Annexure B

The minimum functional and technical specifications for hardware to be used in Hybrid ETC system at the plaza are specified in this section. The Concessionaire shall ensure that the equipment provided meets the basic functional criteria as prescribed in this section.

1.1. Queuing Area

1.1.1. Magnetic Loops

A. Functions

The magnetic loops shall be used for two purposes:

i. Presence Loop – This is a single loop installed in the transaction area. This shall be triggered on the basis of vehicle detection leading to a certain set of activities as required.

ii. Exit Loop – This is a single loop installed at the end of transaction used to trigger the exit barrier once the transaction has been completed.

B. Specifications

The loop detector units/cards shall conform to the following minimum requirements.

i. The unit shall be easily removable and shall be fitted with at least two (2) loops per card.

ii. The unit shall have a minimum of 4 separate adjustable sensitivity and frequency levels.

iii. The unit shall have indicators for vehicle presence, loop on/off and failure.

1.1.2. Overhead Lane Status Sign (OHLS)

A. Function

The Over Head Lane Sign (OHLS) is located above the centre of the lane at the lane entrance. The purpose of the OHLS is to indicate to the User whether the toll lane is open for the

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processing of vehicle or closed. A red cross is used to signal that the lane is closed, whilst a green arrow is used to indicate that the lane is open to traffic.

Signs must be sufficiently bright and directed to indicate to a motorist, approaching the toll plaza, at a distance of 300 m on a bright cloud free day that the lane is available for use. The OHLS status shall also be visible up to a peripheral view of 45 degrees from the travel axis.

At any situation, both RED and GREEN part shall not glow simultaneously. Under failure conditions, only Red Cross shall be displayed until rectification.

B. Specifications

The following minimum specifications shall be met:

Description	**Specification**
Size	300mm X 300 mm
Display (Cross)	Red LED
Display (Arrow)	Green LED
LED	5mm in diameter, 8000 mcd
Visibility Range	300 m
Enclosure	IP 65

1.2. **Transaction Area**

1.2.1. ETC RFID Transceiver

Concessionaire is free to choose any brand of ETC RFID transceiver as long as it satisfies the functional requirements prescribed by the Authority as below:

A. Functions

Each Hybrid ETC lane shall have one ETC RFID Transceiver. The ETC RFID Transceiver shall be mounted at least 5.5 meters above the finished road level. The Concessionaire shall provide cantilever pole (if required), brackets, fixtures and other accessories necessary for the installation of the RFID Transceivers.

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The operator shall design the installation method of ETC RFID Transceiver and decide the height of the RFID Transceiver within the applicable laws and regulations. But in no case, the clearance from the ground level shall be less than 5.5 meter.

B. Specifications

Description	Specification
RF/Radio:	
Frequency	UHF 865 to 867 MHz
Communications	Ethernet/Serial communication (EIA standard RS 232 C/ RS 485)
RF Power maximum	1 W – transmitted & 4 W – EIRP (Equivalent Isotropically Radiated Power)
Reading distance	With the Transceiver mounted typically at a height of 6m above the road surface, the coverage of the antenna shall not exceed a diameter of 3.6m
Antenna	Circularly/Linear Polarized
Protocol	EPC Gen 2, ISO 18000-6C and shall comply with the general conformance requirements of the standard
Visual diagnostics	The Transceiver shall have LED indicators for sense; transmit Fault and Power which shall be visible clearly to the operator on ground while the system is operational.
Environmental:	
Enclosure	Light weight enclosure for the RFID Transceiver and circularly/linearly polarized antenna
Environmental	IP 65 or better for outdoor units
Relative Humidity	95% Condensing
Operating Temperature	-20°C to 55°C
Storage Temperature	-40°C to 85°C
Operational Characteristics:	
Air Interface & Adaptive Noise Features	The Transceiver technology employed should have the capability to optimize read rates for the vehicle identification application and adapt to instantaneous noise and interference level

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Application capability	1. Should have read reliability exceeding 99.5% in the distance range specified 2. Diagnostic and Reporting Tools
Upgradeability	The firmware should be upgradable to support future protocols
Transaction Capability	Reading of Tag & EPC memory for at least 2 Tags per second for a moving vehicle with a speed limit of 40 kilometres/ hour.
Driver Software	The transceiver driver software shall be provided along with the transceiver that will interface to the ETC client through socket interface and handle the communication with ETC client. The packet structure shall be as notified in the ETC client-transceiver interface. The driver software shall implement filtering using a range of EPC-codes /Tag-TID code provided by set of bit pattern masks.

1.2.2. Traffic Light with mounting pole

A. Functions

The Traffic Light (TL) shall be located in the toll lanes in a position where it is readily visible to users of the toll road, usually on the side of the lane beyond the toll booth. The traffic light shall consist of two traffic light heads mounted on a suitable pole. An amber signal with arrow is used to indicate that the user should take suggested path, whilst the green signal is used to indicate that the user should proceed.

At any situation, both AMBER and GREEN part shall not glow simultaneously. Under failure conditions, only Amber arrow shall be displayed until rectification.

B. Specifications

The following minimum specifications shall be met:

Description	**Specification**
Size	200 mm

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Display (Stop)	Amber LED
Display (Start)	Green LED
Visibility Range	20 m (under normal visibility conditions)
Enclosure	SS
Protection	IP 65 rated

1.2.3. Electronic Enclosure

A. All electronic interface and related peripheral/controllers shall be enclosed in an IP65 compliant cabinet.

B. The enclosure shall have a locking mechanism with a unique key providing access to the equipment inside.

C. Door monitoring: The cabinet door shall be monitored utilizing proximity switch. Door open / close events shall be recorded as incidents identified by time and lane. The incidents shall be displayed on the plaza software subsystem.

D. Cabling Layout: All external cables shall be protected against the effects of lightning and shall comply with all requirements for the control of interference from EMI. All data cables shall be screened and shall be properly separated and shielded from all power cables.

E. Ventilation and Internal Temperature: All equipment endorsed by the cabinet shall be kept at a temperature consistent with manufacturers recommendations.

F. Finishing: The cabinet surfaces shall be protected from the environment in which it is to be used and adequate surface treatments shall be applied. Each cabinet shall be painted and numbered in a manner consistent with the toll lanes and consistent with all equipment related functions (e.g. reporting to the plaza software subsystem).

G. Cable dressing: All cables (power & signal) shall be properly routed and dressed with suitable railings inside the enclosure and ties.

H. Cable numbering: The signal & power cable terminations shall be identified by proper numbering. In addition to the termination at the controller end, this numbering shall

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also be maintained at locations where the cables are exposed (like manholes, junctions) and at the peripheral end. Further, all the individual component boards shall be properly identified by labeling.

I. Cable terminations: The signal & power cable (from the peripherals) terminations shall be kept separated inside the cabinet. The cable routing inside the enclosures shall be done in a proper manner, so that, the cable faults can be traced and faulty cables can be replaced easily and quickly.

1.2.4. Hybrid Lane Controller (HLC)

A. Functions

The Hybrid Lane Controller is used to control and monitor all the sub systems and peripheral equipment and communication of the lane for user fee collection process and vehicle passage. The HLC is located in the booth or the tunnel. It is an electronic enclosure that houses the lane computer, AVC computer, peripheral coordination circuitry, redundant power supply, lane network switch and power protection blocks. It acquires the lane data and transmits to the Toll Management System (TMS) in real time.

The HLC shall be connected to the plaza, via fibre optic cable, and shall be required to transmit all transactions, incidents as well as other control information to the TMS in real time. All lanes shall be connected to the TMS server for this test. The LSDU shall be able to monitor activities of each lane in real time. The HLC shall be capable of interfacing with at least the following peripheral equipment –

i. Fee Collector Display
ii. User Fare Display
iii. Overhead Lane Status Sign
iv. Automatic Exit Barrier
v. AVC System including loop
vi. ETC Equipment
vii. Incident Capture Camera
viii. License Plate Image Capture Camera

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The HLC shall be able to track and store in an accurate and fully auditable manner all lane and AVC transactions in a manner as to ensure the system and data integrity is not compromised in any way. A comprehensive test methodology shall be provided for this activity.

The HLC shall be capable of communicating with the local ETC server. Communication shall consist of data necessary to build a complete database in the local ETC server, from which the required financial and operating reports and statistics can be generated. The local ETC server shall also receive and log any reportable incidents occurring in the lane, which shall be transmitted real-time to the Incidents Computer (IC) for action by the toll supervision staff. In terms of incidents, real-time shall mean the time from the occurrence of the incident to the storage of the incident and the subsequent display of the incident on the IC; shall not be greater than ***2 seconds***.

Each Hybrid Lane Controller electrical component should be built on a single rack with its own electrical protections and automatic fuses. Each lane cabinet/enclosure shall have individual independent power sources, one from the UPS and another directly from the plaza power source. All the cabinet power inputs in the plaza are connected to an electrical switch to shut down the power of all plaza lanes for emergency purposes. Separate power supply (SMPS) shall be provided for AVC system and lane computer. The AVC computer shall have additional power back up (UPS) inside the electronic enclosure to provide power backup in case of complete shutdown of the plaza power supply. The UPS shall provide the backup of at least 4 hours to the independent AVC computer and AVC lane components.

B. System Configuration

The system located at the toll booth shall consist of at least the following:

i. Lane computer
ii. Independent AVC computer
iii. Separate power supplies for lane and AVC computer
iv. Power distribution panel with surge and lightening protection circuit
v. Terminal blocks
vi. Relays
vii. Thermostat
viii. IP55 Electronic enclosure with high security locking mechanism

C. Lane Computer

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Lane Computer shall be mounted inside the electronic enclosure. It shall acquire all the data from the lane peripherals and transmit them to the TMS in real time. The specification of lane computer shall be upgraded as per the latest specifications/technologies available. A basic specification is provided in the table below.

Description	Specification
Type	Industrial Grade Cabinet Computer
Motherboard	Industrial Grade
HDD	Based on estimated storage requirement for 6 months data
RAM	2 GB or latest as per requirement
Processor	Intel i3 or equivalent/higher
Processor Speed	2 Ghz or latest as per market
NIC	1 Gbps X 2 Numbers On-board
PCI Slot	2 Nos. spare
USB Port (for authorized)	4
Frame grabber card (if used for capturing images)	1 with 2 channels capable of capturing frames at the same time on both channel

D. Independent AVC Computer

Same as Lane Computer

E. 8-Port PoE Industrial grade rugged Switch with 2 Fibre Port

This device shall have the capability to provide adequate continuous power to each of the CCTV cameras and associated equipment (e.g. video analytics module, PTZ mechanism) to meet the required performance, quality and reliability requirements.

a. Switch shall have minimum 8 nos. 10/100Base-T (with minimum 6 PoE ports with power budget of 60W) ports and additional 2 numbers of SFP uplink ports loaded with MMF Modules.

b. Shall have be IP30 rated and shall work on up to 60°C temp in a sealed enclosure and should be DIN Rail mountable.

c. Switch shall be IEC 60068-2-6, IEC 60068-2-27, IEC 60068-2-47, IEC 60068-2-64, IEC 61000-4-5 and NEMA TS-2 compliant.

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F. 24 Port Switch with 4 Fibre Port

a. Switch shall have minimum 24 nos. 10/100/1000 Base-T ports and additional 4 nos. SFP uplink ports loaded with MMF modules with dedicated stacking ports

b. Switch shall have wire rate performance and 48 Gbps of dedicated stacking bandwidth.

1.2.5. Automatic Vehicle Classification (AVC) System

A. Functions

The AVC system shall be able to distinguish between pre-defined classes of vehicle. This information shall be transmitted to the lane computer, and simultaneously to the LSDU (Lane Status Display Unit) database system, on completion of AVC classification. The lane computer will match this information with the classification entered by the Fee Collector (FC). If there is a discrepancy between the two classifications, the incident capture camera shall be triggered to capture a digital image of the vehicle.

The classification sensors is a combination of the following:

i. Height sensors, axle counters and profilers

ii. Inductive loops

The choice of classification sensor rests with the Concessionaire. The Concessionaire can propose a better proven combination of above mentioned classification sensors. The treadles shall not be installed in the road directly without the frame for the same.

B. Specifications

The AVC shall have the following accuracy for the standard vehicles:

i. For vehicle counting : 99 %

ii. For vehicle classification : 98 %

The minimum specifications for Height Sensors shall be as follows:

Description	**Specification**
Sensor type	Through beam
Sensor Range	Between 5m
Light source wavelength	Infrared LED

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Full clad housing	Outdoor mild steel
Power supply requirement	Vendor Specific
Access for maintenance, modularity of construction	All cables termination are well identified and have signal received indicator Modular design with low cost maintenance.
Environmental Conditions	Operating Temperature of 10°C - 55°C
Sensor Type of Protection	IP65
Reliability and maintainability	MTBF 30,000 hrs MTTR 1 Hour.

The minimum functional specifications for AVC shall be as follows:

In case of network failure, the AVC system shall function independently and store all data locally on a storage device. The data shall be sent to the independent database system via a separate data communication link which is different from the Hybrid Lane Controller.

The system shall be able to detect a vehicle moving in wrong direction.

The AVC computer

i. Shall be a real-time processing unit
ii. Shall be the trigger source for Incident Capture Lane Camera system
iii. Shall have a local storage device capable of storing data for a period of at least 30 days.
iv. Shall have a standby power supply capable of operations for a period of at least 24 hours

1.2.6. Medium Speed Weigh-in-Motion

A. Functions

i. The MSWIM system shall be able to capture number of axles, axle spacing, number of wheels, gross weight of vehicle and height of each passing vehicle and provide data of each vehicle to the lane controller for further auditing and analysis.

ii. The Gross Vehicle Weight of vehicles approaching the toll booth shall be automatically detected for speed range prescribed in the specifications.

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iii. This detected weight shall not be displayed on the computer terminal of toll collector until the toll collector classifies the vehicle.

iv. If the vehicle is found to be overloaded based on Toll Collector Classification, the Weight information shall be displayed as "Overweight Warning" and appropriate toll receipts with 10 times the fare/fee, shall be generated automatically.

v. The excess fee charged against such overloaded vehicles shall also be separately printed on user fee receipts of such vehicles.

vi. MIS reports shall be available for the Authority, on numbers of overloaded vehicles crossing any toll plaza as per mutually decided format.

B. Specifications

Description	**Specification**
Capacity of the Platform	30 Ton/Axle
Stationary Accuracy	±0.1% FSR
In Motion Accuracy	±7% FSR up to speed 50 Km/h; and
Overload capacity of the platform	150% of rated capacity
Vehicle separator	IR Based curtain housed in Weather Proof, IP65 Rated pillars with proper sealing
Controller Housing	Water/ weather proof with anti-rust coating; IP65 rated
Approval/ Certification	Weights & Measures Approved Model, Duly stamped & sealed by W&M Department on Installation
Re-calibration/ Stamping & Verification	Every 12 (Twelve) months
Downtime allowed for Periodic Maintenance	Maximum 24 (Twenty Four) hour/ Quarter

1.2.7. Fee Collector Terminal

The Fee Collector Terminal (FCT) shall consist of following equipment:

A. Fee Collector touchscreen Display (FCD)

B. Fee Collector Keyboard (FCK)

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C. Barcode Reader (BCR)

D. Receipt Printer (RPR)

The FCT shall be the interface between the system and the Fee Collector. With the FCT, the collector shall be able to input the data in the system and the fee collector display and receipt printer shall provide the output data from the lane controller to the collector.

A. Fee Collector Display

The Fee Collector Display (FCD) shall be located on the Fee Collector's desktop and shall be screwed or bolted through the counter top. Suitable mounting brackets manufactured from stainless steel shall be provided to fix the screen to the desktop. All nuts and bolts are used to secure the FCT to the booth counter top shall be stainless steel. It shall be the system's interface to the fee collector, to display the status of transactions and status of the lane peripherals.

The minimum technical specifications are as follows:

Descriptions	**Remarks**
Display Type	Touchscreen TFT with Diagonal Size of 18.5" Minimum
Cables	Power Cable 1 x VGA Cable (15- pin HD D – Sub)
Cable routes	Power cable is terminated to the Hybrid Lane Controller power distribution block via booth ducting VGA Cable is terminated to the SVGA Port at the LC via booth ducting
Colour	Manufacturer's Original Colour
Voltage	AC 230 V (50 / 60 Hz)
Power Consumption	80 W
Operating Temperature	0°C to 50°C
Relative Humidity	20 % to 80 %
Design Criteria	- Min. Resolution: 1024 X 768 / 60 Hz - Aspect Ratio : 4:3 - Number of Colours : 16.2 M, (6bit+FRC) - Video bandwidth: 70 MHz

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	- Viewable size: 18.5" Minimum - MTBF: 30,000 hrs - MTTR: 0.25 hrs

B. Fee Collector Keyboard

The keyboard on the Fee Collector Terminal for registration of toll operations shall be a programmable Industrial Grade keyboard. The keyboard shall be used to enter data such as:

i. Staff ID number
ii. Classification of vehicle
iii. Type of transaction
iv. Accept/Cancel transaction
v. Selecting method of payment
vi. Operating OHLS
vii. Bleed-off button
viii. Violation Cancel/Accept Button
ix. Simulation Button (Only to be used during Maintenance Mode)
x. Alpha Numeric Keys in QWERTY format

The minimum specifications shall be as follows:

i. Shall have good programming capability
ii. Programming under DOS and Windows, multiple page, multiple level, whole range key content, time delay, position sense answer back code, etc.
iii. True spill-resistant design
iv. Optional blank key, double key for alternative key group layout
v. Optional Magnetic Stripe Reader
vi. 70 programming keys + 6 position control key
vii. Key top size: 18 mm x 22 mm for single key
viii. Interface : PS/2 or USB
ix. Dimension : 340 mm (W) x 150 mm (D) x 58 mm (H); Weight: upto 1.2 kg
x. Color : OEM Specific

C. Barcode reader

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Desktop mounted fixed barcode reader shall be installed in the toll booth on the fee collector desktop. The road user upon reaching the pay-axis of the lane will produce the return/ daily pass ticket. The fee collector will place the ticket on the barcode reader which will read the 2D barcode printed on the ticket. The lane controller shall get the transit details from the barcode which validates the ticket and authenticates the vehicle class (as entered by the fee collector) for processing of the transaction.

The minimum BCR features and specification shall be as follows:

i. BCR shall be a high performance 2D omnidirectional laser scanner
ii. Shall have programmable sleep mode which can be reactivated by simple push of a button
iii. BCR shall perform Full automatic scanning operation
iv. Depth of Field: 300 mm (EAN 0.33 mm / 13 mil, PCS = 90%)
v. Scan Patten: 7 directions of scan field, 24 scan lines
vi. Scan Rate: 2400 scans/sec for omnidirectional scanning
vii. Dimension: 152 mm (H) x 152 mm (W) x 91 mm (D); Weight: not more than 500 g
viii. Interface: USB or Serial

D. Receipt Printer

The thermal RPR shall be used to print receipts in the lanes. The printer shall be provided with the automatic advance function of the paper after printing so that the space for the first line of printing is aligned under the print head thus reducing the time taken to produce a receipt.

For design purpose it shall be assumed that receipts will be approximately 70mm in length. The Authority and Project/plaza information will occupy space on the top. The area under this shall be used for particular printed data. The Concessionaire shall take the approval from the Authority for the format of the receipt.

The minimum technical specifications for the RPR shall be as follows:

Descriptions	**Specification**
Dimension	Maximum up to 145mm (W) x 195mm (D) x 148 (H)
Weight	Shall be less than 2 kg
Installation and Fixing Details	Installed and fixed on the Fee Collector desk

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Cables	- Power cable - Serial RS232C/ Parallel /USB
Cable routes	Power cable is terminated to the HLC Termination Block via booth ducting. Data cable is connected to the HLC
Colour	Cool White/Dark Grey
Power Supply Requirement	24 VDC ± 7%
Access for maintenance, modularity of construction	The cover can be opened for maintenance. It also has paper sensors. Off-the-shelf product
Operating Temperature	58C to 508C
Relative Humidity	5 % to 90 %
Design Criteria	Print Speed: 47 LPS Print font: 9x17/12x24 Print column capacity: 56/42 columns
	Character size (mm): 0.99(W) x 2.4 (H) / 1.41 (W) x 3.4 (H) Paper dimension (mm): 79.5 ± 0.5 (W) x 83 (diameter) Paper thickness: 0.06-0.07 mm Auto cutter life: 1.5 million cuts Real-time printer status: Auto status back (ASB) messages MCBF: 52 million lines MTBF: 360,000 hours, Overall MTTR: 0.25 hrs

1.2.8. User Fare Display

A. Functions

The User Fare Display (UFD) shall be a LED display panel controlled automatically by the lane computer. It shall indicate to the road user the category of the vehicle and the amount payable/ balance in prepaid account. The STOP/GO light shall be integrated in the UFD at the top corner.

B. Specifications

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Description	Specifications
Size	750 mm x 400 mm
Display	Red LED
Visibility Range	10 m
Enclosure	MS
MTBF	50,000 hours
MTTR	Less than 30 minutes
Protection	IP 65

1.2.9. Incident Capture Camera

A. Functions

The Incident Capture Camera is installed at a convenient location on the island to capture images and video clips of the vehicles for the following incidents:

i. Class discrepancy between the classes detected by the AVC and that entered by the fee collector
ii. Exempt users
iii. All transaction of vehicle with special events
iv. Offending vehicles
v. When the panic alarm footswitch is activated by the fee collector

The camera shall be installed inside the housing at the suitable height above the surface of the lane to be decided by the Concessionaire on a pole to record the vehicle images and video clip for every transaction in the lane. The vehicle images captured shall be of the front and right side portion of the vehicle.

General Requirements:

i. The housing will be equipped with a hood to protect the camera under direct sunlight.
ii. Protection: IP65.
iii. The stand of the lane camera shall be made of steel that shall not swing or twist under gutter speed of strong wind. The stand will be protected from corrosive environmental conditions.

B. Specifications

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Description	Specification
Image Sensor	1/3" Progressive Scan CMOS
Min. Illumination	0.01 Lux @(F1.2,AGC ON), 0 Lux with IR
Shutter time	1/25s ~ 1/100,000s
Lens	2.8 - 12 mm @ F1.4,Angle of view: 80°-28.7°
Lens Mount	φ14
Day& Night	IR cut filter with auto switch
Wide Dynamic Range	Digital WDR
Digital noise reduction	3D DNR
Video Compression	H.264/M-JPEG
Bit Rate	32 Kbps ~ 16 Mbps
Audio Compression	-S: G.711/G.726/MP2L2
Dual Stream	Yes
Max. Image Resolution	1280x960
Frame Rate	50 Hz: 25 fps (1280 × 960), 25 fps (1280 x 720), 25 fps (704 x 576), 25 fps (640 x 480), 60 Hz: 30 fps (1280 × 960), 30 fps (1280 x 720), 30 fps (704 x 576), 30 fps (640 x 480)
Image Setting	Saturation, brightness, contrast adjustable through client software or web browser
BLC	Yes, zone configurable
ROI	Yes, up to 4 configurable areas
Network Storage	Shall store data on NVR
Alarm Trigger	Motion detection, Dynamic Analysis, Tampering alarm, Network disconnect, IP address conflict, Storage exception
Protocols	TCP/IP,ICMP,HTTP,HTTPS,FTP,DHCP,DNS,DDNS,RTP, RTCP,PPPoE, NTP, UPnP, SMTP, SNMP, IGMP, 802.1X,QoS
Security	User Authentication, Watermark, IP address filtering, anonymous access
System Compatibility	ONVIF, PSIA, CGI, ISAPI
Communication Interface	1 RJ45 10M / 100M ethernet interface
On-board storage	Built-in Micro SD/SDHC/SDXC card slot, up to 64 GB
Reset Button	Yes

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Operating Conditions	-30 °C ~ 60 °C (-22 °F ~ 140 °F)
Power Supply	12 VDC ± 10%, PoE (802.3af)
Weather Proof	IP66
Power Consumption	Max. 5.5 W (Max. 7.5 W with IR cut filter on)
IR Range	Up to 30m

1.2.10. License Plate Image Capture Camera

The camera shall be installed inside the housing at the suitable height above the surface of the lane to be decided by the Concessionaire on a pole to allow the automatic number plate capturing of the vehicle in the lane.

A. General Requirement:

The system should automatically detect a vehicle in the camera view using video detection and activate license plate recognition. The system shall automatically detect the license plate in the captured video feed in real-time.

The system shall perform OCR (optical character recognition) of the license plate characters (English alpha-numeric characters in standard fonts). It is expected that the software should provide at least 80% detection accuracy in day time and 70% during night time with proper IR illuminator and with standard license plates. The system shall be self-learning and shall improve the reading accuracy with time.

The system shall store JPEG image of vehicle and license plate and enter the license plate number into DBMS database along with date time stamp and site location details.

System should be able to detect and recognize the English alphanumeric license plate in standard fonts and format for all four wheelers including cars, HCV, and LCV.

The system shall be robust to variation in license plates in terms of font, size, contrast and colour and should work with good accuracy.

B. Vehicle Status Alerts

The system should have option to input certain license plates according to the hot listed categories like "Wanted", "Suspicious", "Stolen", etc. by authorized personnel such as administrator or supervisor.

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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.

C. Vehicle Status Alarm Module

On successful recognition of the vehicle 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).

D. 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:

i. Report of vehicle flow at each of the installed locations for Last Day, Last Week and Last Month.

ii. Report of vehicles in the detected categories at each of the installed locations for Last Day, Last Week and Last Month.

iii. 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 system.

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).

E. Central Management Module

The Central Management Module shall run on the video server in every TMS. It should be possible to view records and edit hotlists from the CCTV Workstation. The extracted data shall be provided to other sub system through seamless integration. The system shall be integrated with Weight in Motion system which will detect overweight vehicles and will pass on the trigger to the licence plate image capture system to capture vehicle image with license plate.

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The License Plate Image Capture system shall also achieve:

i. Continuous monitoring of the operational status and event-triggered alarms from servers, cameras and other devices. This shall provide a real-time overview of alarm status or technical problems while allowing for immediate visual verification and troubleshooting.

ii. Recording schedules can be continuous, event based, schedule based, trigger based etc.

iii. Virtual Matrix – To allow viewing of live video in different layouts on operator screen.

iv. Seamless working of fully integrated software platform.

v. Archive search using dates, time, event etc.

F. Specifications

Description	**Specification**
Image Sensor	1/2.8" Progressive Scan CMOS
Signal System	PAL / NTSC
Min. Illumination	0.05Lux @(F1.2,AGC ON) ,0 Lux with IR
Shutter time	1/25(1/30) s to 1/100,000s
Lens	E13: 6mm@ F2.0 Angle of view:45.3°(4mm optional) EI5: 12mm@ F2.0 Angle of view:22°
Lens Mount	M12
Day & Night Function	Day Night visibility with color images / videos
Video Compression	H.264 / MPEG4 / MJPEG
Bit Rate	32 Kbps ~ 16 Mbps
Dual Stream	Yes
Maximum Image Resolution	1920 x 1080
Frame Rate	50Hz:25fps (1920×1080), 60Hz:30fps (1920 × 1080)
Image Settings	Saturation, brightness, contrast adjustable through client software or web browser
Alarm Trigger	Motion detection, Dynamic Analysis, Tampering alarm
Security	User Authentication, Watermark, IP address filtering, anonymous access

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System Compatibility	ONVIF, PSIA, CGI
Operating Conditions	-10°C ~ 60°C (14°F ~ 140°F), Humidity 90% or less (non-condensing)
Power Supply	DC, PoE (802.3af)
Weather Proof	IP66
IP Range	E13: Approx. 20-30 metres; E15: Approx. 50 metres
OCR	Yes
Note	This Camera needs external high power IR panel to illuminate license plate with a stronger IR light.

1.2.11. Emergency Footswitch Alarm System

A. Functions

The emergency footswitch is located in each booth under the fee collector's desk. The footswitch is provided for use in case of emergency or an accident. Pressing the footswitch shall raise an alarm to the auditor via the LSDU & activate a siren. The siren is fitted on the top of the booth. The siren also is triggered by the incidents like violation and the HP & MC convoy as mentioned in the design specification documents earlier.

B. Specifications

The minimum specifications for the emergency footswitch are as follows:

Description	**Specifications**
Installation and Fixing Details	Mounted on the floor inside the tollbooth under the desktop
Cables	- Power cable - Signal cable
Cable routes	- The power cable is laid inside the booth manhole before terminating to the HLC Termination Block. - Data cable is connected to the HLC DI board from the termination block
Material and finishes	Steel
Colour	Manufacturer's Original Colour
Power Supply Requirement	220~240 V AC 50-60Hz with 10 A

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Access for maintenance, modularity of construction	Modular Design, only plug and replace when fails
Environmental Considerations	Operating Temperature 0°C - 50°C
Reliability and maintainability	MCBF: 100,000 operations MTTR: 0.5 hrs

The minimum specifications for the siren are as follows:

Description	**Specifications**
Technology	Motor Driven or better
Audible rating	112 dB at 1 meter
Environmental	Designed to meet IP54

1.2.12. Booth CCTV Cameras

A. Functions

The booth CCTV camera shall be a fixed dome type IP (Internet Protocol) colour camera installed inside the booth to capture the activities of the fee collector while performing his operations. The camera shall also capture the view of the paying vehicle.

These cameras shall have inbuilt voice recording and SD memory card of minimum 32GB for local storage of videos and voice recordings. These cameras shall be connected to the plaza video server installed at the TMS server room at each plaza building.

The camera shall be capable of triggering alarms in case of camera tampering detection and audio detection. The triggering alerts can be controlled by the control room operator.

B. Specifications

The technical specifications of the booth cameras shall be as follows:

Description	**Specifications**
Image Sensor	1/2.8" Progressive CMOS
Maximum Resolution	1920x1080 (2MP)
Lens Type	Fixed Focal
Focal Length	f = 2.8
Aperture	F1.8

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Field of View	110° (Horizontal) 64° (Vertical) 135° (Diagonal)
Shutter Time	1/5 sec. to 1/30,000 sec.
Day/Night	Removable IR-cut filter for day & night function
Minimum Illumination	0.08 Lux @ F1.8 (Color) 0.001 Lux @ F1.8 (B/W)
IR Illuminators	Built-in IR illuminators, effective up to 25 meters or better IR LED*8
On-board Storage	SD/SDHC/SDXC card slot
Compression	H.264 & MJPEG
Maximum Frame Rate	30 fps @ 1920x1080 In both compression modes
Maximum Streams	4 simultaneous streams
S/N Ratio	Above 55dB
Dynamic Range	97dB or better
Video Streaming	Adjustable resolution, quality and bitrate
Image Settings	Adjustable image size, quality and bit rate, time stamp, text overlay, flip & mirror, configurable brightness, contrast, saturation, sharpness, white balance, exposure control, gain, backlight compensation, privacy masks, scheduled profile settings, seamless recording, smart stream, 3D Noise Reduction, Video Rotation
Audio Capability	Audio input /output (full duplex)
Compression	G.711, G.726
Interface	External microphone input Audio output
Protocols	IPv4, IPv6, TCP/IP, HTTP, HTTPS, UPnP, RTSP/RTP/RTCP, IGMP, SMTP, FTP, DHCP, NTP, DNS, DDNS, PPPoE, CoS, QoS, SNMP, 802.1X, UDP, ICMP
Interface	10 Base-T/100 BaseTX Ethernet (RJ-45)
ONVIF	Supported

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Alarm Triggers	Video motion detection, manual trigger, digital input, periodical trigger, system boot, recording notification, camera tampering detection, audio detection
Alarm Events	Event notification using digital output, HTTP, SMTP, FTP and NAS server, SD Card File upload via HTTP, SMTP, FTP, NAS server and SD card
Connectors	RJ-45 cable connector for Network/PoE connection Audio output DC 12V power input Digital input*1 Digital output*1
LED Indicator	System power and status indicator
Power Input	Max. 9 W (PoE)
Safety Certifications	CE, LVD, FCC Class B, VCCI, C-Tick
Operating Temperature	Starting Temperature: -10°C to 50°C (14°F~ 122°F)

1.2.13. Intercom Slave Communication Unit (ISCU)

A. Function

Intercom Slave Communication Unit (ISCU) shall be used for communication between the fee collector at the lane and the auditor/supervisor at the plaza building. It shall have the following functions:

i. It shall provide hands free two-way verbal communication between the supervision staff in the control room and the Fee Collector. The Fee Collector shall be able to attract the attention of the auditor in the control room by pressing a single button on the intercom slave unit.

ii. The equipment shall also have the facility to allow the supervision staff to monitor communication in the booth between the Fee Collector and the user or between any two booths without alerting the Fee Collector.

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iii. The voice communication system shall operate independent of the HLC system.

iv. Voice communication shall also be implemented in various rooms of the plaza building and at building access points:

v. Two-way communications shall be possible as soon as the auditor responds by selecting the appropriate lane button on the master communication unit

vi. One-way communication shall be possible from the Control Room intercom to all lanes simultaneously (broadcast)

B. Specifications

ISCU shall meet the following minimum specifications:

Descriptions	**Remarks**
Installation and Fixing Details	Fixed in the booth. (wall/desktop mount)
Speech Method	Hands-free
Wiring distance	120 meters with 0.202 mm diameter (33 AWG) cable, 300 meters with 1.024 mm diameter (18AWG) cable
Speaker	20 ohms
Power Consumption	6 W (max.)
Power Supply Requirement	Power supply from Master System
Wiring	2 wires, non-twisted
Environmental Considerations	Operating Temperature of 10°C to 50°C
Reliability	30,000 hrs

The operator may also propose/provide an IP based intercom system.

1.2.14. Automatic Lane Exit Barrier (ALB)

A. Functions

The function of the ALB is to control the passage of vehicles through the lane. Each lane shall be fitted with an ALB, the exact location of the ALB shall be provided by the Concessionaire in the lane layout drawing at the time of tender.

The operation of barrier is linked to the lane controller. It allows the vehicle to pass through after a successful transaction has happened at the lane.

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The system consists of a fixed housing and a movable arm with a high impact breakaway device or provision. The housing shall contain the motor and control units along with the integrated metal detectors for vehicle detection purpose. The housing shall be installed on the right side of the traffic direction, after the booth on a concrete base.

The boom arms shall be fitted with a swing-away flange to prevent damages to the barrier/vehicle in case of an unpermitted or forced drive-through. Boom contact shall be available which gives continuous alert to the TMS when the boom is missing or swung away.

B. Specifications

The ALB shall meet the following technical specifications:

i. The lane exit barrier shall be suitable for high-speed ETC transactions. One full open-close cycle shall not take more than 1.2 seconds. The barriers used shall be capable of full lane open from a close state in less than 0.6 seconds.

ii. The housing and any mounting frame shall be fabricated from corrosion-resistant materials. They shall be IP 55 rated. The barrier shall be driven electrically. The motor shall not be damaged when the barrier is blocked in any position. Exit barriers shall have presence detectors independent to the AVC system to prevent barrier arms coming down on vehicles while passing. This shall be in the form of infrared units and dedicated embedded loops. Apart from the barrier arm, the mechanism may not have any moving protrusions that pose a risk to persons standing in close proximity to the barrier.

iii. The barrier arm shall be fabricated from a light, corrosion resistant material readily and inexpensively available in India. The barrier arm shall further have a protective mechanism whereby controlled fracture of the barrier arm occurs without damage to the housing or motor in the event of frontal collision. Preference will be given to non-destructive break-away mechanisms. Further, there shall be a protection mechanism to detect the presence of vehicles to avoid accidental hitting on the vehicles, whenever the boom is triggered for closing.

iv. Suitable power supply scheme shall be implemented by the Contractor to feed the Exit barrier to protect the source from being damaged due to electrical surges / spikes injected by the dynamic (inductive) load. Further, the drive shall be so designed as to the damping factor is just sufficient for the drive to operate the booms without any jerks during open / close to avoid freak hitting by the exiting vehicles.

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v. Barrier arms shall have retro-reflective red stripes in accordance with the local traffic sign standards.

vi. The Automatic Barrier Gate shall be IP 55 rated.

vii. The Automatic Barrier Gate shall receive power directly from dedicated online UPS. Suitable protection shall be provided by the Contractor at the load end to protect the Boom Barrier. The Contractor shall fulfill any specific earthing requirement.

viii. The following minimum specifications shall be met:

Boom Length: 3.5 m

Boom Material: Aluminium

1.2.15. Network Video Recorder (NVR)

H.265 Linux-based embedded standalone NVR shall be provided. Shall support 16-Channel /24-Channel / 32-Channel network cameras. The NVR shall be ONVIF compliant and scalable configuration with features to help users to set up and manage advanced IP surveillance systems with ease. The NVR shall also support remote and mobile access, via web based application, and app for both iOS and Android devices.

The NVR shall have minimum following technical features:

a) H.265 Compression Technology

b) Plug & Play One Button Auto Setup

c) Intuitive, Intelligent and Interactive UI

d) Live viewing, recording and Playback features

e) Embedded Linux OS or OEM Specific

f) Support RAID 0/1/5 Storage

g) Up to 12MP Camera Liveview & Playback

h) Dual Lan Network Ports with Failover Function

i) ONVIF Open Platform

1.3. **Administrative Area**

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1.3.1. Master Communication Unit

A. Functions

The master communication unit MCU is a master communication system to control communication between the fee collector at the lane and the auditor at the plaza building. The unit will be located in the control room and controlled by auditor/supervisor.

B. Specifications

Description	**Specifications**
Power Source	24V DC
Current Consumption	Max. 1A, 80mA in standby
Communication	Push-to-talk at master station hands free at sub
Calling	LED and intermittent ringing tone at master until answered
Frequency Response	770 – 6800Hz
Total Harmonic Distortion	3% @ 1000Hz at 20 ohms
Mounting	Wall or desk mount
Wiring	2 conductor per sub station
MTBF	30,000 hrs

1.3.2. Static Weigh Bridge

The handling of overloaded vehicles shall be governed by terms of directives issued by the Authority.

A. Functional Requirements

i. A Static Weigh Bridge (SWB) shall be installed in each direction of traffic, after the toll plaza, in a separate area having facility of parking of overloaded vehicles. This is to ensure that an overloaded vehicle does not ply on National Highways.

ii. The SWB system shall be able to capture Toll Transaction Number with Date and Time, Vehicle Registration Number, Category of Vehicle, Permissible Weight, and Gross Vehicle Weight along with date/ time of weighing, and the receipt printed by the SWB system shall contain these information. This system shall also be integrated with the toll system and generate a closure report.

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iii. The SWB station shall have a CCTV camera for capturing image of vehicle while weighing.

iv. Monthly MIS reports shall be available for the Authority, such as Actual Over loaded vehicles, Total Overweight Vehicles (WIM) vs Actual Overweight vehicles (SWB) etc.

B. Technical Specifications

Type	Site specific (Pit / Pit less / Mobile)
Body/Platform	Steel
Size	18 meter x 3 meter
Capacity	120 Tonnes
Structure	I-Beam complying BIS 2062. Top Plate - 10 mm or more – Steel as per BIS 2062
Structure	Duly certified for Structural Analysis And Design(STAAD)-III
Number of Load cells	8
Type of Load Cells	Compression Type/Double Ended Shear Beam – Stainless Steel 17-4 Ph
Protection Class for the Load Cells	IP 68 or better, Operational Temp: -10 to 65 Degrees
Protection Class for the Weighing Indicator	IP 65 or better, Operational Temp: -10 to 65 Degrees
Overload capacity	150% of rated capacity
Accuracy Class	OIML - C-IV
Accuracy Tolerance	Up to 0.02%
Painting	Anti-rust & anti-corrosion painting
BIS Specification	IS-9281(Part-III)
Compliant	Legal Metrology Act 2009 (1 of 2010) & Rules framed there under from time to time - Duly sealed by the Weights & Measures Dept.
Approval/ Certification	Weights & Measures Approved Model

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1.3.3. UPS System

A. Specifications

Online UPS with 4 hours of backup and sizing based on power requirement calculation, shall be provided. The UPS design shall take the following into account:

i. The system shall be capable of maintaining an uninterrupted power supply to the UPS loads for a sustained period of at least 4 hours under full load conditions from a fully charged battery.

ii. It shall also be capable of continuously supplying power to the system under an intermittent interruption cycle.

iii. The UPS shall be capable of operating at input voltages of 210/380Volts ±10% and 50 Hz ±2.5 Hz.

1.3.4. Network Laser Printer (Black and White)

A. Specifications

At least 2 Network Printer shall be required in the Plaza office/Control Room with following minimum specifications:

- 25 PPM
- Duplex;
- Fast Ethernet; and should support Paper size(s): Letter/ Legal/ Executive/ Statement/ 8.50" x 13"/ Envelope No. 10/ Monarch Envelope/ Custom Size.

1.3.5. Cabling

A. Specifications

All cables and wires shall be of good quality, conforming to normally accepted industry standards, and shall be of the proper type and have sufficient ratings for the particular application.

All exposed ends of unconnected cables and wires shall be coated with water tight sealing compound or sealing tape to avoid damage to conductors. All communication cables used shall

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have a clearly marked label securely fixed near each end in accordance with the cable network diagram.

All cables and wires shall be adequately protected from the edges of equipment housing or other surrounding objects. All the cables and wires shall be neatly arranged and securely placed in such a way that all terminals are relieved of the weight of the cables. Terminals shall be coded and identified as per the wiring diagrams. Live metal shall be recessed or protected to avoid accidental contact.

1.3.6. Workstation

A. Functions

The workstation will be used by the System Administrator and / or Toll Supervisor to access the system for Admin/Audit purpose. At least 4 work stations / laptops should be provided in the Plaza office/Control Room with following minimum specification:

B. Specifications

The TMS workstation shall comply with the minimum specifications prescribed in the below table.

Description	**Specifications**
Processor	Intel Core i5, Processor 2.4 GHz; 8 MB Cache, 1600 MHz, 4 Cores, Hyper threading, Intel HD Graphics
Memory(RAM)	4 GB or better
Storage	300 GB or better
Network	Integrated NIC
Ports	RJ-45, 1 USB 3.0, 3 USB 2.0
Monitor	18.5"LED
Input interface	Keyboard and Mouse
Antivirus	Yes

1.3.7. Server

A. Functions

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The Plaza Server should have 1+1 redundancy and should be provided with Server Rack 24U, with fan and adequate power points and cable management adjustable for caster / wall mount.

B. Specifications

Description	Specifications
Form factor/height	2U Rack
Processor	4 - core Intel Xeon E5-2600 v2 series processors – 2 Nos. or better
Cache	15 MB per processor or Better
Memory	32 GB RAM, DDR 4, Shall be expendable to 64 GB
Internal Storage	Minimum 8 TB SAS/SATA or Better
Media bays	ODD and tape drive bay
RAID support	Integrated 6 Gbps or new optional 12 Gbps* hardware RAID-0, -1, -10 with optional RAID-5, -50, -6, -60
Power supply (std/max)	2 - Redundant Hot swappable
Hot-swap components	Power supplies, fan modules and hard disk drives
Network Interface Controller (NIC) Trusted Platform Module (TPM)	4 × 1 GbE (std.), 2 × 10 GbE Embedded Adapter (slot less opt.)/TPM
PCIe 3.0 Expansion slots (x16/x8)	4 - 6 PCIe ports or 4 PCI-X (CTO) or 2 double-width PCIe (for GPU)
USB ports	2 front/4 back/2 internal
Internal storage	Minimum 8 TB SAS/SATA or Better
Energy-efficiency compliance†	80 PLUS® Platinum and ENERGY STAR® Compliance
Monitor	18.5" LED
Input interface	Keyboard and Mouse
Operating System	Windows Server 2012 Std. or Open source OS such as Linux, Unix flavours, as per requirement of Toll Management System

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1.3.8. Display for CCTV Monitoring

The Display shall be a 55" inch professional grade display with wide viewing angle, full HD resolution and shall be suitable for 24x7 indoor application. The monitor shall have high contrast ratio, lightweight design, full high definition 1920x1080 resolution, and anti-glare panel. It shall have inbuilt VGA, DVI, S-Video and HDMI ports for multiple video inputs.

Description	Specifications
Panel Size	55 inch
Light source	LED Backlight
Resolution	1920 X 1080 pixels
Dynamic Contrast Ratio	1400:1
Viewing angle	Horizontal: 178 Degree, Vertical: 178 Degree
Display feature	Full HD; Panel
Response time	Minimum 8ms
Lifetime	Minimum 50,000 Hrs.
Colours	Minimum 16 Million
Brightness	350cd/m^2
Panel thickness	Not more than 65mm

1.3.9. Network Switches

A. Functional Requirement for Switches

i. Switch should support port security, DHCP snooping, Dynamic ARP inspection, IP Source guard, BPDU Guard, spanning tree root guard.

ii. Switch should be IPv6 Certified/IPv6 logo ready and Switch / Switch's Operating System should be tested and certified or in process of certification for EAL 2/NDPP or above under Common Criteria Certification.

iii. Switch should have 1:1 redundant internal power supply. Power supply modules, fan modules and transceivers modules should be hot swappable.

iv. Should support IEEE Standards of Ethernet: IEEE 802.1D, 802.1s, 802.1w, 802.1x, 802.3ad, 802.3x, 802.1p, 802.1Q, 802.3, 802.3u, 802.3ab, 802.3z, 802.3az.

B. 24 Port Layer 3 Switch with 4 Fiber Port

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i. Switch shall have minimum 24 nos. 10/100/1000 Base-T ports and additional 4 nos. SFP uplink ports loaded with MMF modules with dedicated stacking ports

ii. Switch shall have wire rate performance and 48 Gbps of dedicated stacking bandwidth.

1.3.10. Building Surveillance System

The system shall be connected to the NVR. The Video Management Software installed on NVR shall provide the facility to control the cameras at the Supervision Control room at the plaza buildings.

The cameras shall be for monitoring of security areas such as plaza compound, security garage, control room, change of shift room and cash counting room, lobby, hallway, tunnel, fee collector walkway, parking, staircase, DG room, electrical room, server room, UPS room, loading bay, etc.

These cameras shall be – Fixed lens Bullet CCTV night vision colour cameras. The bullet cameras installed outdoor shall be installed in the weather proof enclosure.

A. Fixed lens Bullet CCTV night vision color cameras

Description	**Specifications**
Image Sensor	1/2.8" Progressive CMOS
Maximum Resolution	1920x1080 (2MP)
Lens Type	Fixed-focal
Focal Length	f = 3.6 mm
Aperture	F2.1
Field of View	83° (Horizontal), 53° (Vertical), 91° (Diagonal)
Shutter Time	1/5 sec. to 1/30,000 sec. or better
Day/Night	Removable IR-cut filter for day & night function
Minimum Illumination	0.06 Lux @ F2.1 (Color)
	0.001 Lux @ F2.1 (B/W)
IR Illuminators	Built-in IR illuminators, effective up to 30 meters
On-board Storage	Slot type: SD/SDHC/SDXC card slot
	Seamless Recording
Compression	H.265 & MJPEG

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Maximum Frame Rate	30 fps @ 1920x1080
	In both compression modes
Maximum Streams	4 simultaneous streams
S/N Ratio	50 dB or better
Dynamic Range	95 dB or better
Video Streaming	Adjustable resolution, quality and bitrate, Stream
Image Settings	Adjustable image size, quality and bit rate, Time stamp, text overlay, flip & mirror, Configurable brightness, contrast, saturation, sharpness, white balance, exposure control, gain, backlight compensation, privacy masks, Scheduled profile settings, 3D Noise Reduction, Video Rotation, Defog
Audio Capability	Two-way audio (full duplex)
Compression	G.711, G.726
Interface	External microphone input
	Audio output
Users	Live viewing for up to 10 clients
Protocols	IPv4, IPv6, TCP/IP, HTTP, HTTPS, UPnP, RTSP/RTP/RTCP, IGMP, SMTP, FTP, DHCP, NTP, DNS, DDNS, PPPoE, CoS, QoS, SNMP, 802.1X, UDP, ICMP, ARP, SSL, TLS
Interface	10 Base-T/100 BaseTX Ethernet (RJ-45)
ONVIF	Supported
Alarm Triggers	Video motion detection, manual trigger, digital input, periodical trigger, system boot, recording notification, camera tampering detection, audio detection
Alarm Events	Event notification using digital output, HTTP, SMTP, FTP and NAS server, SD Card
	File upload via HTTP, SMTP, FTP, NAS server and SD card
Smart Focus System	Fixed Focus
Connectors	RJ-45 cable connector for Network/PoE connection
	Audio input
	Audio output
	DC 12V power input

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	Digital input: 1, Digital output:1
LED Indicator	System power and status indicator
Casing	Weather-proof IP66-rated housing
	Vandal-proof IK10-rated metal housing (Casing Only)
Safety Certifications	CE, LVD, FCC Class A, VCCI, C-Tick
Operating Temperature	10°C to 50°C

1.3.11 Hybrid Toll Management System/Software – Lane and Plaza level

i. The Toll Management System (TMS) shall be responsible for capturing & processing toll transactions into information, that will be used to verify toll collections, provide toll collector control, cash-up and shall include a host of management tools and reports for the effective administration of the toll operation.

ii. The TMS shall also assist in auditing the toll collection operation. It shall be a modular system with the capability for various modules and functions to perform independently at different levels of the toll collection operations.

iii. The TMS shall have various customizable reports.

iv. The TMS shall have financial management and traffic analysis tools to assist the Concessionaire in planning operations.

v. The Service Provider shall ensure that security updates and latest service packs, "patches" are loaded on the Lane / AVC Controllers as well as Toll Plaza Servers. Industry standard operating systems shall be utilized and all user licenses shall be provided.

vi. The database shall be an industry standard relational database management system and shall be supplied with all the latest service packs and patches, including required user licenses.

vii. Toll Management System should be able to support all kind of Fare structures & Payment methods including, but not limited to, Daily Pass, Return Pass, Monthly Pass,

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Discounted tariffs, Exemptions, Open / Closed fare schemes etc. and shall meet the Tolling System requirements of the respective Concession Agreement.

viii. Fully integrated with all other peripherals and systems such as WIM, SWB etc.

ix. Shall be able to send data to Central data center designated by the Authority, in real time.

1.3.12 Monitoring system

A monitoring system of the Hybrid ETC hardware in real time through a system logger shall be available. The monitoring system shall keep record of its operation and status of the various Hybrid ETC Systems and devices in a unified manner in the database. All incident and events shall be recorded. Data retrieval software shall be provided to retrieve and display the operating history of the specified systems and devices.

The system shall be used for monitoring the up-time of entire system (including each peripheral and network connectivity) including generation of system alerts/reports on system downtime for SLA monitoring/compliance. This shall also include monitoring of downtime of any lane/plaza level equipment, poor/low video quality, no video signal, communication network or bandwidth related issues etc. Entire process of capturing downtime, reporting, escalating till resolution should be enabled within the system itself like standard CRM practices.

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SPECIFICATION OF FIREWALL HARDWARE

a) Physical Interfaces

i. LAN ports: Four (4) 10/100/1000 Mbps auto-sensing, Auto Uplink RJ-45 ports
ii. WAN ports: Two (2) 10/100/1000 Mbps auto-sensing, Auto Uplink RJ-45 ports to connect to any broadband modem, such as DSL or cable

b) Network Requirements

i. Firewall should operate in Route mode and transparent mode.
ii. Traffic shaping/bandwidth management on a per policy basis for specific network/IP/Interface/Zone (individual or shared) and should be able to define guaranteed, burstable/maximum bandwidth per policy. Also, able to set different level of priority.
iii. Support DHCP server, DHCP client, DHCP relay, DNS client and NTP client. xix. Support NAT (SNAT and DNAT) with following modes Static, Dynamic, PAT and IPv6 to IPv4 (vice a versa).
iv. Support both IPv4 and IPv6
v. The appliance should support Link aggregation (IEEE 802.3ad) technology to group multiple physical links into a single logical link of higher bandwidth and link fail over capability.
vi. Remote access VPN (client-to-site), site-to-site VPN
vii. IPsec NAT traversal (VPN pass-through)

c) Data Leak Prevention requirements: -

i. Should have the ability to prevent data loss through SMTP, FTP, HTTP, HTTPS & IM
ii. Should have built in pattern database

d) Support SSL VPN with following requirements:

i. Should support at least 20 SSL VPN users with at least 10 users from day 1.
ii. Should support two factor authentications with LDAP, Radius and using tokens/email/SMS.
iii. Support for clientless or client-based VPN in Full Tunnel and Split Tunnel mode.
iv. Should support HTTP/HTTPS proxy, FTP, RDP, SSH, VNC, SMB service access provision through portal.
v. Support on 32 bit and 64-bit OS.
vi. Certified by ICSA preferred.
vii. Support for all major browsers like Firefox/IE/Chrome etc. Java Script, Basic and Advanced Network Extensions.
viii. Management over GUI using HTTPS or equivalent secure mechanism, SSH and console access.
ix. Generate GUI based reports categorized on IP, user etc.
x. The Firewall should support for TWO modes of SSL VPN:
xi. Web-only mode: for thin remote clients equipped with a web browser only and support web application such as: HTTP/HTTPS PROXY, FTP, SMB/CIFS, SSH, VNC, RDP
xii. Tunnel mode, for remote computers that run a variety of client and server applications
xiii. The system shall provide SSL VPN tunnel mode that supports 32 and 64-bit Windows operating systems
xiv. The proposed solution shall allow administrators to create multiple bookmarks to add to a group and make these bookmarks available for SSL-VPN users.

e) Support IPS with following requirements

i. ICSA and NSS certified preferred.
ii. Anomaly detection and prevention up to layer 7 traffic including application type, SSL/TLS and must be applicable on any firewall policy.

iii. Should be able to respond to any unauthorized activity, Dos/Distributed Dos, network missuses, pre-attack probes like various types of TCP/UDP scanners etc. that originate from both inside and outside network.
iv. Management over GUI using HTTPS or equivalent secure mechanism, SSH and console access.
v. Generate GUI based reports categorized by alerts, attackers, severity wise, protocol etc.

f) Web content filtering

i. Support web content filtering up to layer 7 traffic like HTTP, HTTPS, FTP, DNS, SMTP, IMAP, POP3 etc., with Application identification like IM, torrent etc., Allow/Deny traffic based on Src / Dst IP / Networks, Web URLs, Regular expressions, Web plug-ins such as ActiveX , Java Applet & Cookies, Regular file extensions, Spy wares, Ad wares, Time/Day.
ii. Should have URL database of 20 million or more for web content filtering based on categories.
iii. Data leak prevention for up to layer 7 traffic.
iv. Should provide an option to send customized Access denied message to the end user.
v. The proposed solution must block HTTP or HTTPS based anonymous proxy request available on the Internet.
vi. Support for geographical based filtering like country level TLD etc.

g) Gateway Antivirus

i. Should provide protection against viruses, worms or any other malicious content in traffic like SMTP, POP3, IMAP, HTTP/S, FTP etc. and must be configurable/applicable on specific firewall Policy.
ii. Should be able to scan the file either on the basis of flow or buffering.
iii. Should have option to respond to virus detection in several ways like delete/quarantine the file and send notification via e-mail/SMS.
iv. Antivirus signature updates must be done automatically/schedule and should not require reboot of the appliance.
v. Management over GUI using HTTPS or equivalent secures mechanism, SSH and console access.
vi. Support at least 1 million or more signatures
vii. The antivirus signature database of proposed solution should comprise of up to date list of signatures of virus, malwares, spyware etc.
viii. Support on quarantined facility on the appliance or on a remote system.
ix. Allow/Block/quarantine file type extensions
x. Generate GUI based reports categorized by virus signatures, host/user infected etc.

h) Logging and Reporting

i. Have standard report templates
ii. Support scheduling of reports
iii. Support sending of reports by email at scheduled intervals
iv. Should provide standard dashboards
v. Should be possible to offload logs from the logging and reporting appliance to other external storage for long term retention.
vi. Logging up to layer 7 traffic details (firewall policy level, denied traffic details etc.)
vii. Should provide log report in Web/GUI /dashboard-based format with detailed information categorized by IP/Application/Port/Protocol etc., able to forward logs to syslog server and sending schedule reports and send via email.
viii. Log storing facility on a local disk or on to a remote system. Logs stored on the local disk must be transferable over network(scheduled) to a remote system and must be in a generic format like CSV, HTML, PDF, Excel(formats) or if proprietary, must provide appropriate software/hardware to generate the report.

ix. Support configurable option for E-mail or SMS alerts (Via SMS gateway) in case of any event trigger.
x. Should provide information of real time data transfer/bandwidth utilization of individual IP/Application/protocol/port/Interface/Zone.