TECHNICAL SPECIFICATIONS FOR AUTOMIZATION OF TOLL PLAZA

Specifications for automation of Toll Plaza

The Contractor shall provide computerized automatic toll collection system at his own cost at the location specified in the bid document.

The Contractor shall provide the system within 180 days from the date of award of Contract.

The system shall be in two parts:

1. Cash collection & management system for daily cash & for electronic cash for Concessionaires i.e. frequent travelers.

2. Toll Audit system -
   a) to facilitate Audit to the Contractor
   b) to have a data to the Corporation

Toll Audit System

To monitor the traffic count and classification information for each lane in a toll plaza shall be collected. The information thus collected shall be matched to a set time period, such as the duration of an operator’s shift. The proposed toll audit system shall have a treadle – loop – treadle configuration for accurate and efficient vehicle counting and classification.

CONTRACTOR
Scope of Equipment Supply -

The Contractor shall supply the following components of the toll audit system;

i) Combination of Double Strip treadle Sensor System & Inductive loops for vehicle classification (treadle-loop-treadle configuration) for every toll lane.

ii) Traffic Data Processor Unit – Should be able to count and classify up to a minimum of 4 toll lanes.

iii) Plaza Computer.

iv) Data Collection and processing software.

The specifications and system capabilities for the toll audit system to be used shall be as follows:

Specifications of Double Strip Treadle Sensor System

The Double Strip treadle system shall consist of one inroad classifications sensor mounted in a metal frame, minimum of 2.4m long, to be employed for axle detection on a roadway regardless of vehicle speed. The mounting of the sensor in the frame shall enable fast and convenient replacement and maintenance without disturbing the lane traffic. Incase of a sensor failure, the sensor should be replaced in the treadle frame without the need to remove the frame from the pavement. The system shall incorporate the following features.

- The dimensions of the Double Strip Treadle shall be a minimum of 8 feet long, 1 inch thick and 6 inch wide.

- The axle sensor shall be an inverted “T” shape in cross-section. Machined ASTM A36/CSA C 44W Steel clamp bars shall secure each sensor in place. These removable clamp bars shall be held in place with SAE Grade & centre lock nuts on
B7 studs which shall be embedded into the roadway. This method shall allow for rapid removal of the clamp bars when sensor replacement is necessary. The recessed nuts must be protected by expansion plugs.

- All axle sensors shall be weather proof and field replaceable. Each sensor shall be constructed using Force Sensing Resistive (FSR) elements and sealed in black UV-resistant polyurethane. The sensors shall be wear resistant with a minimum of Shore D hardness of 80.

- The sensor lead cable shall consist of an 18 gauge, twisted, individually shielded, stranded and tinned copper pair wire with a polyethylene jacket and a length of 30m. The connection to the sensor element shall be sealed during the moulding process.

- The Double Strip Treadle installation frame shall be mounted in existing pavements. When mounting into existing pavements, the frame shall be secured using chemical anchors. It shall be surrounded with high strength epoxy grout and supported with vertical epoxy anchors. Alternately, a shallow vault installation shall be employed which will utilize concrete to provide the necessary support around the frame.

- The treadmill frame shall be constructed from ASTM A36/CSA C44W Steel, and then commercially sandblasted to SSPC-10. For corrosion protection, the frame shall be primed with zinc-rich paint and then top coated with black epoxy paint.

- The complete treadle system must be flush mounted to allow normal dust removal and road cleaning to be carried out, therefore no component of the system (i.e. frame, clamping bars, or sensor) will be elevated above the surface of the roadway.

CONTRACTOR
• Multiple interface cards shall be available to connect the Treadle System to a variety of electronics for different applications such as Toll Roads, Weight-In-Motion, etc.

Specifications of Traffic Data Processor Unit

The data processor unit shall be a portable, battery operated, multi-lane time interval recording counter and classifier, able to collect traffic data in following formats:

• Vehicle Count
• Vehicle classification
• Gap
• Headway
• Speed by axle
• Speed by length

The detailed specifications for the system shall be as follows:

• Programming - From counter keyboard and display
  - From IBM compatible computer (standard for tolling applications)
  - Remotely with telephone modem
  - With Take Away Memory (TAM) card.

• Lane Test - All lanes shall be monitored.

• Monitoring - Sensor activation shall be tested.
  - Configuration, spacing and ID’s shall be verified
  - All above functions shall be completed without interference with data collection accomplished either from the display or a computer.

CONTRACTOR
• Data Collection - Through a telephone modem.
  - With IBM compatible computer
  - With Take Away Memory (TAM) card
  - With a Datahog (Portable Data Collection Device)

• Memory - 68K of counter memory (standard for tolling applications)
  - UP gradable to 964K internally.
  - UP gradable to 16MB externally with TAM card.

• FIFO Sensor Input - A FIFO (First in, First out) buffer on all sensor inputs to
  eliminate sensor misses due to simultaneous activation.

• Telemetry - Remotely accessible with addition of external modem &
  phone.
  (Standard Rs.232 port with baud rates from 300 to 19, 200
  (standard for tolling applications)

Case - Minimum of 10 gauge welded aluminium, powder coated
  - Modular plug-in CMOS electronic circuit boards
  - ANS 170 powder paint finish

Power - AC power operation
  - 6 volt, 12 amp hour rechargeable battery
  - Shall have the capabilities to operate with solar power
  - Shall have the capabilities to selectable option that requires the
    operator to verify turn off the equipment (to prevent false shut down
    during lightening or accident turn-off)

Key board / Display - 16 key watertight keyboard

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- Complete alphabet and number on two line, 32 characters, liquid crystal display.
- Capabilities to operate with a laptop

The system shall be capable of providing data in MM/DD/YY, DD-MM-YY or YY-MM-DD formats. The system shall provide the following data collection modes:

- **Counting Modes**

  **Time Interval Count Mode** - Traditional method of time interval counting, which shall use the field unit to collect and sort count data by user selectable time interval traffic counts. Count method shall include direction, lane subtraction and normal.

  Time Stamped Sensor Event - The system shall be capable of collecting traffic data where the field unit shall store sensor activations with a time stamp accurate to 1/10000 of a second. This data then shall be transferable to plaza computer that will use it to produce selected reports.

- **Classification Modes**

  **Binning** - System shall be capable to a minimum of user defined 30 speed, 30 axle, 30 headway and 30 gap bins.

  **Time Stamped Sensor Events** - The system shall be capable of classifying traffic data where the field unit shall store sensor activations with a time stamp accurate to 1/10000 of a second.
Individual Vehicle Record - The system shall be capable of storing the time of passage to 1/100 second, speed to 1/100 km/h, number of axles and spacing between axles for each vehicle.

Performance Criteria

The toll audit system shall be capable of following performance criteria:

- The system shall have a temperature operating range of -25°C to +70°C. The Traffic Data Processor Unit shall have a climatic operating range of 0-90% non-condensing relative humidity.
- The Sensor shall achieve an operating life of 2 millions axles or two years.
- To replace an axle Sensor in a frame, the MTTR (Mean Time To Repair) shall be ½ hour.
- The Treadle Frame shall have a MTBF of 15 years and a MTTR of 48 hours.
- The Treadle and Interface board, in a typical installation, shall have an accuracy of better than 99.9%
- The Treadle system must withstand the action of single axle loads of up to 14000 kg.
- The Traffic Data Processor Unit shall measure the speed and distance in Imperial (U.S) or metric units. It shall record interval lengths ranging from one minute to 24 hours.
- To avoid the parts of system to come to loose accidentally during its operations, the system shall have military specification connectors, all metal, rust proof and sand proof with locking bayonet connectors, with bayonet mount and threaded protective steel caps for all connection, power, sensors and programming.
- To keep out harmful dirt and moisture, the lid and seal shall be watertight.
Software & Reports

- The software to be provided for data collection and processing shall be extremely user friendly working under windows based environment and contain industry standard classification modes.
- The software shall be configurable allowing Corporation to set many parameters including data storage mode, date format, password requirements, time adjustments, etc.
- The software shall be capable of printing the desired report to the screen, a printer or to a disk file.
- The software shall be capable of generating reports for total volume of traffic and for the binned classification for the same data set.

Technical Specifications For Cash collection & Management System

1.0 General Requirements
The proposed Toll Collection and management system shall meet the following requirements:

a. It shall be a single system that supports both cash and Electronic Toll Collection at the toll plazas.

b. The system shall be based on state-of-the-art hardware and software. The software shall be based on state-of-the-art operating system like Linux, UNIX & windows and shall support current & well-proven concepts like Object Oriented Programming.

c. Since the system shall be in operation 24 hours a day, it is essential that the successful tenderer shall provide quick and effective repair / maintenance service
from his office located in Mumbai. The tenderer shall therefore, in his bid, furnish evidence of an established office in Mumbai.

d. The Electronic toll collection shall be based on the contact less mifare smart card technology. The system shall further support both the Touch-and-Go as well as the non-stop methods of Electronic Toll Collection.

2.0 System Requirements

2.1 System Architecture

The toll collection and management system shall principally consist of two functional groups i.e. the “Front-end-System” and the “Back-end-System”. The Front-end-System shall include all software and hardware that is necessary to operate a single toll lane. The Back-end System shall include all software and hardware that is necessary to manage and service the tolling system. Further the Back-end System shall include a Point of Sales, which provides all customer related services (i.e. selling and re-loading of devices). The Front-end and Back end Systems shall be connected via Ethernet or any other communication media offering a minimum bandwidth of 10mbps.

2.1 The Lane Equipment

The lane equipment shall form part of the ‘Front-end-System’. Each lane shall have the following equipment:

a) Touch and go contact-less smart card readers with built in user display.
b) Lane PC with a suitable tollbooth operator monitor and keyboard.
c) Control Unit which acts as a lane-wise controller for all electronic transactions.

d) A receipt printer for printing out receipts against manual cash payment of toll.

e) A cash drawer to hold the toll amount collected as cash.

f) Easy up-gradability to non-stop toll system.

2.2 Backend equipment

a) A Toll Management System server. It shall serve as the core unit of the backend system and shall collect toll collection transaction information from the Lane PCs and shall perform administration of the system database.

b) All Toll Management tasks shall be executed by workstations. Due to security reasons direct access to the TMS is not allowed. The number of workstations within a system shall be adjustable / scalable at any time. The interface between TMS shall use standard web-technologies and security mechanisms and shall be platform (OS) independent.

c) A workstation that serves as an user interface to the Toll Management system server. With the aid of the workstation it shall be possible for the system supervisor / manager to access the central database and generate necessary financial and operational reports.

d) PC shall be located at the Point of Sales and shall be used for initializing, loading and reloading Contact less Smart Cards using a suitable card-accessing device.
The Network printer shall be used automatic and manual printouts of TMS reports.

3. Individual Equipment Requirements
3.1 Lane Equipments
3.1.1 Touch and go smart card reader
The Touch and go smart card reader shall have the capability of accessing (Reading and writing) contact less smart cards of ISP 14443 Type A. For this purpose it shall be equipped with a suitable Radio Frequency interface. For the convenience of the road users it shall have a suitable display that will guide customers through the toll payment process. There shall also be a built in buzzer that provides acoustic indication of the transaction status. Further the smart card reader shall be suitable for outdoor installation and shall be aesthetically pleasing.

3.1.2 Lane PC
The Lane PC shall be suitable for operation in a hot and dusty environment and therefore shall be an industrial grade PC. It shall be equipped with an advanced CPU technology to guarantee maximum system performance. Further the Lane PC shall be equipped with a suitable disk storage system (RAID 1 or higher) that ensures data security through adequate redundancy. Also in order to ensure high performance and data security the Lane PC shall be based on a suitable operating system like Linux.

3.1.3 ETC Controller module
The operating system of control unit shall be such that it guarantees maximum performance and security for Electronic Toll Collection transactions. It shall be equipped with a sufficient number of interfaces for the smart card readers and
capability to communicate with Lane PC. The unit shall be rugged enough to work in a hot and dusty environment.

The control unit shall be responsible for execution and handling of Electronic toll collection transactions and thus it shall have the capability to perform the following tasks:
- Execution of cards transactions at the connected smart card readers
- Communication with the Lane PC for receiving blacklists and toll tables.
- Handling of blacklists and toll tables
- Transfer of transaction data to the Lane PC

The control unit shall be upgradeable to handling non-stop Electronic Toll Collection.

### 3.1.4 Receipt Printer

The receipt printer shall be of the thermal type with a sufficient speed of operation in order not to delay the toll collection operations. It shall be activated from the Lane PC. The ticket size shall be compact and yet sufficient to hold the necessary information.

### 3.1.5 Cash Drawer

The cash drawer shall be used for storage of the collected cash. The cash drawer shall automatically open, when a cash transaction is confirmed. It shall possess sufficient mechanical strength and ruggedness and preferably made from steel.
3.2 Backend equipment

3.2.1 The Toll Management Server

The Toll Management Server forms the core of the back-end system and is responsible for collecting the transaction log files from the Lane PCs, administrating the database, generation of reports and data evaluation. Thus the server shall be a machine of sufficient speed and possess adequate data storage facilities (for primary and secondary storage as well as for data archiving).

3.2.2 The Workstation

The workstation shall be equipped with a software interface to the Toll Management Server and shall be used for execution of the various tasks that are needed for a comprehensive toll management. Thus the Workstation shall be a standard office PC designed to run the Graphical User Interface software (TMS-interface) using an Internet browser.

3.2.3 The Point of sales PC

The point of Sales serves as a service point for customers. Its main functions include initialization & loading of Contact less smart cards. For this purpose the POS shall have direct access to the Toll Management Server database via suitable interface software and therefore shall be able to register new customers at the database and install use accounts. Further it shall also serve as a service point for user inquires and registration point in case of problems (i.e. lost or stolen devices, defective devices,)

Only authorized operators shall be allowed to access the Point of Sales PC. The POS shall have a convenient and intuitive graphical user interface, that supports
the operator and clearly leads an operator through the different processes typically needed at a device issuing and service centre.

For the purpose of initialization, loading and reading of smart cards the Point of Sales PC shall be connected to a suitable smart card reader / writer.

3.2.4 The Printing Facilities

The Network shall be primarily used for printing reports of the Toll collection and management system and shall be located in the control room. The number of printers is adjustable.