

Parking Management System

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Parking Management System

Parking Management System is an integrated solution for controlling, managing and guiding vehicles in and out of a parking facility. The system facilitates movement of vehicles right from entry to exit of the facility.

It comprises of the following main components:

A. Parking Management Software
B. Security System
C. Ticketing and Payment system
D. Real-time vehicle guidance, counting and reporting

A. Parking Management Software



MAIN CONTROL SERVER

The software integrates parking, access, security and revenue control operations for the parking facility through a central server. This software should support over the air backup support from the vendor. It should allow easy modification to manage tariffs, generate required reports and set rules for traffic guidance as required.

B. Security System

For managing secure operations inside the parking space a well defined security system is needed. The various components of security systems are

I. Access Control (in the form of bollards, boom barriers, etc.)
II. Video surveillance and Recording (general CCTV and special cameras for LPR, backed up on DVR)
III. Under Vehicle Scan System (UVSS)

I. Access Control

For the purpose of Lodha constructed PPLs or Experia Retail spaces, we will consider the use of automated boom barriers as the primary point of access control in and out of the parking space. Automated bollards are primarily used in low traffic, high security facilities and not suited for our projects.

The boom barriers are needed to stop the vehicle at a designated space, perform regular checks and issue/verify ticket of the vehicle. Depending on the use, space available & design of the entry area to the parking facility, there could be the following four cases of possible entries to the parking:

Types of Entry and Proposed Solution:

For all the PPL's there will be a compulsory 2-Wheeler + 4-Wheeler entry within the 3m wide entry lane. To allow for entry only to 2-wheelers while restricting 4-wheelers (if a 2-Wheeler ticket is obtained), two boom barriers must be provided opening on either side with lengths of 0.5m and 2.5m respectively (please refer figure below). For 4-wheelers both boom barriers must open when appropriate ticket is selected. Ticket dispenser should be planned on the right side and tickets for LMV (cars & small tempos e.g. Tata Ace) and 2 wheelers should be assigned through one machine. For PPL's where there is HMV (Buses & Trucks) parking, a separate ticketing dispenser 2m high may be required to issue tickets apart from the standard dispenser for LMVs. The boom barriers must not be more than 3m from this machine.

- **Single lane – Single Vehicle Type entry**

An automated ticketing dispenser should be placed for issuing the tickets and a kiosk should be avoided. This is the easiest to set up and recommended, but depends on expected traffic. (*Lodha Example: Altamont Road PPL*)

- **Multiple lane – Single Vehicle Type entry**

For such a scenario, median should be planned segregating different entry lanes as each lane will require automated ticketing dispenser, LPR and boom barrier pedestal on the driver side (RHS). (*Lodha Example: Kanjurmarg PPL*)

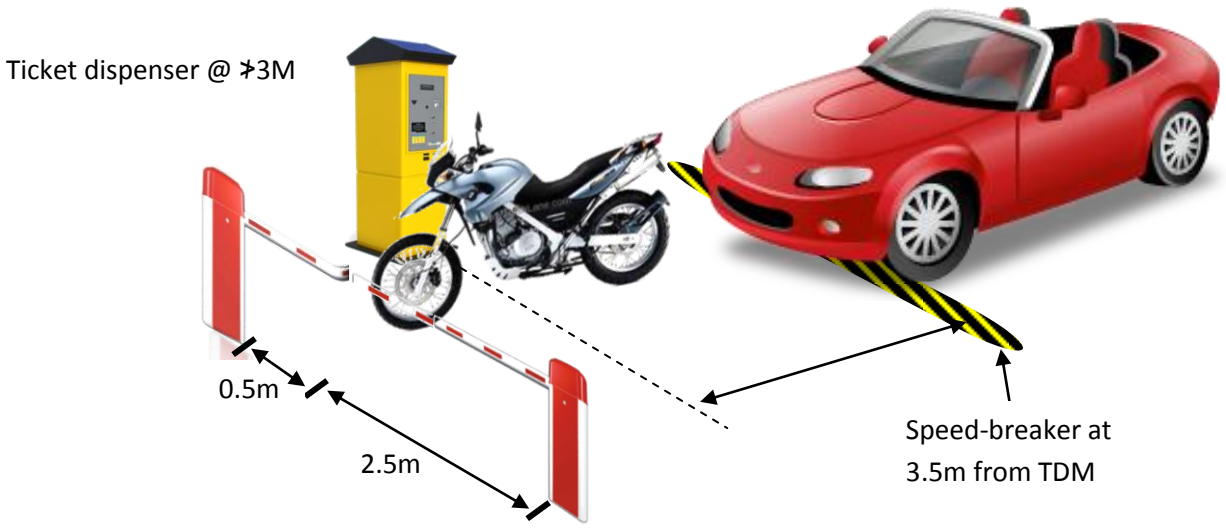
- **Multiple lane – Multiple Vehicle Type entry**

In such a case, each lane should be marked as per the vehicle type and ticketing dispensers can be provided as per the specified vehicle type (2m high for HMV / 1.5m high for LMV). Lane widths can ensure that bigger vehicles do not enter the lanes for smaller vehicles.

- **Single lane – Multiple Vehicle Type entry**

Managing different type of vehicles from a single lane boom barrier controlled entry is complicated and requires detailed planning. The main issue here is the prevention of larger vehicles taking entry tickets of smaller vehicles. Hence to avoid this, entry lanes must be planned with a folding type articulated boom barrier.

Typical Entry lane planning



In case of HMV vehicle the 2.5M boom barrier will be the folding type articulated boom barrier. This boom operates in three stages as shown below. For car entry it will operate till stage 2 and for HMV it will operate till Stage 3. *(Images are for representation purpose only)*



Stage 1



Stage 2



Stage 3



Folding type

Typical entry and exit scenarios are shown pictorially below:

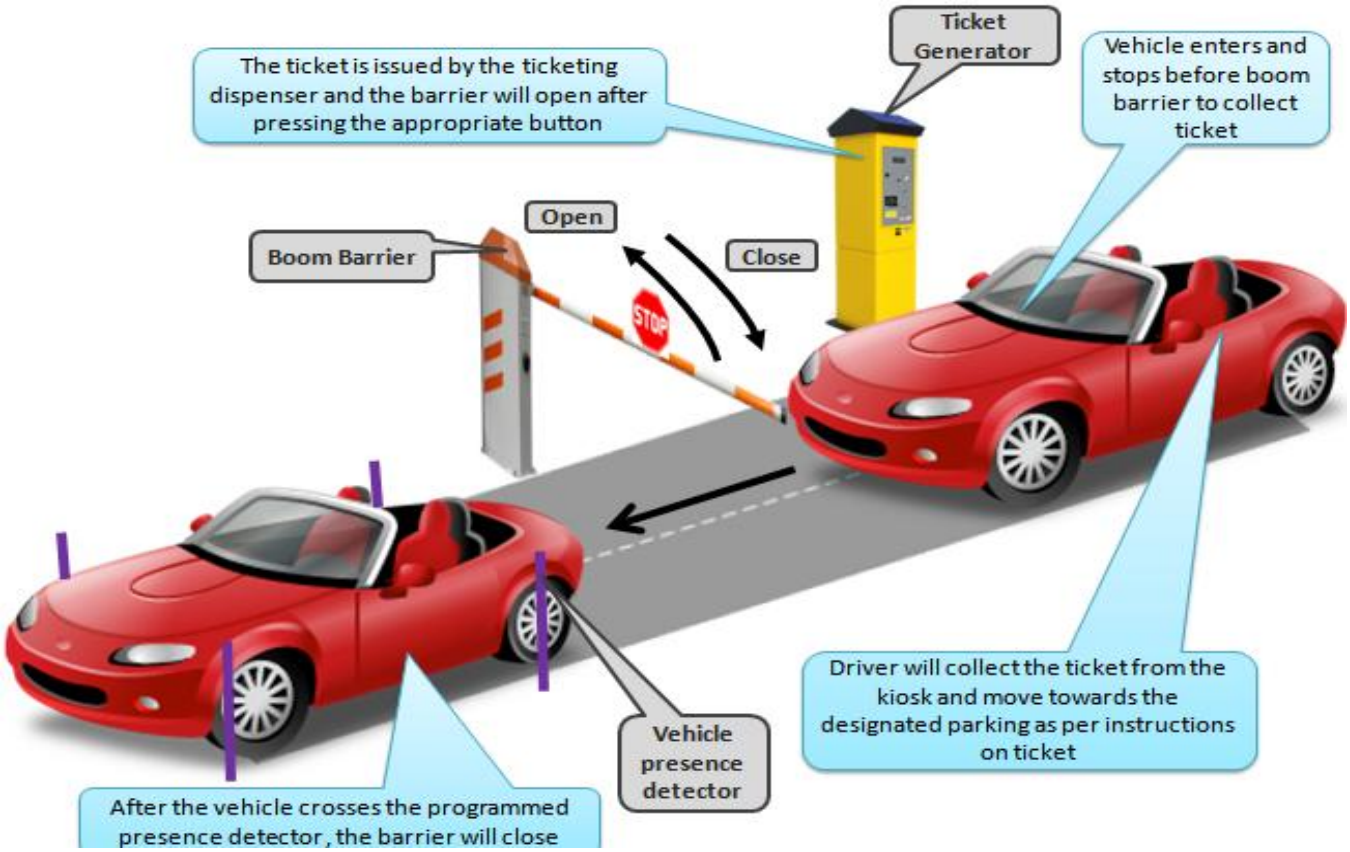
ENTRY:

For every type of entry lane, the boom barrier is to be programmed in such a way that after the respective vehicle type ticket is dispensed the associated boom should open automatically. However it should only close when the vehicle has perfectly crossed the boom barrier and should not fall on the vehicle. For this an infrared vehicle presence detector assembly should be planned, fixed to a stand after the barrier gate at a fixed angle. This presence detector is also used to count the vehicles entering the facility. (2 stage loop detector could be planned but they have a tendency to fail very often as they are embedded in ground.) Ticket dispenser will be a single unit dispensing bar-coded tickets for 2-Wheelers and 4-Wheelers.



Dual ticket dispenser @ 1.5M and @ 2M

Typical entry simulation for single lane

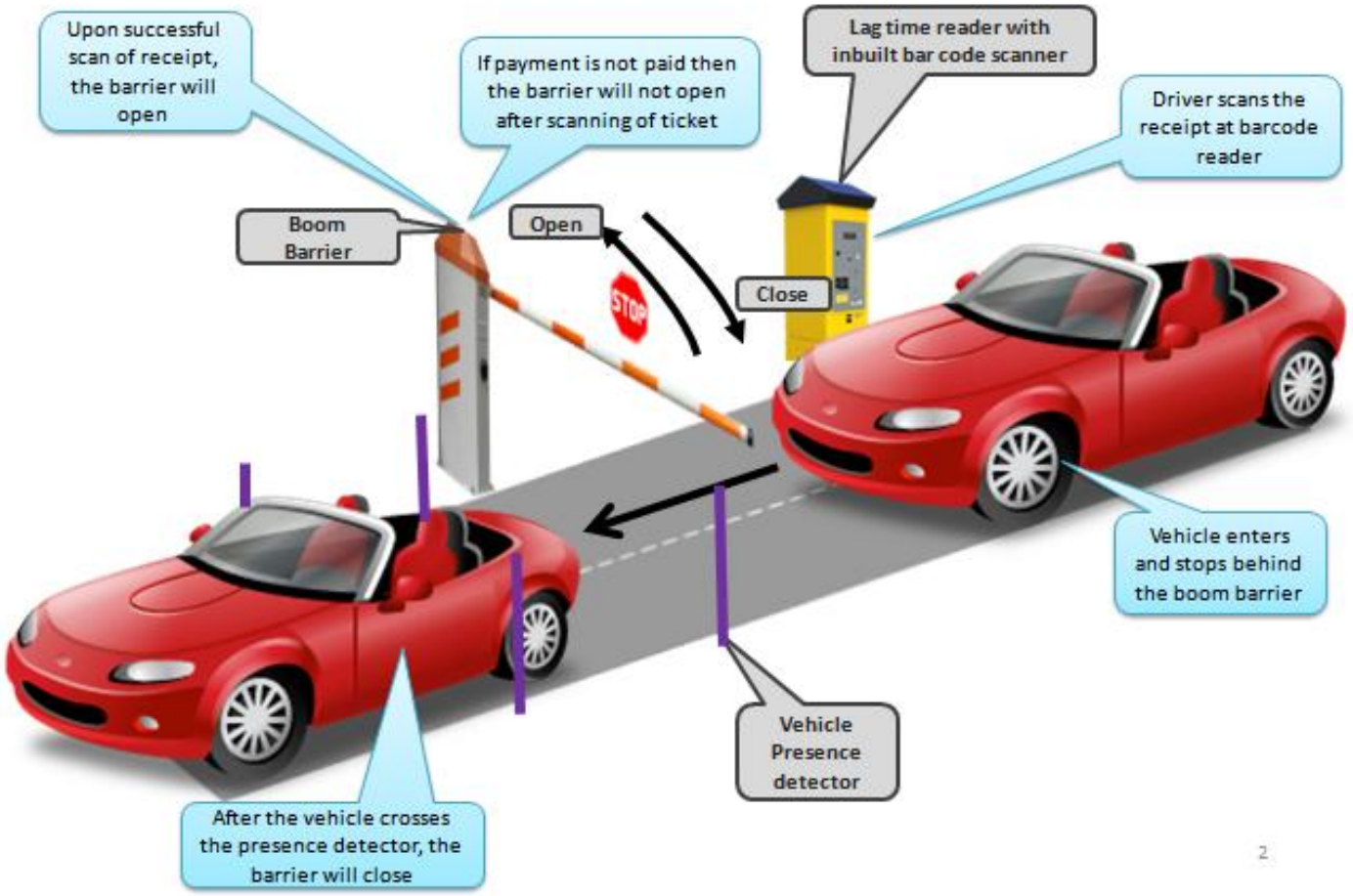


EXIT:

At each exit lane a "Lag Time Reader" should be installed which will enable the opening of the 3M boom barrier after vehicle ticket is scanned and verified against payment. Bar code reader should be placed ergonomically such that it is easy for the driver to uphold the entry ticket and enable the system to release the boom barrier safely. There will not be any payment terminal at exit lane so as to avoid queuing of vehicles.

If the vehicle comes to the exit terminal without paying/or after 30 min of payment then the boom will not open after the ticket is scanned. During day hours (0900-2000 hrs) a person can monitor the exit with a handheld programmed to issue receipts with penalty of 50% of minimum applicable tariff (*it should be programmable at server level)* for respective category. Upon payment, the barcode on the ticket then allows the boom barrier to open.

During after hours (2000-0900 hrs), there may not be a person required at the exit lanes for manual payment. In such cases, if the driver requires assistance, an alarm buzzer in exit verifier ("Lag time reader") should be provided that conveys to the control room that assistance is required in the exit lanes. Same process to be followed after. A signage should also be displayed near payment terminals and exit denoting the penalty charges for the same.



Typical exit simulation for single lane

II. Video Surveillance and Digital Video Recorder (DVR)

A multi camera video surveillance system should be integrated into the Parking Management Software. The video surveillance data, License plate reader images, Under Vehicle Surveillance videos should be stored and saved on a DVR. It should have a recording capacity of 30 days.

Proposed locations for CCTV are at main entry capturing the driver and vehicle, entry of each floor from ramp, payment terminal(s), at exit to the facility, elevators and ground floor landing of each staircase (covering up and down movement). The cameras must function in reduced lighting.

III. Under Vehicle Scan System (UVSS)

These are advanced solutions that scan vehicle's bottom chassis for hidden explosives and modifications. The solution can take tons of weight and are designed to withstand harsh environments, rugged terrain, and extreme temperatures. Likewise, cameras and lighting are encased in sturdy, weather-proof housings.

There are two main types of UVSS: Analytical or Manual Scan type.

The analytical model works by identifying the vehicle's make and model and then comparing current image with its database for any foreign objects or modifications. However, these models are extremely expensive, and don't work in Indian conditions (not all LMV, HMV models in database). No vendor has given a guarantee for its performance. It is recommended that we use the manual scan type that allows security guards to visually see the under-chassis of the incoming vehicle (exactly like baggage screening).

Further, it is recommended to use Surface Mounted UVSS instead of the In-ground UVSS. Surface mounted systems are cheaper to install and are recommended by various Indian vendors.



Surface mounted UVSS

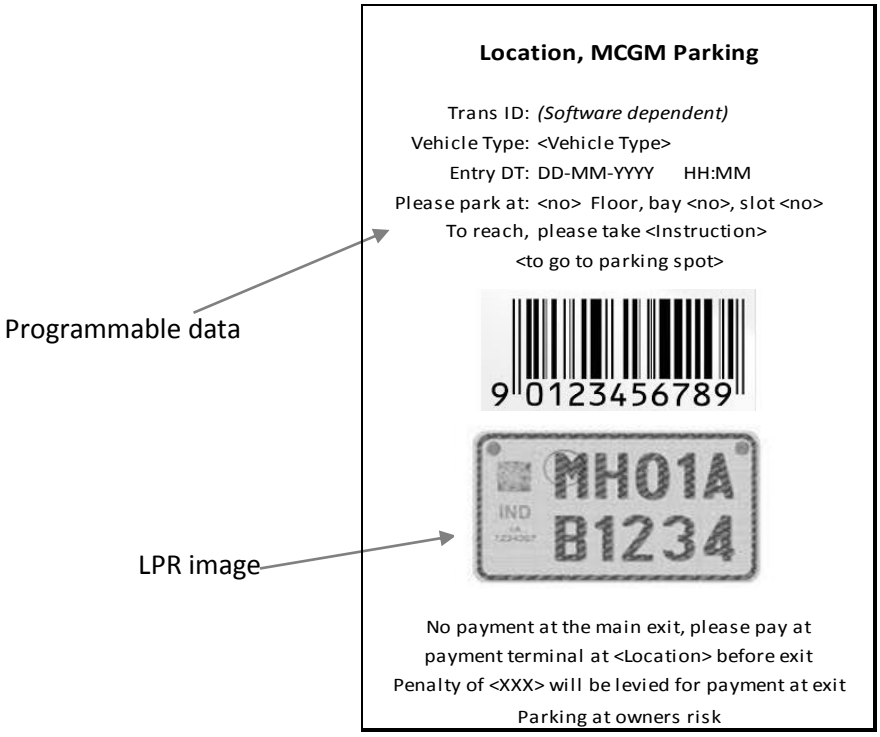
There must be a monitoring facility near the entry lane to allow a security guard to monitor these visuals. If the security guard finds an irregularity in the under-belly of the vehicle then he should be able to press a manual override switch which will not allow the boom barrier to open even after ticketing is done. In addition, there must be an intercom facility from this monitoring room to the Security/Control Room.

C. Ticketing and Payment system

This system is the revenue collection component of the PMS. It comprises of two parts: the Ticketing system (at entry) and the Payment Terminal (before exit)

Ticketing System

The ticketing system begins with an Automatic Ticket Dispenser to be located at the entry lanes before the boom barrier. Tickets should be generated in the following format from the ticketing dispenser and provision to edit fixed data at server level should be there. Provision to print graphical content should also be available. The thermal paper roll/sheet for ticket should be of 70 GSM or more so that it last for at least 7 days.



Sample ticket

The software should allow setting of tariffs on hourly basis and must be allowed to be re-programmed easily at the server level without going to the software developer. The logic of tariff should be set for 24-Hrs basis where overnight parking is allowed. For e.g. if a vehicle is checking in at 21:00 hrs and checking out 01:00 hrs then the charges will be applicable for four hours only. If the same vehicle checks out at 23:00 hrs on the next day then total hours are 26 hrs. Charges should be calculated by adding tariff applicable for 24 hrs and adding for 2 hrs.

RFID (monthly pass) based entry exit:

In addition to daily tickets, it is also proposed to give long duration Passes (monthly/quarterly) to regular visitors of PPLs in the form of pre-paid cards. This will provide ease of use to regular users and also help in traffic congestion to a certain extent. To achieve this, RFID cards (with a fixed 1-time cost) will be provided to interested users. Proximity sensors should be compatible with payment terminal to deduct applicable payment from the prepaid cards. Provision to set tariff monthly/quarterly should be there in the system. Entry and exit feature will be same as a regular user.

License Plate Recognition System (LPR)

This should be fixed near the boom barrier/TDM to capture the number plate image from the front. The image must be taken prior to the ticket being dispensed so that the LPR image is printed on the ticket. Again, there are two types of LPRs available: analytical and image capture type. The task of recognising number plate in Indian conditions becomes difficult as most Indian vehicles do not follow a standard format of the number plates. Indian number plates can have a single row or double row with variations in font type and that is why analytical type of LPR is not advisable and image type LPR system should be used.



Typical working of LPR system

The camera should be able to capture the image in day and night with different atmospheric conditions. It should be able to capture image in case the vehicle has its head lights switched on. The captured image will be printed on the entry ticket and it should also be able to print on a log report from the server for random security checking.

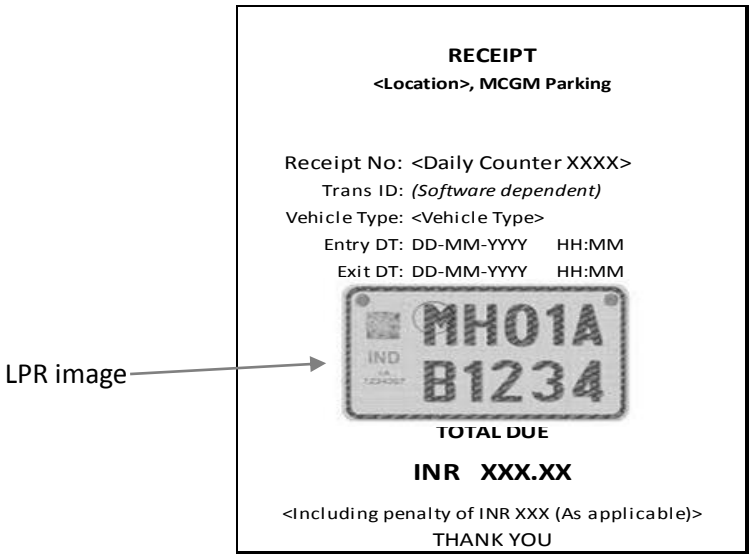
Payment Terminals

Automated Payment terminals should be provided at different locations in the parking facility with clear guidance signage. They must be preferably located near points of pedestrian entry into different floors/levels or main entry as deemed fit by architect. The number of such payment terminals' is to be decided as follows:

No. of payment machines to be provided = No. of vehicles planned/400 *(This number has to be rounded-up)*

Based on the answer above, the Design team is to locate such terminals at convenient places like Lift/Staircase lobby of every alternate floor per lift+stair wing.

The payment terminal must generate a receipt on the payment in the following format. This should be allowed to be re-programmed at any point without any interface with the software developer. The thermal paper roll/sheet for receipt should be of 70 GSM or more so that it last for at least 7 days.



Sample receipt

Automatic pay station

Currently cash and electronic payment modules are available for fully integrated secure payment by Scheidt & Bachmann and SKIDATA in India. These are expensive, but machines from other vendors with similar functionality must be sourced locally. These machines allow currency notes, Credit & Debit Card transactions. However due to some banking norms for debit card transactions here *(as of writing this document)*, these machines are only programmed to accept credit cards. While automated payment station is preferred, manual payment stations can be considered in case of budget constraints only for PPL's.

Note: Manual payment stations do not have effective inbuilt ventilation system hence a well lit and ventilated area/booth is to be provided; also the ergonomics of the operator is to be considered.



(a) Automatic pay stations





(b) Manual pay stations

D. Real-time vehicle guidance, counting and reporting

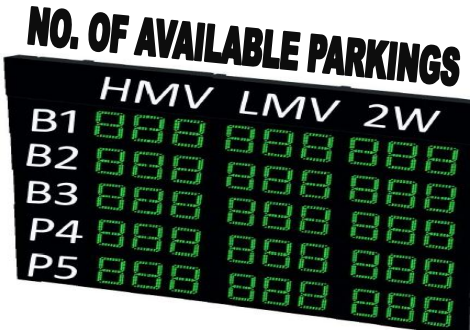
The vehicle counting system constitutes of a non intrusive vision based vehicle counting system. This will be installed at the main entry/exit point to the facility such that the system gets real time knowledge of the number of cars present at the facility. This will be done through the infrared based vehicle presence detector assembly.

External parking guidance system

The external parking guidance system enables the user to understand how many empty car slots are there on each parking floor. The numbers in front of an assigned level must reduce after the vehicle takes the ticket and crosses the vehicle presence detector situated at entry. At exit of the vehicle the available parking number at the assigned level should increase. For e.g. if vehicle is assigned a parking at P2 level exits than P2 level indicator should increase by one and vice versa.

When the system will start for the first time (or is RESET) it will show the total number of vehicle parking spots available (predefined). As the vehicle crosses the presence detector it should subtract one from the total number and so on. The display will show the available parking slots on real time basis. Once the user exits the facility, the vacancy is reflected in the database and the LED display is auto-updated. At software level, the operator should be able to restrict some of the parking number from being assigned in case of the specific area maintenance.

At the entry, the ticket will also guide the driver to the zone and level where he/she is supposed to park. The logic of numbering parking should be programmed in such a way that the nearest parking slot after entering should be the first in the allotted serial numbering. In case of multiple basements, it should follow the sequence as GF→P1→B1→P2→B2 and so on. On the display it should show labels as Truck/Bus, Car/Tempo and two wheelers as applicable.



Sample display board

The external display guiding board should display the number of empty slots at every parking level and at the main entry with a signage on top saying “NO OF AVAILABLE PARKINGS”. Provision to reset/configure the number should be there at the server level. This system should also integrate with any LED type indicators needed to complete this guidance system. For user to easily locate the parking spot, zones should be demarcated in the following format <Zone no> <Parking no> (i.e. on ticket it will show guidance with the floor no as P1 - C2 - 54).

Statistical Reporting

The parking management system should allow generating hourly, weekly, monthly and yearly reports as required. Examples of some reports are revenue collections report, licence plate recognition system report, terminal based reports, terminal operator based reports and access card based reports.

Signages

Florescent signage guidance should be there in the whole facility either fixed on walls/columns or suspended from ceiling to guide the users in the parking facility. These Signages' must comply with the CFO NOC requirements as well.

Other Operational requirements for parking space

Mobile signal booster

Car washing bay *(If in LOI of PPL)*

Drivers and waiting lounge

Male/Female toilets (preferably every level)

Air conditioned BMS room/Control room to be detailed where central server/computer, fire alarm panel, etc to be stationed

As per PPL LOI a car charging station for electric cars to be provided by the relevant vendor.

Draft BOQ for parking management system

S.NO.	SUB-HEAD	AMOUNT (Rs.)
A	Parking Management System	
B	Payment Station	
C	Parking Guidance System	
D	Vehicle Counting System	
E	Peripheral Equipment	
F	Implementation & Commissioning	
	Total	

Details

	Description	Qty.	Unit Price (INR)	Item Total (INR)
(A)	**Parking Management System**			
	Entry Lane			
1	**Barcode Ticket Dispenser** Issue barcode parking ticket with entry records at entrance. Dispenser should be able to issue multiple vehicle type ticket from the same machine by pressing pre-assigned buttons. Intelligent controller that can run in stand-alone or on-line mode. Ticket should display guidance to the driver. High paper-roll capacity of at least **1,000** tickets per roll. Built-in photo sensors to give paper roll low level indication. Casing with outdoor type of epoxy powder coating in **blue** colour. Internal mounting bracket ready for intercom & RFID reader *(monthly pass reader).*			
2	**Mid-range Proximity Reader** Reading distance up to 1 meter. Reader interface & External relay board. Power supply unit & rechargeable battery.			
3	**Automatic Lane Barrier type 1** Barrier opening time below 2 second. Intelligent embedded barrier controller. Barrier arm with total length of **0.5 meter**. Barrier arm cover with protective foam & reflective stripe. Casing with outdoor epoxy powder coating in yellow & blue colour.			
4	**Automatic Lane Barrier type 2** Folding type articulated boom barrier. Barrier opening time below 2 second. Intelligent embedded barrier controller. Barrier arm with total length of **2.5 meter**. Barrier arm cover with protective foam & reflective stripe. Casing with outdoor epoxy powder coating in yellow & blue colour.			
5	**Vehicle Presence Detector (4 nos on 2 poles)** Infrared detectors for each lane after boom barrier. Infrared beams should run at an angle. Counting of vehicles should be possible through this too.			
6	**License plate recognition camera** Takes a picture of the front of the vehicle and reads registration plate ~number. Transmits captured images to LPR system			

	Entry: Prints recognized number plate on the short term ticket and stores parking information and number plate images. **Exit:** No analytics is performed. **Camera unit:** Digital camera or CCD camera **Number recognition unit (Analytics)**: Vehicle number plate image is converted to text - Optional **Image Server:** Stores Parking ticket information, number plate and Image **Advantages** Prevents illegal usage of tickets Checks entering time on registration number plate, if drivers loses tickets.			
	Exit Lane			
7	**Lag Time Reader (Exit)** Check & verify validity of parking ticket at exit. Intelligent controller that can run in stand-alone or on-line mode. Intelligent & low maintenance contact-less barcode scanner. Casing with outdoor type of epoxy powder coating in blue colour. Internal mounting bracket ready for intercom & RFID reader.			
8	**Mid-range Proximity Reader (Optional)** Reading distance up to 1 meter. Reader interface & external relay board. Power supply unit & rechargeable battery.			
9	**Automatic Lane Barrier** Barrier opening time below 2 seconds. Intelligent embedded barrier controller. Barrier arm with total length of **3 meter.** Barrier arm cover with protective foam & reflective stripe. Casing with outdoor epoxy powder coating in yellow & blue colour.			
10	**Vehicle Presence Detector (4 nos on 2 poles)** Infrared detectors for each lane after boom barrier. Infrared beams should run at an angle. Counting of vehicles should be possible through this too.			
(B)	**Description**	**Qty.**	**Unit Price (INR)**	**Item Total (INR)**
	Payment Station			
1	**Automatic Payment Station** Pay on Foot Machine type machine with cash accepter and dispenser Debit/credit card reader (dual reading heads) PCI compliant PED (PIN Encrypting Device) In built barcode scanner Voice Prompt options Secure Wire/Wireless Network compatible			

	Equipped with tamper alarms and convenience lighting Provide integrated voice system for customer communication including microphone, button, and speaker maintain a minimum storage of 600 banknotes of the same value Issuing capacity of up to 3000 receipts Control unit, complete with hard disk Should be able to program pre-paid based proximity card and user credentials Ergonomically arranged user interaction controls User guidance with graphic colour display and illuminated pictograms			
2	**Manual Payment station**			
	High quality Intel motherboard & chipset. High speed Core 2 Dual central processor. High performance 2 GB RAM & 160GB hard disk. High contrast & wide 15" LCD colour monitor. Intelligent proprietary micro-controller board. Fast switching equipment relay board. High speed receipt printer with validation. Portable automatic barcode scanner. Dual side single line LED to display amount. Customized keyboard for parking operation. Secure lockable cash drawer with coin & note box. Intelligent & user friendly parking payment software. One Microsoft Windows XP/7 operating software license. Secure lockable enclosure to provide better security.			
3	**Mobile Payment Handheld**			
	Integrated Mobile handheld ticket Dispenser having Wi-Fi/GPRS Connectivity, complete with barcode scanner, Licensed software and a receipt printer. This handheld will be integrated with the parking management system. After barcode scanning, software should allow to choose penalty and print ticket as per the applicable charges.			

	Description	**Qty.**	**Unit Price (INR)**	**Item Total (INR)**
(C)	**Guidance System**			
1	**Parking Guidance System** Vehicle Presence monitoring real-time space status, and report to host controller. PC-based guidance control system. Guidance control system updates real-time available space on no of parking slots available based on ticket dispensed and no of exits. Then it displays after logical judgments on overall parking status.			

	Guidance displays (If installed on each floor) should interact with each other, indicating driver from each entry. Red/Green LED indicators visually assist driver against no of vacant space on that floor. **SYSTEM FUNCTION** Increase parking efficiency. Increase client loyalty and park rotation. Reduce fuel consumption and combustion emission. Optimize human resource. Realize user-controlled override or space reservation. Report available to assist parking management team.			

	Description	**Qty.**	**Unit Price (INR)**	**Item Total (INR)**
(D)	**Vehicle Counting System**			
1	**Vehicle Counting Display (VCD)** High performance intelligent VCD controller. Display to indicate available bay at each zone/floor. Main display with **6 rows for 6 different** parking zones. High contrast 5 digits seven-segment LED display for each row. Front cover with acrylic with label sticker for each bus parking zone. Casing with outdoor type of epoxy powder coating in blue colour. Mounting bracket & pole/gantry to be included. Main display at each park entry for incoming vehicle. (Optional) More display can be added later upon customer request.			
2	**Vehicle Count** Counting of vehicles should be done through the Vehicle Presence reader assembly installed at every level entry/exit and checked against ticket dispenser and lag time reader.			
3	**Vehicle Counting Control (VCC) Station** High quality Intel motherboard & chipset. High speed Intel Dual Core processor. High performance 1GB DDR2 RAM. High capacity 160GB hard disk for data storage. High contrast & wide 17" LCD colour monitor. Real-time monitoring of vehicle counting control linked with ticketing dispenser and lag time reader. On screen info display with parking zone layout drawing. Locally setting of zone info & number of bay per parking zone. Standard VCC software report formats on zone			

	occupancy.			

	Description	Qty.	Unit Price (INR)	Item Total (INR)
(E)	**Peripheral Equipment**			
1	**Power Surge Protector** Minimize the risk of equipment damaged if strike by lightning.			
2	**Signal Surge Protector** Minimize the risk of equipment damaged if strike by lightning.			
3	**Network Surge Protector** The risk of equipment damaged if strike by lightning.			
	Description	**Qty.**	**Unit Price (INR)**	**Item Total (INR)**
(F)	**Implementation & Commissioning**			
1	**Project Implementation** Supervision of equipment installation and termination of cables. Include two commissioning trips to our engineer/HFM at site. Up to seven days on site per trip. Labour, man-power, tools & machinery at site to be provided by the vendor. Hotel accommodation at site shall not be provided.			
2	**Training & Commissioning** Initial price table, duration, holiday & all other parameter setting. Full system hardware & software integration test. 2 day on site training on system operation. 2 day on site training on equipment maintenance. 3 copies of system operation manual in English. 3 copies of equipment maintenance guide in English.			