I.Lens, Camera Mounts, Power Supply and all Ancillary Equipment & all accessories. The camera shall be UL Listed Wall / Ceiling Mounted
177	Supply and Installation of 42" colour , Flat Screen Type Professional CCTV Surveillance HD monitor for above client workstation
178	Supply, installation, testing and commissioning of QNAP Make Real-time monitoring and recording (video/audio) from maximum 32 IP cameras High quality H.264, MPEG-4, M-JPEG, and MxPEG recording (depending on the camera models),Complete recording features, Megapixel recording (up to 10-megapixel),PC-less network surveillance by HD (high definition) HDMI or VGA local display, Multi-server monitoring (up to 128 channels) Dual display mode, Dynamic E-map, Video search by date and time, timeline, and event, Intelligent video analytics (IVA),Multi-view playback from multiple NVR servers, Real-time digital watermarking for recording Advanced event management, Real-time SMS and email alert, VMobile surveillance app: Remote monitoring of IP cameras by Android phones, iPhone, iPad, iPod touch, and Windows PDA phones, Trouble-free installation Linux-embedded, highly reliable standalone NVR, Advanced RAID with hot-swappable hard drives design, Online RAID capacity expansion and online RAID level migration With 30 Days of Recording and Storage for the same need to include in the cost - QNAP Make & Should be enable client to monitor & Control completely from remote location.

179	Supply and laying of 2c x 1.0 Sq.mm FRLS Shielded wire.
180	SITC of Weather proof Enclosure (JB) 600W / 1000W x 1200H x 300D of Hensel / Spelsberg make
181	SITC CAT 6 Patch cord, 3 Mtr, Yellow - LSZ Ative Data Make of MOLEx/SIEMON/SYSTIMAX/ PANDUIT
182	SITC CAT 6 Patch cord, 2 Mtr, Yellow - LSZ Ative Data Make of MOLEx/SIEMON/SYSTIMAX / PANDUIT
183	SITC 24 Port Configurable Fiber Sliding Drawer. Make of Molex/Systimax/Siemon / PANDUIT
184	SITC OF PoE Media Convertor for Out Door CCTVs
185	SITC OF Outdoor Fiber Junction Box with SC Adapaters to terminated Fiber for Outdoor CCTV.
186	SITC OF 6 Pak SC adapter plate with 3 duplex, SM SC adapters. Make of Molex/Systimax/Siemon/PANDUIT
187	STIC OF SC Pigtail, SM, 9/125, 900 micron 1.5 mtrs. Include cost for Certification, Labeling, Documentation, and Test Reports. Test reports has to be of LEVEL-4 Testing Tool like FLUKE. Make of MOLEX/SYSTIMAX/SIEMON/PANDUIT
188	SITC HP X120 1G SFP LC LX Transceiver Make of HP / CISCO
189	SITC OF HP 2530-24G-PoE+ Switch, 24 10/100/1000 PoE+ ports, 4 SFP Ports, 195W PoE+ (J9773A) Make of HP/CISCO
190	3M SC - LC Patch Cord, DPX OS1, PVC Make of Molex/Siemon/Systimax/PANDUIT
191	SITC OF PowerCat 6 DataGate Jack for Indoor CCTV, 568A/B - Yellow with Dust Cover / Blank/. Cable Laying, Labling, Ferrule, Testing, Certification to be included in cost. 20 Years of Certification is required. Test reports of Level-4 Scanners only. Make of MOLEX/Siemon/SYSTIMAX/Panduit
192	SITC OF 24 Port Configurable Patch Panel - Unloaded for Indoor CCTV. Make of MOLEX/ SIEMON/ SYSTIMAX/ Panduit
193	**Miscellaneous** Supplying & erecting carbon dioxide (CO2) fire extinguisher user of following capacity with necessary clamps made from 50 x 6 mm M.S. Flat with nut & bolts grouted in wall complete. 4.5 Kg Capacity
194	SITC of IP66 Water Tight Junction Box 180mm x 130mm x 77mm With necessary clamp for mounting of the J.B. (All the cable / wire connections to the JB shall be with the Water tight IP 66 Polyamide Glands, open Holes should be sealed with the IP65 Grommets only) J. B. Should be provided with Hensel make cable connectors to connect 1 nos. of 6/10 sq. mm. x 4 core cables+ 4-5 nos. of 4 sq. mm x 4 core wires + Earthing wires of Hensel make Cat. No. WP1010 B + Connectors + IP65 Glands + IP65 Grommets.
195	SITC of IP66 Water Tight Junction Box 130mm x 130mm x 77mm With necessary clamp for mounting of the J.B. (All the cable / wire connections to the JB shall be with the Water tight IP 66 Polyamide Glands, open Holes should be sealed with the IP65 Grommets only) J. B. Should be provided with Hensel make cable connectors to connect 1 nos. of 6/10 sq. mm. x 4 core cables+ 4-5 nos. of 4 sq. mm x 4 core wires + Earthing wires of Hensel make cat. no. wp0604 b + Connectors + IP65 Glands + IP65 Grommets.
196	Providing & laying. Double walled corrugated pipes (DWC) of polyethylene (conforming to IS 14930 II) Anti Rodent type with necessary connecting accessories of same material at required depth for laying of cable. below ground / road surface for enclosing cable and backfilling the same to make ground as per original.©120 mm dia.
197	Providing and erecting 3 star and above rated approved make split air-conditioning unit consisting of condensing unit with fan motor, hermetically sealed rotary compressor with accessories etc. duly connected separately erected evaporating unit and blower motor with its accessories by means of proper insulated copper tubing up to 5 RMT suitable for (Cost includes M.S. Stand, Gas Charging & Internal Copper Wiring & Remote Control) (A) for 1.5 ton capacity

198	Providing and erecting 3 star and above rated approved make split air-conditioning unit consisting of condensing unit with fan motor, hermetically sealed rotary compressor with accessories etc. duly connected separately erected evaporating unit and blower motor with its accessories by means of proper insulated copper tubing up to 5 RMT suitable for (Cost includes M.S. Stand, Gas Charging & Internal Copper Wiring & Remote Control)(B) for 2 ton capacity

5.4 Civil and Architectural work

Propose CCC's building is ready to use with required Civil Infrastructure and Successful bidder is responsible for Plan, design, supply, installation, commissioning and O&M of 24x7 command and control centre (but not limited to)-

- Entire interior infrastructure- False ceiling, Flooring, Wiring, Switches & Sockets, lighting & illuminations, doors & windows, partition, panelling etc. ,
- furniture & Fixtures, Interior/beautification
- Electrical & LAN work
- Structural/civil work (required as per the design for creation of Server room, Conference room etc.).

As the Command and Control room is a significant place, it is imperative that it is designed properly in terms of Aesthetics, Ergonomics and Functionality. Various aspects should be considered while designing Command and Control room area to create ideal work place, considering physiological aspects such as line of sight and field of vision and cognitive factors such as concentration and perceptivity as per latest ISO ergonomic norms. These detailed designs shall be submitted along detailed layout, drawings, 3D views, colour pallets, product catalogue for the approval from the office of the CGM.

a. Furniture and Fixture

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

b. Partitions (wherever required as per approved drawing)

- Full height partition wall of 125 mm thick fireline gyp-board partition using 12.5 mm thick double fireline gyp-board on both sides with GI steel metal vertical stud frame of size 75 mm fixed in the floor and ceiling channels of 75 mm wide to provide a strong partition. Glass wool insulation inside shall be provided as required. Fixing is by self-tapping screw with vertical studs being at 610 mm intervals. The same should be inclusive of making cutouts for switch board, sockets, grill etc. It shall also include preparing the surface smoothly and all as per manufacture's specification etc. finally finishing with one coat of approved brand of fire resistant coating.
- With glazing including the framework of 4" x 2" powder coated aluminium section complete (in areas like partition between server room & other auxiliary areas).

- Fire Rated Wire Glass minimum 6 mm thick for all glazing in the partition wall complete. (External windows not included in this). The ceiling, panelling and partition must be of modular design, facilitating future equipment retrofits and full reconfigurations without requiring any major modification to the structure.
- All doors should be minimum 1200 mm (4 ft.) wide.

c. Painting

- Fire retardant paint of pre-approved make and shade to give an even shade over a primer coat as per manufacturers' recommendations after applying painting putty to level and plumb and finishing with 2 coats of fire retardant paint. Base coating shall be as per manufacturer's recommendation for coverage of paint.
- For all vertical Plain surface and fireline gyp-board ceiling.
- POP punning over cement plaster in perfect line and level with thickness of 10 – 12 mm including making good chases, grooves, edge banding, scaffolding pockets etc.
- Fire retardant coating on all vertical surfaces, furniture etc. as per manufacturer's specification.

d. Key Administrative Building for Integrated Checkpost- Features and Specifications

5.4.1 Technical Specifications for civil components

Sr.	Building Component	Area (SQM)	Floor Height (m)	Properties
1.	Administrative Block	36	3	For 3 pax
2.	Network Storage	8.6	3	
3.	Hardware Storage	17.4	3	
4.	Dorm room	17.4	3	For 4 pax
5.	Officer's room 1	10.3	3	
6.	Officer's room 1	13.7	3	
7.	WC and bath 1 & 2	5.4 each	3	
8.	Toilet Block (common)	17.4	3	
9.	Panty	8.3	3	
10.	Watercooler area	8.6	3	
11.	Store	4.2	3	
12.	Terrace	61.5	-	
13.	Stair block	10.2	-	Per floor
14.	Security Block	6	3	

Technical Specifications for civil components of Checkposts are as described below:

- Clearing site including uprooting of vegetation, grass, bush, wood, trees and sapling of girth upto 30 Cms measured from height of 1m above ground level and removal of rubbish.
- Cement shall be 43 grade of approved brand and as per the approval of the office of CGM.
- Grade of concrete for water retaining structure in M-25. Minimum cement content for M25 grade for water retaining structures as per IS 3370.

- P.C.C. as mud mat below water retaining structure will be 100mm thk grade 1:4:8 (1 cement: 4 coarse sand : 8 coarse aggregate).
- All reinforcing steel shall be TMT bars/HYSD FE-415 (as per specification) confirming to IS 1786 with anticorrosive treatment for water retaining structure.
- Water stops, plasticizers & water proofing compounds shall be provided.
- Handrailing shall be in MS 25 MM dia with verticals angle 50 x 50 x 6mm at 1.5 m c / c & two rows of horizontals 25 dia MS pipes inclusive of 2 coats of red oxide & 2 coats of synthetic enamel paint of approved colour & shade.
- All external brickwork will be 230 thk in CM (1:6)
- Internal brickwork will be 115 thk in CM (1:4)
- All external plaster of brick wall shall be 15 MM thk cement plaster in CM (1:4) with water proofing compound.
- All internal plaster of brick wall shall be 12 MM thk cement plaster in CM (1:6)
- Ceiling plaster shall be 5 mm thk (1:3)
- Internal wall finish - White wash (2 or more coats)
- All external wall finish - Cement paint (2 or more coats, waterproof)
- Ceiling finish - White wash
- All rain water down comers shall be cast iron of 100 MM dia (anti corrosive paint) including all fittings confirming to IS 1230.
- All windows, ventilators, doors shall be in MS as per relevant specifications.
- In general all flooring shall be 25mm thick precast terrazzo tiles over 20mm thick 1:4 mortar layer over 100mm thick PCC 1:4:8 over well compacted soil.
- Toilet flooring- 7mm thick non skid ceramic tiles over 20mm thick cement mortar (1:4) over 100mm thick PCC(1:4:8) over compacted soil. Dadooing – Glazed tiles-7mm thick over 155 mm thick cement mortar 1:4. vitrous china EWC (10 litres)with cistern-1 No, piping-GI, service tank in working conditions (of appropriate volume). PVC door – frame and shutter including aluminum fittings.
- Plinth height considered 450 MM
- All filling of good earth shall be well compacted in layers of 20cms
- 40mm DPC with coat of bitumen.
- Chajja and lintels shall be provided as per requirement.
- Cable trenches if requirement shall be in brick masonry (of required depth etc) with chequred plate of thick ness 5mm shall be as required.
- Ramp as required

5.5 Fire Alarm System

System Description

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

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

Control and indicating component

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

Manual Controls

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

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

- Heat detectors
- Heat detectors shall be of the fixed temperature (58° C) or rate of temperature rise type with a fixed temperature operating point.
- Devices shall be compatible with the CIE conforming to the requirements of UL/ EN54 Part 5 the detectors shall have a single LED to indicate the device has operated and shall fit a common addressable base.
- All bases shall be compatible with the type of detector heads fitted and the control system component used. Each base shall comprise all necessary electronics including a short circuit isolator.
- The device shall be automatically addressed by the CIE on power up of the loop without the need of the insertion of a pre-programmed EPROM or setting of DIL switches.

- Detector bases shall fit onto an industry standard conduit box.
- Addressable Manual Call points must also be provided
- Control & Monitor module must be provided for integration with 3rd party systems.

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

Commissioning

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

5.6 Aspirating Smoke Detector System

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

Codes and standards

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

Approvals

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

Design Requirements

- The System shall consist of a high sensitive LASER-based smoke detector, aspirator, and filter.
- It shall have a display featuring LEDs and Reset/Isolate button. The system shall be configured by a programmer that is either integral to the system, portable or PC based.
- The system shall allow programming of:
    a) Multiple Smoke Threshold Alarm Levels.
    b) Time Delays.
    c) Faults including airflow, detector, power, filter block and network as well as an indication of the urgency of the fault.
    d) Configurable relay outputs for remote indication of alarm and fault Conditions.
- It shall consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design modelling tool.

- Optional equipment may include intelligent remote displays and/or a high level interface with the building fire alarm system, or a dedicated System Management graphics package.
- Shall provide very early smoke detection and provide multiple output levels corresponding to Alert, Action, and Fire 1 & 2. These levels shall be programmable and shall be able to set sensitivities ranging from 0.025 – 20% obscuration / meter.

Displays on the Detector Assembly

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

Sampling Pipe

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

Installation

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

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

5.7 Water leak detection System

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

i. EQUIPMENT

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

ii. CONTROL PANEL

- The control panel should be computerized 4/8/12 zone multiplex controller with a facility to add on dialer and speech processor. The system should be programmed, armed or disarmed through a control key pad. The control key pad should have a 16 character LCD display for viewing various events. The code to arm or disarm the system should be changed only by entering a master code.
- The system should have 4/8/12 zones and all the detectors should be connected through a 2 core cable. Each area of the premises should be divided into specific zones such that any zone should be isolated by the user if required.

- The entire system should be backed up by a maintenance free rechargeable battery to take care of system's power requirements whenever power fails.
- The system should be totally tamper proof and should activate an alarm if the control panel is opened, the sensors tampered with or if the system cables are cut even in the disarmed state.
- The system should log 500 events and optionally printer should be connected for generating reports.
- The Detectors, I/O Modules, Remote Keypads and other Devices should be connected to a system on a single 2/4/6 Core Cable Bus to avoid individual cabling of zones.
- The system should have a Buffer memory of minimum 250 events and log each event with exact date and time.
- The controller should have a Serial Port for connecting to a computer.
- The controller should work on 220/240V AC power supply and it should also have a built in battery backup.
- The memory inside the controller should be backed up by a lithium battery. The controller should work effectively over a temperature range of -10 Deg. C to + 55 Deg. C. and 0 to 90% of Humidity.

iii. WATER LEAK DETECTION SENSOR

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

iv. TAPE SENSORS

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

v. HOOTER / SOUNDER

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

5.8 Access Control System

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

doors through magnetic reed contacts. The system should be designed and implemented to provide following functionality:

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

Covered Inspection Shed for integrated checkpost – features & specifications

SN	*Component*	*Area (SQM)*	*Floor Height (m)*
1.	Inspection Shed (2Nos) (800 sqm each)	1600	As required

5.9 Rodent Repellent

The entry of Rodents and other unwanted pests shall be controlled using non-chemical, non-toxic devices. Ultrasonic pest repellents shall be provided in the false flooring and ceiling to repel the pests without killing them. However periodic pest control using Chemical spray can be done once in 3 months as a contingency measure to effectively fight the pest menace.

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

5.10 Fire Suppression System

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

Kyoto Protocols

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

Minimum Specifications

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

- Zero-ozone depleting potential
- Global-warming potential not exceeding one
- Atmospheric lifetime not exceeding one week
- The clean agent fire suppression system with FK-5-1-12 and inert gas-based systems are accepted as a replacement of HCFC and HFC in accordance with Kyoto Protocol.
- The clean agent considered for the suppression system shall be suitable for occupied areas with No Observable Adverse Effect Level of 10% as compared to the design concentration to ensure high safety margin for the human who might be present in the hazard area.
- The minimum design standards shall be in accordance with NFPA 2001, 2004 edition or latest revisions.
- Care shall be given to ensure early warning detection system with minimum sensitivity of 0.03% per foot obscuration in accordance with NFPA 318 and NFPA 72 to ensure a very early warning signal to allow investigation of the incipient fire with significant time before the other detectors activate the fire suppression system automatically.
- All system components furnished and installed shall be warranted against defects in design, materials, and workmanship for the full warranty period, which is standard with the manufacturer, but in no case less than operational readiness closure period.
- Fire suppression system shall deploy NOVEC-based gas suppression systems with cross-zoned detector systems for all locations. These detectors shall be arranged in a manner such that they activate the suppression system in zones to cater to only the affected area.
- Illuminated signs indicating the location of the extinguishers shall be placed high enough to be seen over tall cabinets and racks across the room. A linear heat detection cable shall be placed along all wire pathways in the ceiling. This cable shall not directly trigger the suppression system; rather, it shall prompt the control system to sound an alarm.
- The SI shall give a certificate stating that their NOVEC system is approved by UL/FM/VdS/LPC/CNPP for use with seamless steel cylinders, including component and system approval.
- The SI shall also provide a letter that the OEM has NOVEC flow calculation software suitable for seamless steel cylinder bided for in accordance with the List of Major Components and that such software shall be type approved by UL/FM/VdS/LPC/CNPP.
- The storage container offered shall be of seamless type, meant for exclusive use in NOVEC systems, with UL/FM/VdS/LPC/CNPP-component approval. Welded cylinders are not permitted.
- The NOVEC valve shall be differential pressure design and shall not require an explosive- or detonation-

type consumable device to operate it.

- The NOVEC valve operating actuators shall be of electric (solenoid) type and shall be capable of resetting manually. The valve shall be capable of being functionally tested for periodic servicing requirements and without any need to replace consumable parts.
- The individual NOVEC bank shall also be fitted with a manual mechanism operating facility that shall provide actuation in case of electric failure.
- The system flow calculation is to be carried out on certified software, suitable for the seamless steel cylinder being offered for this project. Such system flow calculations shall be also approved by UL/FM/VdS/LPC/CNPP.
- The system shall utilize 42-bar/high-pressure (600 psi) technology that allows for a higher capacity to overcome frictional losses, higher distances of the agent flow, and better agent penetration in enclosed electronic equipment such as server racks and electrical panels.
- The designer shall study and address possible fire hazards within the protected volume at the design stage. The delivery of the NOVEC system shall provide for the highest degree of protection and minimum extinguishing time. The design shall be strictly in accordance with NFPA standard NFPA 2001.
- The suppression system shall provide for a high-speed release of NOVEC-based on the concept of total flooding protection for enclosed areas. A uniform extinguishing concentration shall be 7% (v/v) of NOVEC for 21 degrees Celsius or higher as recommended by the manufacturer.
- The system discharge time shall be 10 seconds or less, in accordance with NFPA standard 2001.
- Sub-floor and the ceiling void to be included in the protected volume.
- The NOVEC systems to be supplied by The SI shall satisfy all the requirements of the authority having jurisdiction over the location of the protected area and shall be in accordance with the OEM's product design criteria.
- The detection and control system that shall be used to trigger the NOVEC suppression shall employ cross-zoning of photoelectric and ionization smoke detectors. A single detector activated in one zone shall cause an alarm signal to be generated. Another detector activated in the second zone shall generate a pre-discharge signal and start the pre-discharge condition.
- The discharge nozzles shall be located in the protected volume in compliance to the limitation with regard to the spacing, floor and ceiling covering. The nozzle locations shall be such that the uniform design concentration will be established in all parts of the protected volumes. The final number of the discharge nozzles shall be according to the OEM's certified software, which shall also be approved by third-party inspection and certified such as UL/FM/VdS/LPC/CNPP.
- The cylinder shall be equipped with differential pressure valves and no replacement parts shall be necessary to recharge the NOVEC containers.
- NOVEC shall be discharged through the operation of an electric solenoid-operated device or pneumatically operated device, which releases the agent through a differential pressure valve.
- The NOVEC discharge shall be activated by an output directly from the NOVEC gas release control panel, which will activate the solenoid valve. NOVEC agent is stored in the container as a liquid. To aid release and more effective distribution, the container shall be super pressurized to 600 psi (g) at 21°C with dry Nitrogen.
- The releasing device shall be easily removable from the cylinder without emptying the cylinder. While removing from cylinder, the releasing device shall be capable of being operated with no replacement of parts required after this operation.
- Upon discharge of the system, no parts shall require replacement other than gasket, lubricants, and the NOVEC agent. Systems requiring replacement of disks, squibs, or any other parts that add to the recharge cost will not be acceptable.
- The manual release device fitted on the NOVEC cylinders shall be the manual-lever type and a faceplate

with clear instruction of how to mechanically activate the system. In all cases, NOVEC cylinders shall be fitted with a manual mechanical operating facility that requires two-action actuation to prevent accidental actuation.

- NOVEC storage cylinder valve shall be provided with a safety rupture disc. An increase in internal pressure due to high temperature shall rupture the safety disc and allow the content to vent before the rupture pressure of the container is reached. The contents shall not be vented through the discharge piping and nozzles.
- NOVEC containers shall be equipped with a pressure gauge to display internal pressure.
- Brass Discharge nozzles shall be used to disperse the NOVEC. The nozzles shall be brass with female threads and available in sizes as advised by the OEM system manufacturer. Each size shall come in 180° and 360° dispersion patterns.
- All the major components of the NOVEC system such as the cylinder, valves and releasing devices, nozzles, and all accessories shall be supplied by one single manufacturer under the same brand name.
- Manual gas discharge stations and manual abort stations, in conformance with the requirements of NFPA 2001, shall be provided.
- Release of NOVEC agent shall be accomplished by an electrical output from the FM-200 gas release panel to the solenoid valve and shall be in accordance with the requirements set forth in the current edition of NFPA 2001.
- A high-sensitivity smoke-detection system shall provide an early warning of fire in its incipient stage, analyse the risk, and set off an alarm and actions appropriate to the risk. The system shall include, but not be limited to, a display control panel, detector assembly, and properly designed sampling pipe network.

5.11 CCC Operator Console (Workspace)

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

Sr.	Parameter	Minimum Specification
1.	Physical Structure	Ergonomically designed desk to ensure 24x7 desking solution with sufficient knee space (min 450mm) and foot space (min 600 mm). width of the console should be minimum 1800mm
2.	Working Surface material	The Console Top / working surface should be made of minimum 25 mm thick MDF with High Pressure Laminate finish. The laminate shall be fire retardant, Insulated, Water Proof, Scratch resistant and high hardness. The Table Top should be as able to mount three 27 Inches Display monitors. Front edge of the table top Should be Moulded Polyurethane (PU) Edge with wood core, which gives cushion to wrist during long working hours.
3.	Console Design	Consoles must be ISO 11064 compliant and of modular design, facilitating future equipment retrofits and full reconfigurations without requiring any major modification to the structure or exterior elements
4.	Equipment Mounting	The workstation shall be able to house computer equipment's, Ethernet Points, Power Distribution Unit. The CPUs shall be mounted on Slide out CPU trays (mounted on Heavy duty slides) for ease in maintenance, all of these equipment's should be concealed from direct human view

5.	Frame material	Made of heavy duty Aluminium. The Extrusions shall be duly powder coated with 40+ micron over all surfaces.
6.	Monitor Arms and Rear Walls	• Die cast mounted Aluminium arm; fixed firmly on MS Pole with powder coating mounted on its rear wall also made of aluminium • Monitor and Functional holder shall guarantee optimum viewing distance. All ergonomic aspects shall be taken in to account. It shall be capable for mounting all type of LCD/LED display with Dimensions between 17" to 27" using suitable brackets/additional base plate • For configuration of working position, it shall allow the technical staff to rotate/ tilt/ raise/the monitors as well as fix their adjustment in a quick and easy manner
7.	Warranty/Guarantee	• 10 years replaceable
8.	Certifications	• ISO 11064, BIFMA-X 5.5., RoHS (UL/Intertek)

5.12 Ergonomic Chair

This chair would be for CCC Operators

Title Adjustment

Armrest Adjustment

Seat Height

Lumbar Support

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

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

9.	Warranty	5 Years Replaceable

5.13 Storage (Under Table) (All photographs for reference purpose, to aid the specification/description)

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

5.14 Cupboard – 5 & 6.5 feet (All photographs for reference purpose, to aid the specification/description)

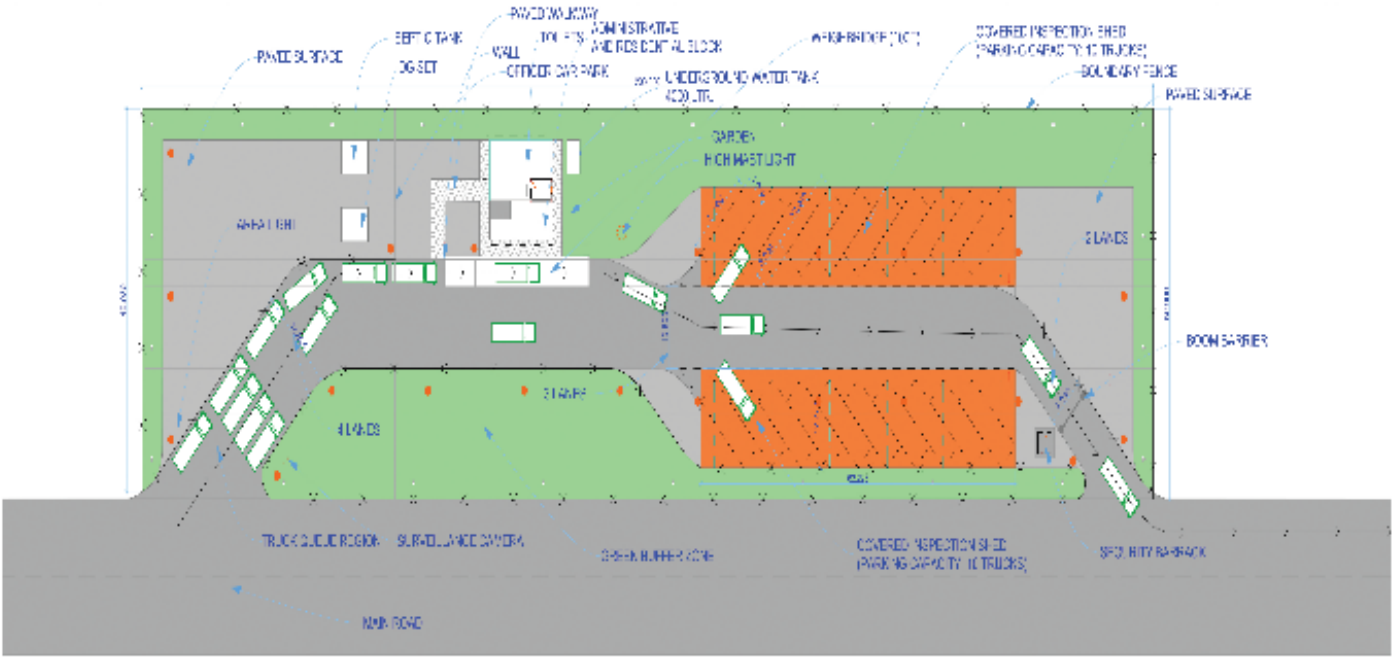
- Storage flexibility achieved through use of adjustable shelves
- Aesthetically appealing snap-on die-cast lock for security
- Wooden and metal top as per requirements
- Top hanging sliding door prevents derailment
- Plastic roller with steel ball bearings for smoother door movement

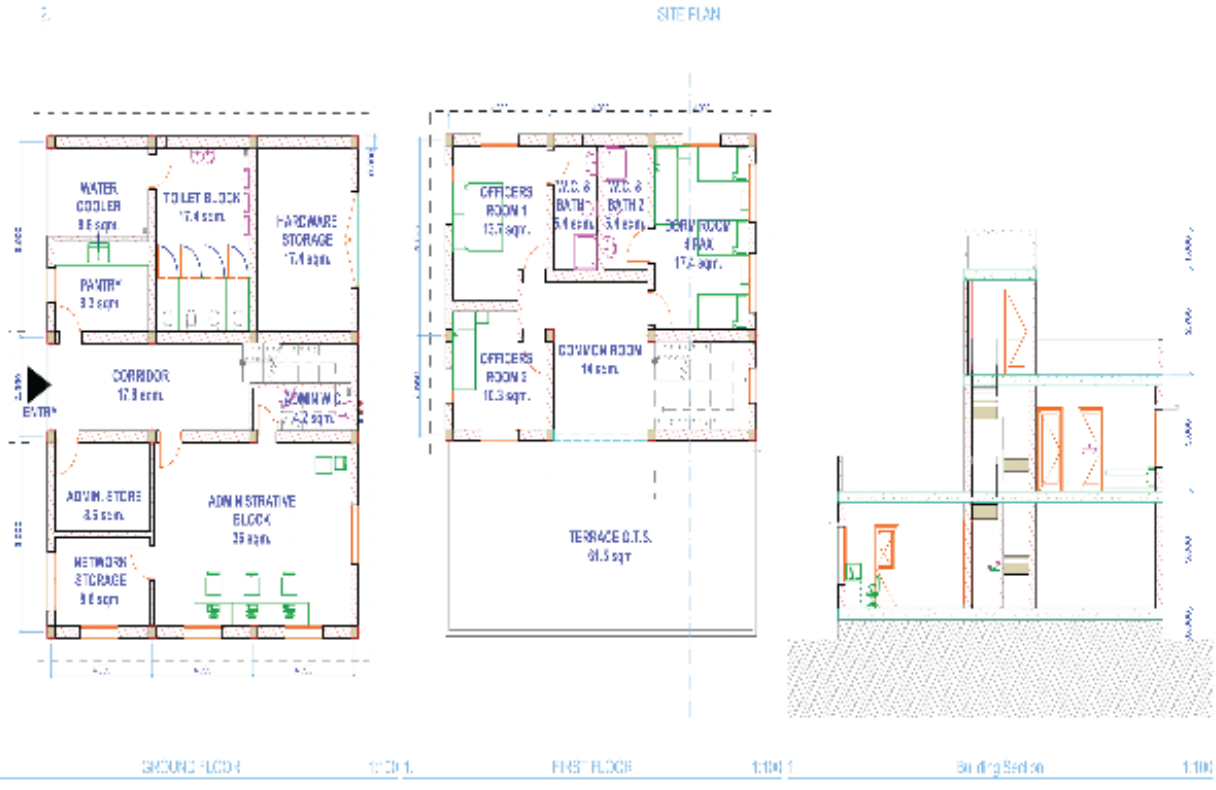
5.15 Sofa -2/3 seater (All photographs for reference purpose, to aid the specification/description)

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

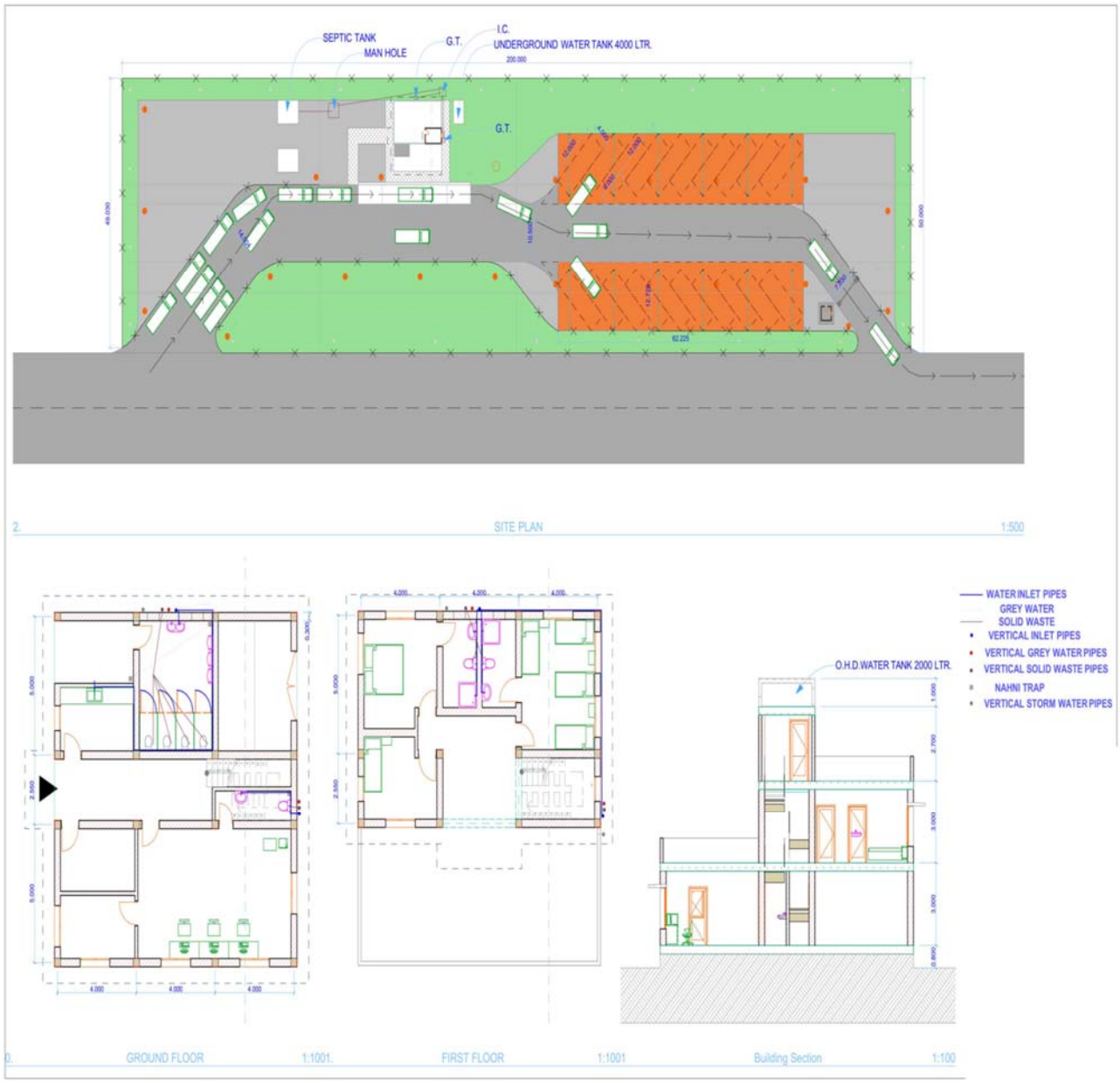
6 Annexure C - Indicative checkpost layout

6.1 Indicative checkpost concept layout drawing





6.2 Indicative checkpost plumbing plan



6.3 Indicative checkpost Electrical plan


TRANSFORMER
DG SET
CONTROL ROOM
CONTROL PANEL
SITE PLAN
1:500
SWITCH BOARD
WALL POINTS
ONE WAY WIRE
PLUG socket 5 Amp
PLUG socket 15 Amp
CEILING FAN
GROUND FLOOR
1:100
FIRST FLOOR
1:100

7 Annexure D- Common guidelines/requirements regarding compliance of systems/ equipment

7.1 OEM Selection Criteria: The OEM of the IP CCTV camera, Server, Storage, firewall and networking equipment should not be a company having its major shareholding stake by any government or its entity or originated/founded by personnel of Defence origin.

Sr.	Component	Selection criteria for the OEM
A	**Surveillance/CCTV Components**	
1.	CCTV Cameras	• OEM of the quoted IP based CCTV cameras should have installation base of minimum 500 cameras in a single project in India as on bid issuance date **AND** • OEM of the quoted CCTV Camera should have its own registered office in India as per the prevalent/ applicable laws of India and be in operation in India for the last five years as on the bid issuance date. Registered offices by way of Joint ventures, Franchise, distribution partners will not be considered.
2.	Video Management System Software	• Minimum installation base of 50 projects across globe as on 31/07/2017 **and** Should have been operational for at least 2 City/outdoor CCTV Surveillance projects (globally, covering open public places) of minimum 500 city/outdoor cameras each in last 3 years from the date of submission of bid **OR** • From any of Top 10 OEM from Latest IHS World Report for Video Management Software
B	IT Infrastructure Components	
1.	Networking Equipment	• OEMs who are amongst the top 5 for World-wide Market share in terms of Revenue as per latest IDC report OR • OEM present in the Gartner Magic Quadrant for Wired & Wireless LAN Access Infrastructure, March 2017.
2.	Servers	• OEMs who are amongst the top 5 for world-wide market share in terms of revenue as per latest IDC report OR • OEM present in the leaders category of Gartner Magic Quadrant for Modular servers, 2016.
3.	Storage Solution	• OEMs who are amongst the top 5 for world-wide market share in terms of revenue as per IDC / Similar organisation's latest published quarterly report / presence in the latest Magic Quadrant by Gartner.
4.	Other Smart Elements (ANPR, Parking Sensors, E-weighbridges)	• Products / Solutions should have been implemented in at least 2 similar projects. Bidder to provide declaration from OEM along with the details of the projects of respective products / solutions are implemented, with following details : City name, Client Name, Duration and Value of the project , Number of sensors implemented etc.

Note: The Bidder shall attach relevant latest report(s) that specifies meeting above OEM selection criteria

7.2 Other/General Criteria

1. The specifications mentioned for various IT / Non-IT components are indicative requirements and should be treated for benchmarking purpose only. SIs are required to undertake their own requirement analysis and may propose higher specifications that are better suited to the requirements.
2. In case of addition/update in number of license for the Command and Control Centre (CCC) software and VMS/VA licenses for Cameras, the SI is required to meet technical specifications contained in the RFP and for the upward revisions and/or additions of licenses are required. The software licenses provided should be perpetual and at enterprise level such that the office of the CGM (or any entity as determined by CGM authorities) can use the software products irrespective of number of users and number of field devices (Sensors, cameras, etc.) or number of cores of computer. Additions to users or filed devices or number cores will have to be done at no additional cost.
3. Any manufacturer and product name mentioned in the Tender should not be treated as a recommendation of the manufacturer / product, unless specifically mentioned so.
4. None of the IT / Non-IT equipment's proposed by the SI should be End of Life product. It is essential that the technical proposal is accompanied by the OEM certificate in the format given in Volume I of this Tender, where-in the OEM will certify that the product is not end of life product & shall support for at least 6 years from the date of Bid Submission.
5. All IT Components should support IPv4 and IPv6
6. Technical Bid should be accompanied by OEM's product brochure / datasheet. SIs should provide complete Make, model, part numbers and sub-part numbers for all equipment/software quoted, in the Technical Bid
7. SIs should ensure complete warranty and support for all equipment from OEMs. All the back-to-back service agreements should be submitted along with the Technical Bid.
8. All equipment, parts should be original and new.
9. The user interface of the system should be a user friendly Graphical User Interface (GUI).
10. Critical core components of the system should not have any requirements to have proprietary platforms and should conform to open standards.
11. For custom made modules, industry standards and norms should be adhered to for coding during application development to make debugging and maintenance easier. Object oriented programming methodology must be followed to facilitate sharing, componentizing and multiple-use of standard code. Before hosting the application, it shall be subjected to application security audit (by any of the CERTIN empanelled vendors) to ensure that the application is free from any vulnerability; and approved by the office of the CGM.
12. All the Clients Machines / Servers shall support static assigned IP addresses or shall obtain IP addresses from a DNS/DHCP server.
13. The Successful SI should also propose the specifications of any additional servers / other equipment/hardware/software, if required for the system.
14. The Successful SI must provide the architecture of the solution it is proposing.
15. The system servers and software applications will be hosted in Data Centre, Gandhinagar as specified in the Bid.
16. The Servers provided should meet industry standard performance parameters (such as CPU Utilisation of 60 percent or less, disk utilisation of 75 percent or less). In case any non-standard computing environment is

proposed (such as cloud), detail clarification needs to be provided in form of supporting documents, to confirm (a) how the sizing has been arrived at and (b) how SLAs would be met.

17. SI is required to ensure that there is no choking point / bottleneck anywhere in the system (end-to-end) and enforce performance and adherence to SLAs. SLA reports must be submitted as specified in the Bid without fail.
18. All the hardware and software supplied should be from the reputed Original Equipment Manufacturers (OEMs). Office of the CGM reserves the right to ask replacement of any hardware / software if it is not from a reputed brand and conforms to all the requirements specified in the tender documents.

8 Annexure E- Manpower planning

The Lead Bidder and Consortium Members (if applicable), need to propose the manpower, taking care of the following criteria.

Sr.	Manpower	Minimum Qualifications
1.	Project Manager -1 No	1. Minimum Education: B.Tech/ MCA/ M.Tech. with MBA/Master degree in management from a reputed institute Total Exp: At least 15 yrs. 2. Languages known (Read, Write and Speak): Hindi, English 3. Should have good knowledge of computers and networking 4. Prior project management experience of at least 10 years of handling large and complex projects, with at least one large scale project with project value of minimum INR 30 crores. 5. Excellent writing, communication, time management and multi-tasking skills 6. Project Experience of managing various components of complex ICT projects, Smart City Projects, covering at least 3 initiatives mentioned in this RFP.
2.	Functional Lead -1 No	Minimum **Education**: MCA/ MBA/M. Tech & B.Tech / B.E. from a reputed institute 1. Total Exp: At least 10 yrs. 2. Languages known (Read, Write and Speak): Hindi, English 3. Should have operating knowledge of computers and networking 4. Prior project management experience of at least 8 years of handling large and complex projects, with at least one large scale project with Project Cost of minimum INR 10 crores. 5. Must have handled and successfully delivered 2 mining projects of 5 crore each 6. Excellent writing, communication, time management and multi-tasking skills 7. Project Experience of managing components of ICT projects, Smart City Projects covering at least the initiatives mentioned in this RFP. 8. Proficient in MS Project (Word, Excel, PowerPoint)

		9. Should be able to perform role of Business and functional analyst as well
3.	Subject Matter Experts- 1 No- as an when required	1. Minimum Education: B.Tech/ MCA/ MBA/ M. Tech & B.Tech / B.E. from a reputed institute 2. Total Exp: At least 12 yrs. 3. Languages known (Read, Write and Speak): Hindi, English 4. Should have expert subject matter knowledge of ICT projects, including most of the component as mentioned in the RFP and various other Smart City related components 5. Prior project management experience of at least 5 years of handling large and complex projects, with at least one large scale project with Project Cost of minimum INR 10 crores. 6. Must have at least 5+ years of working in the mining sector 7. Excellent writing, communication, time management and multi-tasking skills 8. Project Experience of managing components of various ICT, Smart City Projects covering at least the initiatives mentioned in this RFP.
4.	Technical lead- 1 No	1. Minimum Education: MCA/ MBA/M. Tech & B.Tech. / B.E. from a reputed institute 2. Total Exp: At least 10 yrs. 3. Languages known (Read, Write and Speak): Hindi, English 4. Should have operating knowledge of computers and networking 5. Must have hands on experience in integrating various disparate systems on different platform with CCC systems and creating and integrated dashboard to monitor operations. 6. Prior project management experience of at least 8 years of handling large and complex projects, with at least one large scale project with Project Cost of minimum INR 10 crores. 7. Excellent writing, communication, time management and multi-tasking skills 8. Project Experience of managing components of ICT, Smart City Projects covering at least the initiatives mentioned in this RFP.
5.	Full Time- on project- Functional Manager – CCC Expert -1 No	1. Should have fundamental comprehension across areas such as Command and Control Centre Operational Software, Network Infrastructure, CCTV/Surveillance, Security management, ERP, Citizen Portal, Mobile Applications, integration of Third Party Shared Services, Wifi, and Smart (IOT) Devices/Sensors etc. 2. Should be BE / B. Tech or higher from a premier institute with more than 7 years of work experience 3. Should have experience of at least three projects in the area of Command and Control Centre, CCTV, Smart Sensors, E-weighbridge 4. At least 3 years of experience in implementing CCC software from same OEM, which is offered as part of the bid. 5. Should be able to understand various integrating points of CCC and be excellent in correlating data from various systems to derive actionable intelligence 6. Proficient in MS Project (Word, Excel, PowerPoint)

6.	Project Support Staff- 5 No	1. Should be BE / B. Tech or higher from a premier institute with more than 5 years of experience in technology projects 2. Proficient in MS office and MS Project. 3. Should have experience in government projects. 4. Should have worked in similar roles and at large scale IT/ITES Setup. 5. Should have experience in government projects, preferably in mining sector 6. Effective verbal communication skills (English, Gujarati and Hindi).
7.	Solution Architect- 1 No- as an when required	1. B.E/ B.Tech/ MCA/ M.Tech. with minimum 8 years of experience involving solution design, Should have been involved in installation of hardware and operating system, database and configuration, system maintenance 2. Should have experience in government projects with at least 1 mining project 3. Should have experience in architecting a solution where multiple disparate systems are integrated with CCC. 4. Should have worked in similar roles and at large scale IT Setup. 5. Proficient in MS office and MS Project 6. Effective verbal communication skills (English, Gujarati and Hindi)
8.	Database Developer -1 No	1. BE Computers or Diploma with specialization in computers with minimum three years of experience in Database development and database management 2. Minimum five years of experience in Database management and administration 3. Should have experience in multiple databases and No-Sql database administration 4. Should have experience in government projects. 5. Effective verbal communication skills (English and Hindi)
9.	Database Administrator- 1 No- as an when required	1. MCA/ BE/ B.Tech with specialization in computers with minimum five years' experience in Database Administration 2. Minimum five years of experience in Database management and administration 3. Should have experience and proficiency in multiple databases and No-Sql database administration 4. Should have experience in government projects. 5. Effective verbal communication skills (English and Hindi)
10.	Network Engineer- 1 No- as an when required	1. Diploma in Computer Hardware and Networking with course duration of minimum 1 year from Govt. recognized institution. 2. Minimum three years of experience in network implementation and network administration 3. Should have experience performing network testing, equipment testing, fault analysis, network repairs, etc. 4. Should have experience in government projects
11.	Technical Expert – Network Admin and Security	1. Master or Engineering Degree in Computer Hardware and Networking with course duration of minimum 1 year from Govt. recognized institution. 2. Minimum five years of experience in network implementation

	(Dedicated On premise) – I No	and network administration of large and complex IT/ITES/Telecom projects, exposure to network security 3. Should have certifications of industry leading network administration solutions 4. Should have experience in government projects
12.	Server Administrator- 1 No- as an when required	1. Diploma in Computers with minimum three years of experience in server administration for large and complex IT/ITES/Telecom projects 2. Should have OEM certification in server administration (Windows/ Linux) 3. Should have experience in government projects 4. Effective verbal communication skills (English and Hindi)
13.	Technical Expert (VMS) (Dedicated on site)- 1 No	1. B.E/ B.Tech/ MCA/ M.Tech with minimum five years of experience in VMS Implementation/management
14.	Quality Assurance Manager- 1 No	1. B.E/ B.Tech/ MCA/ M.Tech with minimum five years of experience in Systems/Software Quality Assurance 2. Experience devising and establishing a project's quality procedures, standards and specifications, increasing operational efficiency, setting up and maintaining controls and standard operating procedures, creating performance matrix and monitoring performance by gathering relevant data and producing statistical reports, etc. 3. Should have experience setting standards for quality as well as health and safety of the project and its resources 4. Should have experience in government projects 5. Should have knowledge of leading testing tools 6. Proficient in MS office and MS Project 7. Effective verbal communication skills (English, Gujarati and Hindi)
15.	Software Developer- 2 No	1. B.E/ B.Tech/ MCA/ M.Tech with minimum 4 years of experience in Software application development, programming languages and databases 2. Should have experience in government projects 3. Proficient in MS office and MS Project 4. Effective verbal communication skills (English, Gujarati and Hindi)
16.	Civil Engineer	1. B.E Civil minimum 6 years of experience in planning ,architecting and supervision constructions of at least 5 big projects (more than 2 crores each) 2. Ability to define, evaluate and monitor pre- during and post construction activities 3. Ability to define structural components, architectural components 4. Should have experience in building any government building or private sector construction in building G+2 or more buildings 5. Should have experience in RCC construction. 6. Proficient in MS office and MS Project 7. Effective verbal communication skills (English, Gujarati and Hindi)

Apart from the above–mentioned resources, the Bidder shall also propose manpower to be deployed during the Operation & Maintenance phase of the Project as provided in the format in section 9 of volume 1.

The office of the CGM or its appointed agency would conduct interview and shall qualify them before the resources can start working on the project

The successful bidder is expected to deploy required manpower to execute the project as per the scope defined and ensure all the agreements are fulfilled and the project objectives are met.

Bidder shall ensure that each member of the Key Personnel devotes substantial working time as per the staffing schedule/ manpower plan to perform the services to which that person has been assigned as per the bid.

Bidder shall not make any changes to the composition of the Key Personnel and not require or request any member of the Key Personnel to cease or reduce his or her involvement in the provision of the Services during the defined term of the engagement unless that person resigns, is terminated for cause, is long-term disabled, is on permitted mandatory leave under Applicable Law or retires.

In any such case, the CGM's prior written consent would be mandatory. The resource details should be provided using the forms in section 10.8, TQ_6 of volume 1 of this RFP

9 Annexure F: List of Products/Solutions Which Requires MAF from OEMs

The bidder/lead bidder shall submit Manufacturers Authorization Certificate (MAF) from Original Equipment Manufacturers (OEMs) of the following products/ solutions:

Sr.	Product	Submitted (Yes/No)
1.	Video Wall Screen	
2.	Video Wall Controller	
3.	Video Wall Management Software	
4.	LED TV (Professional Displays)	
5.	CCC Software	
6.	CCC Monitoring Workstations	
7.	Desktop PC	
8.	Enterprise Management Systems (EMS), Network Management Systems (NMS)	
9.	Centralized Anti-virus Solution	
10.	RDBMS Licenses (If Any)	
11.	All Routers and Switches	
12.	Next generation/UTM Firewall	
13.	Server Load Balancer	
14.	All Servers/Blades/Chassis	
15.	Storage (Primary and Secondary)	
16.	Tape Drive and Backup Solution	
17.	Online UPS	
18.	Video Management System	
19.	All CCTV and ANPR Cameras	
20.	Cloud Service Provider (CSP)	
21.	RFID Sensors	
22.	Parking Sensors	
23.	E-Weighbridge	
24.	OFC (if applicable)	
25.	Boom-barrier	
26.	Smart LED lights	