REQUEST FOR PROPOSAL (RFP)

FOR

DESIGN, DEVELOPMENT, IMPLEMENTATION, OPERATION AND MAINTENANCE OF AUTOMATIC
FARE COLLECTION SYSTEM (AFCS) FOR BUS RAPID TRANSIT SYSTEM (BRTS), AMRITSAR

PART – 2
SCOPE OF SERVICES AND TECHNICAL SPECIFICATIONS DOCUMENT

FEBRUARY 2016
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ANNEXURE 1 UBS II SPECIFICATIONS

ANNEXURE 2 CODES AND STANDARDS

ANNEXURE 3 SERVICE LEVEL AGREEMENTS
List of abbreviations used in the document:

PBMS – Punjab Bus Metro System
ITS – Intelligent Transport System
ITMS – Intelligent Transit Management System
SP – Service Provider
SC – Smart Card
AVLS – Automatic Vehicle Locator System
AFCS – Automatic Fare Collection System
HTU – Handheld Ticketing Unit
BDC – Bus Driver Console
BCV – Bus Card Validator
STT – Station Ticket Terminal
SCV – Station Card Validator
BDU – Bus Driver Unit
SCU – Station Control Unit
CT – Central Terminus
DMS – Depot Management System
BTMS – Bus Terminal Management System
CCS – Central Computing System
BIM – Bulk Initialization Machine
CPD – Card Personalization Device
MTBF – Mean Time Before Failure
MTTR – Mean Time To Replace
CCHS – Central Clearing House System
GSM – Global System for Mobile communications
GPRS – General Packet Radio Service
GPS – Global Positioning System
IMS – Incident Management System
1. Introduction

The purpose of this document is to provide guidelines for procurement & implementation of Automatic Fare Collection System for Amritsar BRTS. The document underlines all IT related requirements of PBMS to achieve a highly automated and stable environment for Bus Operations Management in city of Amritsar.

1.1. Objectives:

With a view to enhance commuter satisfaction, reliability and punctuality of bus operations thereby enhancing the efficiency of PBMS’s BRT operations and better management of fleet of buses and in order to instil confidence in commuters in PBMS’s services, PBMS is desirous of implementing the “Automatic Fare Collection System” (hereinafter referred to as the “AFCS” OR “AFC” OR “The Project”). PBMS has decided to implement an Automatic Fare Collection System within the BRT system.

1.2. Solution Summary:

PBMS envisages implementing AFCS for its BRT bus operations to bring in world class operational efficiency and automation in its Fare collection system. AFCS is expected to meet the corporate objectives of enhancing service standards, bring in commuter market approaches, better organization of planning and operations; integration of Para-transit, capital improvements, marketing, and automate collection and payment of transit fares. The AFCS system and other applications within AFCS are expected to be flexible enough to complement PBMS’s growth requirements. BRT Buses shall be as per UBS 2 specification with PIS, AVLS and Surveillance equipment.

AFCS should enable PBMS to automate its Financial Characteristics, Operational Characteristics, better insight into Passenger profiles, perform Route Analysis to optimize on operational efficiency, Service Consumption, perform functional area productivity analysis and thereby creating PBMS BRTS a user choice.

AFCS shall provide a new set of tools for achieving urban local transport policies. This system shall provide services using modern computing and communications technologies. AFCS system shall play an important role in delivering policy objectives, including tackling fund leakage, as well as improving accessibility, providing integrated transport solution and making best use of existing infrastructure. The system shall deliver noticeable economic benefits through reduced leakage of funds and journey time, as well as improvements in fare collection efficiency.
The figure above is indicative and does not include all the activities that would need to be carried out as part of implementation of ITMS. Detailed scope is mentioned in the document below.
2. **AFCS Overview**

This following section describes overview of different component to be used for AFCS implementation for PBMS. The figure below provides conceptual view of the Bus Station AFCS to be deployed for PBMS Amritsar.

**Bus Station AFCS Overview**

![Bus Station AFCS Overview Diagram](image)

**NOTE:** All hardware equipment supplied as part of AFCS must carry industry standard certifications like U/L, CE, FCC etc. as may be applicable to different types of equipment to ascertain that, the equipment have been manufactured and certified based on international standards.

### 2.1 Automatic Fare Collection System (AFCS)

The Automatic Fare Collection system shall be an off-board ticketing solution where in the Fare shall be collected at the bus stations and terminal. AFCS shall provide a fast and secure transaction environment using proven technologies. AFCS shall be broadly implemented at following levels:

#### 2.1.1 Level 1: AFCS Media

Media shall have the information in encrypted format and enable the passenger to access the services

- Smart Cards
- RFID Single Journey Coins/ tokens
2.1.2 Level 2: Station Level Equipment

These shall be the front-end equipment/devices, which will be used to serve the commuter. These shall be:

- Station Ticket Terminal
- Automatic Flap Gates
- Media Validator/ Station card Validator

2.1.3 Level 3: Monitoring Equipment

The primary role of such equipment shall be to provide the usage data collection, downloading of parameters to the AFC equipment; control, monitoring and management of the equipment. Its secondary role shall be to provide the station reports (if required). It shall be able to function independently should there be a failure in the communication link with the central system. This shall be:

- Station Server

2.1.4 Level 4: Central System

Central System shall be the AFC management centre which is responsible for generating reports, receiving ticketing data from monitoring/ station equipment, sending control command, downloading system parameter and fare table. Some of the major components are:

- AFCS Server and its Application
- Integration with Business Intelligence
- Integration with Enterprise Management
- Bulk Initialization Module
- Card Personalization Module

Station ticket terminal, smart card Validator/ coin/ token system, Access Control System (Entry and Exit Barrier Gates) shall act as the primary sources for fare collection. Smart Cards / Tokens shall facilitate users to pay for the travel using above devices and the smart cards shall be made available for dispensing after being initialized by BIM and if require, personalized by CPD.

The fare collection and authentication devices as mentioned above shall communicate with Central System based on the operational requirements of PBMS.

It is expected that the system hooks transparently to other transit modes, whenever they become operational in future.
It is a major requirement that the AFCS service Provider shall have proven integration ability between various modes of transport via a central clearing house system.

The system is envisaged to operate automatic fare collection by way of using contactless smart card and RFID coin tokens. The travellers who own smart card shall be required to use smartcard at automatic barrier gates installed on station card Validator for trip start. The travellers travelling with coins shall also gain access to the Bus Station via barrier gate authentication.

Smart card system is envisaged to have following characteristics:

- One time issue multiple usage
- Recharge remotely through following modes:
  - Internet
  - Mobile Phone – future capability
  - Dealer Recharge
  - At ticket counters
  - Recharge Coupons - future capability
  - Handheld Device

In the event that smartcard personalization is required, this shall be provided in the form of hardware and software running on or compatible with a personal computer (PC). Details of each component have been provided in later part of this document.

### 2.2 Financial Management System

The financial management system shall comprise of enterprise reporting management which shall take care of all accounting functions of PBMS including fare accounting, disbursal to operations, profit and loss calculations, asset management etc.

The financial management system should also enable PBMS to manage fare or any other financial transactions with companies offering services to PBMS. It is envisaged to offer single ticket to passengers to travel across all urban transport systems in AMRITSAR and hence the financial management system should have capability to account for all such activities and suitably have function to enable payment receivables and deliverables to respective entities.

The reporting for the automatic fare collection (AFC) component of the system and the accounting package shall be separate. The AFC system shall provide reporting on transactions and other financial data in its own right and shall be separate from a third party corporate accounting system.
2.3 Functional units of AFCS and interrelation

The IT system for PBMS operations shall be designed to meet specific needs of following operational entities to achieve the above system needs:

- Central Control Centre
  - i) Central Computing System (AFCS)
- Bus Terminals
- Bus Stations

The figure below describes the data exchange model between the individual entities of PBMS system.

**Solution Landscape**

The AFCS solution architecture shall be based on integrated approach wherein all the solution sub-components interact with each other to offer business computing outputs in the most optimized manner. The overall infrastructure, network and deployment architecture is depicted below:

**AFCS Overview**

3. Automatic Fare Collection System

The Automatic fare collection system shall comprise of all equipment mentioned to perform fare collection process. Designing of System shall at minimum include:
3.1 Design Process

The service provider shall adopt a structured design process, including, but not limited to the below mentioned points:

1) Conceptual, preliminary and final design reviews with the PBMS, including, but not limited to: system architecture, logic flow diagrams, operation and maintenance philosophy, and verification and test approach; and

2) Conceptual, preliminary, and final software design reviews with the PBMS, including but not limited to: the software requirements specification, software architecture, logic flow diagrams, and verification and test approach.

3.2 Scalability Requirements

1. Shall support scalability both vertically (scale-up) and horizontally (scale-out) across Architecture tiers.

2. Shall ensure well-balanced load distribution on the various hardware and software component to ensure that no congestion in any of the solution hardware components occurring with the growing load on environment.

3. Shall propose suitable multi-processor servers capable of handling the calculated loads. Multi-processing must be natively supported by the hardware serves and operating system to support scalability. In case of cloud solution Service provider shall ensure the scalability and load balancing

3.3 Equipment Type Design Criterion

1) Environmental

The gates shall be installed in open areas at some stations. The service provider shall follow international environmental standards in respect of protection for AFC equipment.

2) Applicable Standards

The standards to be followed during the design, construction, and installation of the AFC System shall be as stipulated in the Codes and Standards (Annexure 2). The service provider may propose alternative or additional standards for review by the Employer at least 60 days before application. Such standards shall include, but are not limited to, the following:

- Tests of individual components;
- Power supply standards;
- System performance and reaction time requirements;
- Earthing & bonding;
- Terminations;
- Fire/smoke proofing of cabling;
- Electrical isolation;
- Lightning protection;
• Structural requirements;
• Cabling standard; and
• Earth leak detection.

### 3.3.1 System Life Cycle Performance Requirement

1) The service provider shall ensure that all equipment and material used is able to meet the specified availability throughout its service life as required to minimize disruption to the bus operation and to minimize the maintenance costs.

2) The Systems shall be so designed as to have a minimum of 10 years of service life (except Computer Hardware/Displays wherein it will be 7 years) operating continuously.

3) The system shall be designed to facilitate normal bus and station operation, management of incidents and abnormal operations as well as of emergencies.

4) The System shall, to the extent practicable, have no credible failure mode, which will directly cause an interruption to security surveillance or delay in the bus services.

### 3.3.2 Design Documentation

The service provider shall, in addition to the documentation requirements specified in the RFP document, supply, as a minimum, the following hardware and software design documentation:

1) Conceptual Design Specifications, details and drawings
2) Detailed Design Specifications, details and drawings
3) AFC Station Layouts
4) Software Design Specifications, Detailed Interface Specifications,
5) Configuration Documents
6) Installation, Validation Procedures and Test Reports etc.
7) All Interface specifications

### 3.3.3 Security Provisions

The equipment shall be designed with features, which deter revenue losses from the following:

1) Acts such as altering, copying or counterfeiting the tickets.

2) Protection from unauthorized changes to the software.

3) Protection from falsification of records. Provision shall be made to allow entry at the internal keypad of pre-encoded ticket serial numbers to track the ticket supply in order to identify any variances between the tickets dispensed and the tickets used in re-supplying STT and the exit gates.
3.3.4 Stand-alone Operation

Individual units of the AFC equipment shall be capable to function in a stand-alone mode. Any breakdown in cabling or communication links between units of equipment or computer installation in stations or at the Central Office shall not affect operation.

3.3.5 Modular Design

Modules, subsystems, assemblies and components shall be of modular design for ease of maintenance and to accommodate a phased implementation.

3.3.6 Maintainability

1) All components shall be packaged in replaceable and repairable modules. Standard hardware and components shall be used for flexibility and ease of maintenance.

2) Special customized carrying cases shall be provided to avoid damage to sensitive modules, as necessary, in quantities sufficient to support the level of maintenance required.

3.3.7 Self-diagnostics and Self-clearing

Self-diagnostics shall be employed to the maximum extent possible to assure the highest possible availability. Standard diagnostic programs shall be provided for computer hardware and software programs. Customized diagnostics shall be employed to assure such items as all modules in place, communications link up, non-computer electronics working properly, battery backup ready and monitoring of wear for signs of deterioration. The service provider shall indicate in the Manuals how the tests are initiated and provide a complete definition of the results of the tests and ranges of the possible results. A problem detected by self-diagnostics and problems occurring during a transaction shall be subjected to automatic resolution before the offending system or the unit of equipment is removed from service. Automatic resolution shall be unique to each subsystem, module or component.

3.3.8 Software

1) Downloading

Downloading of commands and parameters shall be accomplished remotely from Central System. Downloading shall be accomplished using standard communications protocols and connectors. All necessary infrastructure, cables and connectors shall be provided.

2) Software Use and Verification

a) All software shall be complete and fully tested prior to shipment of the respective equipment. The software shall be fully programmed, debugged and updated. The Service provider shall provide the latest version of software and documentation for use during service provider-conducted training, operation and maintenance.

b) All customized software source code, object code and documentation shall be provided on CD-ROM in a MS-WINDOWS compatible format. Upon entry of the
proper command into the service terminal, the AFC equipment shall generate a printed receipt showing the software part number and version of all installed software.

3.3.9 Locks and Keys

The lock and key configurations for all the doors and internal components shall provide separate set of key along with key holder for operations and maintenance and revenue service (Minimum 5 set of keys per lock for each equipment).

3.3.10 Grounding

A copper or copper-alloy, corrosion resistant, high-conductivity grounding pad shall be provided within each AFC equipment to ground all conductive materials such as frames and metallic covers, motor frames, trays and doors.

3.3.11 Safe Guards

The safety of all operating personnel using the equipment or performing their duties shall be an essential aspect of the AFC equipment design and fabrication. The service provider shall provide appropriate safeguards. Such safeguards shall include shields or barriers placed to prevent injury, including burns from heated surfaces or cuts from sharp edges. Safety label shall be shown on moving parts, live voltage etc to alert operating or maintenance staff.

3.3.12 Painting and Plating

All exterior non-stainless steel surfaces shall be painted or plated. Parts or areas in contact with concrete or masonry walls or floors shall receive a minimum of 2 coats of rust and corrosion preventive primer and 2 coats of non-corrosive finish paint.

3.4 Implementation Process

Automatic Fare collection system shall be majorly implemented at following levels as mentioned below:

3.4.1 Level 1 : AFCS Media/ Tickets

Tickets shall have the information in encrypted format and enable the passenger to access the services. Tickets issued under this system shall allow entry and exit from any station of Amritsar BRTS as per their business rule. Tickets issued under this system shall have the feature for full fare, concession fare, distance based as well as flat fares. Ticket layout has to be shared by the service provider during the design phase for review and approval.

- Type of Fare Media :
  - Contactless smart token (CST Type A)
These shall be used for single journey ticket collected on exit. Mifare Ultralite (64 bytes)/My-D Move (Infineon). Type A Token compliant to ISO 14443.

b). Contactless smart card (CSC Type A)
These shall be used for multiple journey of the passengers. Mifare Desfire (minimum 4 KB) EV1 ISO/IEC 14443

Type of Fare Modes

System shall have the capability of implementing fare products like tourist card, Staff/Employee Pass, Police Pass, Daily Pass Test Pass, Group Ticket, Trip Ticket etc..

The system shall issue smart card, which can contain personal information of the passenger, including eligibility for concession, While there can be identifiers in the system to distinguish different consumers/passengers (e.g. Students, Women / Special Categories etc). The system should be able to read the card, verify the same with the central system and debit appropriate fare. It should also be able to warn the passenger / driver if the card has insufficient balance.

Characteristics of Smart Cards / RFID Tokens

- The Smart Card to be used with the AFCS shall be ISO 14443 compliant. The Smart Card to be supplied by the operations team shall be Mifare Desfire 4K and shall be fully compliant with ISO/IEC 14443 and other relevant ISO/IEC standards.
- The SC shall have an operating frequency of 13.56 MHz
- The dimensions of the SC shall comply with ISO 7810.
- The resistance of the SC to mechanical stress and chemicals shall comply with ISO 10373.
- All SC used shall be suitable for personalisation of one surface with photo and personal details as required by PBMS or for Service providers use.
- Each SC / Token shall have a unique external identification number that is linked to the card’s manufacturer supplied internal identification number which shall not be erasable or changeable. The external number shall be engraved or printed in a non-erasable, long lasting ink. The supplier of the cards shall provide an electronic correspondence list between the internal and the external card number where the two are not identical. The external number shall have a check digit to minimise the possibility of errors on data entry.

The AFCS shall be capable of supporting the use of SC which is suitable for both:
- PBMS only applications; and
Multiple applications including generic electronic-purse (multiple) and independent applications which can use the platform without competing intentions of the applications provided by PBMS.

a) Fixed and Variable Data Encoding

- Fixed data shall be encoded onto Contactless Smart Cards by the Operator prior to issuing. Each Smart Card shall be encoded with a unique identification number, date of entering the AFCS, type, encoding device reference number and other pertinent data that shall not change throughout the life of the Smart Card.
- Encoding on variable data fields shall be carried out by the card Validators and field AFCS devices used by PBMS.

b) Validity Checking

- The Contact-less Smart Cards / Coins shall be authenticated by all AFCS devices before the actual financial transactions are initiated in order to check originality.
- AFCS equipment shall be able to check the integrity of the data on the Smart Card / Coins during processing. Smart Card / Coins which are no longer capable of being accurately encoded shall be detected, rejected and blocked.
- Blacklisted tickets shall be rejected / blocked by AFC gates when Card is shown for Entry and rejected/ blocked by STT card reader/writer when the Card is presented for doing Add Value.

c) Smart Card Issue

A Contact-less Smart Card / Coins shall be considered issued when a value is encoded on it. This shall process in the following ways:

- Encoding of Smart Card for future off-site sales by authorised agents. Value is encoded on the Smart Card that are then handled with the same security as actual money;
- Encoding of Smart Card for first issue by the Station ticket terminal.

d) Smart Card Security / RFID Coins

- Each transaction of card with any device in the system shall first be security authenticated with exchange of encrypted (with the appropriate application key set) number exchange
- When corrupted or suspicious Smart Card numbers are detected, the numbers shall be added to the blacklist that is downloaded to the AFCS equipment to protect against fraudulent use of Smart Card.

Certification & Standards
AFCS TECHNICAL SPECIFICATIONS FOR AMRITSAR BRT

- The card should incorporate Mifare Desfire Chip or compatible (minimum 4 Kbytes).
- Valid ARSENAL Certificate of Mifare Desfire (having above mentioned chip) or compatible smart cards to ensure the quality, reliability and compatibility of the Mifare Desfire (or compatible) based smart cards.
- Electrical specifications should comply with Arsenal Certification from Mifare Arsenal Institute. Arsenal Certification to be submitted for Desfire or compatible chip along with the bid.
- Dimensional Specifications to comply with ISO 14443-1.
- Mechanical / environmental tests complying with ISO IEC 10373 as detailed in the acceptance tests.

Warranty

Warranty for a period of three year or 100,000 times of writing whichever is earlier.

Detailed Specifications

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Card Geometry</td>
<td>Shape and Physical dimensions (including thickness) to be compliant to ISO 14443-1 standard.</td>
</tr>
<tr>
<td>2</td>
<td>Base material</td>
<td>• The complete base material including card body and transparent outer layer should be high grade PET-G.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Test report for the PET-G material to be submitted from a recognized test laboratory.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The surface must be such that it is low sensitive to dust and moisture adherence.</td>
</tr>
<tr>
<td>3</td>
<td>Card lifetime</td>
<td>Must be: &gt; 5 years.</td>
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<tr>
<td></td>
<td></td>
<td>During this lifetime, the card must not develop cracks, hole, printing fading, major surface imperfection etc. due to aging.</td>
</tr>
<tr>
<td>4</td>
<td>General characteristics</td>
<td>Card must adhere to specifications covered in ISO IEC 10373-1-General characteristics (for following parameters):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Resistance to dynamic bending stress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Torsion stress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bending stiffness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Resistance to break</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flammability, Peel strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Card warpage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Resistance to chemicals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Adhesion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Card stability etc.</td>
</tr>
</tbody>
</table>
### Electrical characteristics

<table>
<thead>
<tr>
<th></th>
<th>Distance of work</th>
<th>Cards should work up to a distance of 10 cm from antenna.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Certification</td>
<td>Supplier to submit Arsenal certificate (specifically for Mifare Desfire based or compatible cards). The submitted Arsenal certification shall include certification for essential electrical parameters, protocols and characteristics of Type A Desfire contactless card chip or compatible. Such parameters (but not limited to) include:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Antenna coil size, Card chip / antenna inlay design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Communication frequency, Operating field strength,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Modulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- User available application memory (4Kbytes)</td>
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<tr>
<td></td>
<td></td>
<td>- Read/write time, Read/write endurance (100,000 cycles), Data retention (&gt; 10 years), Data transfer rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Security features such as Anti-tearing, Momentary power loss protection, Anti-collision, Data integrity (support mutual authentication with the reader), 3DES encryption, EEPROM failure automatic detection, Transaction atomicity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The supplied card should comply with all standards / specifications covered under ISO 14443 Type A standard for contactless smart cards.</td>
</tr>
</tbody>
</table>

|   | Card Antenna | The Construction of the Card Antenna should be made of copper-wire and should be embedded type only for long durability and better readability. The Tenderer should specify the technology used for embedding. |

### Security features

<table>
<thead>
<tr>
<th></th>
<th>Transportation keys</th>
<th>Card manufacturer will encode cards with transportation keys prior to delivery to ensure security/integrity of the chip.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unique serial number</td>
<td>- Card shall be issued with a Unique ID (serial number).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Unique engraved ID will be embossed on the card Surface (laser engraved). Unique serial no. with padding digits for supplier identification to be used (to be consulted with PBMS). Each card will have a unique internal ID (7 bytes).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Engraved ID and corresponding Unique ID information for complete delivery should be available in recorded electronic media (CD etc.) which will be securely delivered to PBMS.</td>
</tr>
</tbody>
</table>
Card tamper protection | Card opening must not be possible without breaking the card itself and card must become useless. If card is opened, it should become unusable.

Hardware Security Certification | Minimum CC EAL4+ for Hardware.

Transport key for the supplied batch shall also be securely delivered to PBMS Security manager.

Environmental conditions parameters
Physical card and embedded data should not be tampered in adverse utilization conditions.

| Resistance to environment | Cards must resist up to environment stresses as: Temperature: +50°C Relative Humidity: 100 % |
| Storage condition | Temperature: -10, + 60°C Relative Humidity: 15 to 100 % |
| Operating condition | Temperature: -10, + 60°C Relative Humidity: 15 to 60 % |

3.4.2 Level 2: Station Level Equipment:

A. Station Ticket Terminals (STT):

Each STT may be considered as a Point of Sale of tickets and terminal for handling passenger's enquiries. The STT shall be installed at each bus station to dispense tickets and handle queries from passengers. STT shall have following modules:

- Contactless Media reader/writer
- (English / Hindi) Passenger information display
- Token Dispensing mechanism for issue of Pre Vended tokens using containers, Receipt printers,
- Minimum specifications - CPU (Corei7 or better, Processor speed 1.6 GHz or above, 2 GB RAM, 160 GB HDD, 4 USB ports, Serial Port -2, Parallel Port - 1, minimum Win 2000 Professional licensed software Preloaded with CD, Antivirus licensed software preloaded with CD, built-in speakers, 10/100 Mbps NIC, scroll optical mouse, keyboard, 17” TFT monitor two pin European standard power cord)
- Electronically Operated Cash Vault
- Interface Unit
- Software and accessories
- Suitable enclosure racks for CPU shall be provided. Suitable covering for other modules shall also be provided.
- Networking

i) Functional Requirements
• The Station Ticket Terminals shall be manually operated, desk mounted units and shall be used to read and write to the Contact less Smart Cards and single journey RFID Coins.

• The STT shall be able to issue with stored value, add value, Online top up on CSC, analyse and replace all types of deployed SC within PBMS system and its participating partners.

• The STT shall be able to perform the above functions in combination on a single SC according to PBMS configurable business rules.

• Account for quantity/cash collected for the adjustments and surcharge handling such as entry/exit mismatch of PBMS. It should also have the detailed information about the media stock to be reflected in the end of shift report.

• The STT should also be integrated with electronically operated cash vault which is activated through software installed on STT.

• The STT shall not accept a new transaction until the previous transaction has been completed. The display shall time-out after a period defined through its operating parameters at the CCS unless a new transaction takes place before the end of the defined period.

• It shall be possible to request a receipt to be printed for the last completed transaction on the STT but receipt printing shall be on request only and not automatic.

• STT shall store all records (transaction, audit and status records) for a minimum of seven days in case of communication failure and shall restore the same once communication link is up and running.

• Provision for degraded mode data transfer shall be provided.

ii) Operation of the Ticket Office Terminal:

• The STT shall permit all required functions to be easily accessible to the operator through an intuitive interface that will permit transactions to be completed with the minimum of operator actions.

• The service provider shall modify the STTs operation sequence to meet PBMS’s requirements, if necessary.

• Irrespective of the automatic selection, the mode of operation shall always be selectable by the operator.

• For the card sale function, the amount of deposit shall be encoded together with the initial amount of travel value or the selected Period Pass values. The STT shall always verify the amount encoded against the value selected by the operator and generate the required transaction record for auditing and updating of the database.
• For the top-up function, the STT shall add the amount selected from the list of available amounts or an amount entered by the operator to the current remaining value of the SC. If the deposit has been used for a fare and the current value is negative, the amount shall be used first to replenish the deposit and then to increase the travel value such that the new remaining fare value will be equal to the amount paid minus the existing negative amount. The STT shall always verify the amount encoded against the value entered or selected by the operator and generate the required transaction record for auditing and updating of the database.

• For the analysis function, the SC to be analysed shall be presented to the CARD READER/WRITER. Selected data encoded on the SC shall be read and displayed on the passenger display unit together with error code and the computed penalty or excess fare due, if any. In the case of entry-exit flag mismatch, the amount of the penalty, if any, shall be applied. The payment due shall be deducted from the remaining value or taken in cash and the flag reset to its correct state.

• In the case of a SC having been rejected by entry or exit Validator due to corrupted data, the STT shall be used to analyse the SC. The STT shall read as much data as is possible. If necessary and if this data includes the serial number of the SC, the STT shall interrogate the Central Control System to determine the remaining data associated with the SC as recorded in the CCS database. Alternatively, the operator shall enter the engraved or printed SC identification number to retrieve the remaining data from the CCS. Using this data and operational regulations, the Ticket Office personnel shall use the STT to cancel the rejected SC and issue a replacement SC on receipt of the appropriate payment, if any, which will be valid for use.

• Smart Card with invalid codes as a result of exceeding the period of validity of the card since first issued or since last used shall be analysed and the relevant data displayed on the STT. If the limit has not been exceeded to the point where the card has been cancelled and removed permanently from the database in accordance with operational regulations, the card shall be re-validated by re-encoding the last used date.

• All penalty amounts shall be determined in accordance with the PBMS’s business rules and shall be configurable from the CCS. All penalty amounts shall be displayed on the STT even where these have been set to zero at the CCS.

• Refund; card in damaged/ good working condition return shall be handled at STTs. Configured to do so, the refund of deposit and purse shall be as per business rules of PBMS. All pass return refund and damaged card refund shall be handled by STT configured to do so.

• STT shall provide interface unit near the STT unit for smart card travellers to check balance and validity related activities at all stations. This interface shall also allow the smartcard holders to update balance on their card in-case they have recharged the same using internet based or scratch card based recharge voucher.
iii) **Methods of Payment:**

- The STT man machine interface shall be designed to facilitate the recording of payments in cash with future scalability to validate credit card (using third party terminal) and by the receipt of vouchers issued or validated by PBMS.

- The end of shift reports shall discriminate between payments made in cash, by credit card and by receipt of vouchers to facilitate the end of shift reconciliation process.

iv) **Security**

- STT shall be configured for operator identification and access control. The process shall serve to identify operating personnel and record an operator’s start and end of duty. It shall ensure the transaction security and data transference.

- It shall have the mechanism (like audit registers) for audit of all transactions (for quantities and revenue figures)

- No chances of any fraud transactions by fast swiping of tickets over reader/writer or any other means. Data should be recorded first in system and then in card/token or provide any other way to take care of fraud due to fast swapping of card

- It shall be necessary for the operator to enter his identification and PIN into the STT before being able to start a shift. It shall not be possible for an operator to start a new shift without having first closed the previous shift.

- Provision shall be made for an operator to break his shift such that access to the system is denied to any other user during this break and the shift will resume on re-entry of the original operators PIN and password. The Service provider may configure a time limit to this break such that the STT will automatically log off the original operator and produce close of shift reports accordingly. After an automatic log off, any operator with a valid PIN and password shall be able to start a new shift on this STT.

- The STT will be enabled to collect payment to a preset amount per day, downloaded by the central system. The STT will be automatically disabled if the amount exceeds the preset limit and upon payment, the limit will be released after proper authorisation from authorised team member.

- Access to the STT for servicing and maintenance purposes shall also require the use of high security access control. When accessed by maintenance personnel, the STT shall only process test SC.

v) **STT’s Interface**

Service provider to design the architecture of data flow from STT to CCS. This shall carry information on the following (indicative list, not limiting):

- Identification of the operator on duty;
The stock registers of the STT shall include, but not be limited to, the following:

- Number of SC issued for each type;
- Value of deposit and travel value encoded on new SC issued by type;
- Number of Period Passes issued by type;
- Total value of Period Passes issued by type;
- Number of Penalty deductions made; and
- Total value of Penalty deductions made.

**Performance Parameters**

- Throughput – 10 Passenger Transaction per minute
- MCBF – 10000 cycles
- MCBJ – 20000 cycles
- There should not be frequent hang faults during operations.

**B. Flap Barrier**

I. **Function**

Gate arrays shall be the normal-means of controlling entry to and exit from the paid areas. Control shall be by means of actuating a physical barrier on recognition of a valid
token or card by the gate. The barrier shall be retractable flap type. The gate shall be capable of operating either normally open or normally closed. The gates should provide fare processing ability to ensure that the transport system is only used by fare-paying passengers. It processes the fare media of each passenger wishing to enter or leave the transport system and allows or denies passage through the gate aisle according to the validity of the fare media. The gate can operate either under control of a station computer system or in a stand-alone mode. The barrier mechanism separates the paid zone and unpaid zone and gives an effective compromise between fraud prevention and physical safety of adult, child and handicapped passengers. The physical barriers are automatically opened in case of an emergency evacuation.

II. Features

- The different gate operating modes may be set locally or remotely. The modes are:
  - In service: Entry/Exit
  - Out of service: Out of service/Maintenance/Station Closed/Power Failure
- Different fare modes are permitted by the business rules (set remotely or locally)
- Business rules, operating parameters and fare tables updated by the central system
- Tokens after completion of journey shall be captured at exit. Should there be any positive remaining value on a token after the completion of the journey, the exit gate shall encode the remaining value to zero and capture these tickets regardless of the unused remaining value.
- Gates shall give alarm / warning to STT/ Station Computer when its bin is 75% full (which should be configurable). If the collecting bin is full, the gate shall go into ‘out of service’ mode.
- The service provider shall propose user friendly and efficient methodology for capture of tokens in gates. Exit gates shall validate and capture tokens in single presentation. In case ticket is not valid, the gate shall not accept it and a corresponding error message should be displayed on the LCD. After the token is removed by the passenger, the gate should activate the card reader and wait for another ticket.
- In the event a ticket or card does not work first time the display shall inform the passenger as to what he should do next, such instructions shall include “Try Again”, “Ticket Error”, “Go to Customer Care Centre” etc
- Token captured at exit gate shall be counted and recorded by audit register. Token count accuracy by Gate should be more than 99.8% in normal operation
- At validation of ticket, the ticket type and amount shall be displayed at the LCD of gates
- Flap gate should have adequate non-volatile storage to store program code, individual blacklist/ whitelist records, operational data parameters etc

III. Fare Processing

- Fare media are checked for validity and updated in accordance with the business rules and fare tables currently in force
- Media acceptable: Mifare 4KB, Desfire 4K and equivalent
IV. Flap Gates

- Operate in normally- Open mode or Normally- Closed mode
- Passenger throughput (Contact less smart card and token): 40-60 passengers/min
- Barrier types: Central retractable flaps
- Gap between flaps < 50 mm
- Flap opening < 0.5 sec
- Flap MCBJ: > 1,000,000 transactions
- Flap MCBF: > 1,500,000 cycles
- MTTR: ≤30 Mins
- Consumption: 250VA, 550VA peak
- Minimum Clear Passage: 590 / 990 mm

V. Physical Characteristics

- Integral body type unit made from stainless steel with a brushed finish
- Passenger detection by optical sensors
- Directional Display by LED Pictograms: Entry or Exit aisles visible up to 10m
- User friendly display or LCD display provides clear and logical passenger interface. Displays shall be clearly visible in the ambient light level of 300 Lux at gate arrays and at installations in shaded sunlight. The display shall be mounted in a convenient position so as to enable approaching passengers of various heights to read it
- Invalid transaction warning (alarm and display)
- Intrusion and fraud management (alarm and display)
- Modular design with ease of maintenance
- Recognition system, card readers and Card Validators can hide in the cabinet.
- Inner circuit - DC 24V and DC 12V to drive and control for safety
- Built-in 8-digit counter - display passage records.
- Cabinet with 1.5mm thickness, SUS-304 brushed stainless steel or coating.
- 40 mm soft flap barrier.
- High brightness LED light embedded panel emitting red cross and green arrow to enhance guidance for passengers.

VI. Environment

- Power supply: 220V ±10% 50Hz ± 2%
• Operating Temperature Range: 0 °C to +50 °C
• Humidity: 20% to 80% (non-condensing)
• Power: AC110 / 220V, 50 / 60Hz, 1PH
• Photocells: Minimum 14 pairs
• Quality Certification: ISO 9001 / CE
• IP : 65

VII. Input and Output

• Entry / exit direction input
• Open status input
• Compelling open signal input
• Fire alarm output
• Passage completion output
• Error status alert
• Tailgating alert
• Reverse intruding alert

C. Station Card Validator (SCV) - Installed on entry/exit flap gate

Functional and Operational Requirements

• The SCV shall be capable of performing a transaction with ISO14443 “Type A” cards / Single Trip Coins as a minimum
• The SCV should read cards at a distance 0mm to 30 mm, but shall not operate at a distance that introduces a risk of unintentional operation(tolerance limit + 10%).
• The SCV shall read, write and verify all required data for the transactions associated with SC to permit the application of all the PBMS’s business rules and the collection of all records required for the PBMS’s accounting and reporting purposes.
• Transaction time shall not exceed 300ms for agreed and used types of Contact less cards.
• SCV shall be connected to the access gates installed at Bus stations and Bus terminals. They shall control the access gates based on the validation process of SC.
Minimum Technical Specifications:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Module</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Display</td>
<td>Approx. 6 Inch LCD Display, capable of showing 4 rows, 30 characters minimum</td>
</tr>
<tr>
<td>2</td>
<td>SAM slots</td>
<td>4, ISO 7816</td>
</tr>
<tr>
<td>3</td>
<td>Processor</td>
<td>Minimum 32 Bit ARM 11/ equivalent or above</td>
</tr>
<tr>
<td>4</td>
<td>Memory</td>
<td>Minimum 12 MB up to 24 MB</td>
</tr>
<tr>
<td>5</td>
<td>Media Reader</td>
<td>ISO / IEC 14443, Type A/B, Mifare, DesFire</td>
</tr>
<tr>
<td>6</td>
<td>Security</td>
<td>3DES/ AES Crypto</td>
</tr>
<tr>
<td>7</td>
<td>Buzzer</td>
<td>95dB</td>
</tr>
<tr>
<td>8</td>
<td>Operating Temp</td>
<td>0 deg C to 50 deg C</td>
</tr>
<tr>
<td>9</td>
<td>Humidity</td>
<td>5% to 90%</td>
</tr>
</tbody>
</table>

D. Swing barrier

Service Provider shall provide one swing gate with opening closing facility for authorized movement in both directions of station equipment / large groups of visitors etc. at least 1200 lbs barrier lock has to be provided.

Functional and Operational Requirements

- Barrier frame shall be stainless steel, smooth finished (Grade SS304 satin finish) surface with chamfered edges / corners without any protruding parts.
- The diameter of pipe at curvature should remain uniform as rest of the pipe (50 mm). The frame shall have thick clear toughened glass (fixed in between) securely with rubber / fibre lining.
- The barriers shall be firmly mounted on mounting plates on the station flooring. Both fixed and swing barrier shall be designed for lateral force of 250 N

E. Receipt Printer

- Receipt for shift end report reconciliation, group tickets and all transactions.
- Impact Dot Matrix, black / white, Power - 24 V DC.
- Character set - 95 alphanumeric, 37 international, 128 x 12 graphic.
- Columns - 40/42 columns, Characters per inch - 17.8/16 cpi
- Printer should allow the use of 2ply/3ply stationery.
3.4.3 Level 3: Station Computer

- Functional and Operational Requirements
  - The object of the this System is to collect transaction data and other information at a central point in each station for transmission to the Central Control system (CCS) and to supply AFC equipment with necessary data received from the CCS.
  - This system shall monitor the status and functions of the AFC equipment and provide warnings and alarms.
  - This system shall be located in a secure area to which unauthorised persons will be denied access.
  - At each station, station computer shall communicate with all station AFC equipment to collect transaction and status information. It shall process the transaction data received from station AFC equipment, respond and store the data accordingly.
  - Alarms and equipment status changes shall be reported to CCS via this system on real time basis.
  - At intervals not exceeding 15 minutes, this system shall conduct a traffic audit by processing traffic data received from the Automatic Gates/SCV.
  - This system shall record the accounting and user flow data of the AFC equipment regularly, including CSC and CST origin information.
  - It shall record the CSC identities received from the entry and exit gates.
  - It shall automatically record details of all transactions as well as the total value of all CST and CSC sales. The revenue from each station shall be counted and reconciled with the station level financial reports.
  - It shall ensure that all data is received with no duplication or omission by monitoring transaction IDs.
  - Duplicate transactions shall be rejected. Where the transaction IDs are not consecutive, it shall initiate automatic data recovery procedures to obtain the missing transaction data from the originating CSC device.
  - It shall automatically record the CSC identities together with details of all transactions received from the equipment.
  - It shall maintain the current record of passenger flows at the station that will be available for display at all times. This shall be based on traffic data received from each Gate and shall be updated at intervals not exceeding 15 minutes.
  - It shall also provide fall back facilities in the event of prolonged communication failure with the station level equipment. Station configuration data files shall be copied onto a backup media and downloaded to station level equipment if necessary.
• Anti-fraud measures shall be incorporated into the design of the SC to prevent fraud due to unauthorised CSC transaction record duplication or alteration. A full description of the proposed measures shall be submitted for the Employer's approval.

• Station computer should be of industrial grade system with Minimum specifications - CPU (Corei7 or better, Processor speed 1.66 GHz or above , Cache 1 MB, 4 GB RAM (2 x2 GB) DDR2 or above , Mini PCI slot -1 , 160 GB HDD, 4 USB ports, minimum Win 2000 Professional licensed software Preloaded with CD, Antivirus licensed software preloaded with CD , built-in speakers, 10/100 /1000 Mbps, Ethernet – 3 ports , COM port- 6 (1 x RS232, 3 x RS232/ 422/ 485, 2x RS-422/ 485).

3.4.4 Level 4 : Central System

A. Bulk Initialization Machine (BIM)

The Card Bulk Initialisation Devices shall be PC-based systems capable of initializing SC for use in the AFCS. The device shall be essentially identical in functionality to the STT except that it will not require receipt printer and shall have the capability to initialise cards received from the manufacturer with transport key-security key replacement. BIM shall be connected to the LAN at the Administration Office and shall be set up to enable mass initialization of SC prior to the commencement of full scale SC revenue service. BIM shall be located within the central computing location.

The main function of the initialization process is to replace the SC factory transport keys with the system specific diversified master keys; diversification shall use card electronic number to ensure safety across the system and to format the fixed data fields of the SC depending on their ultimate use and the SC type. The number of SC types and Employee Pass types shall be defined by the Employer during the Project implementation.

The Service provider shall use the configurable file format for the different types of SC, including Employee Passes and Period Passes. Where requested and required the service provider shall provide APIs and Security modules customised for the application to be provided by a third party service provider joining the system in agreement with PBMS.

The BIM shall have separate audit registers to track the total number of SC initialized by type of SC when operating in the initialization mode.

Cards shall be procured initialised and deployed by the service provider.

B. Card Personalization Device (CPD)

The CPD shall have facilities to receive digital images of user photographs and digital input of user particulars as required for the electronic and physical personalisation of specific user Passes for whom physical personalisation is required. It shall also be able to receive and process custom designed graphics for promotional SC.

The CPD is an extension of to the BIM with the card printer attached to it.

Card Issuance Points in City for concession & normal smartcard can be issued from any station.
The service provider shall make provision for setting-up different locations within the city to provide concession cards to the travellers which shall include necessary documentation to validate use type and delivery of the same at the required address of the recipient. Normal smartcards can be dispensed at the stations and designated retail delivery points within the city.

C. Key Management System

Key management shall be done at CCS level. Security access module, SAM (having Security keys) of all the equipment shall be issued from CCS. Blank SAM as per CCS requirement shall be procured & provided by service provider.

D. Workstations for Monitoring

<table>
<thead>
<tr>
<th>Specifications of Desktop</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU</strong></td>
</tr>
<tr>
<td><strong>speed</strong></td>
</tr>
<tr>
<td><strong>HDD</strong></td>
</tr>
<tr>
<td><strong>RAM</strong></td>
</tr>
<tr>
<td><strong>Ports</strong></td>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td><strong>OS</strong></td>
</tr>
<tr>
<td><strong>Antivirus</strong></td>
</tr>
<tr>
<td><strong>App</strong></td>
</tr>
</tbody>
</table>

Detailed functional requirements for the central application are mentioned in clause 4 of this document.

3.4.5 Other Transit Service Providers / Other Services:

A. Handheld Terminals for Ticket Inspection/issue of tickets

The service provider shall provide handheld terminals capable of reading contact less smartcard / token for spot checking purposes. The handheld device shall be able to issue tickets and validate smart card in case of power failure or any other emergency cases. The handheld shall read smartcard/token and display card information including last transaction details in-order to ascertain travel details from compliance perspective.

The handheld shall be programmable to include audit functions as desired by PBMS audit process. The handheld should be able to store violation data and the same should have capability to communicate to the central control centre.

i) Functional Requirements:

The unit shall meet the general functional requirements.

The Handheld Terminal Unit (HTU) unit shall have a LCD screen for displaying ticketing process with an alpha-numeric keypad including software configurable function keys.
next to the display. The HTU should also provide navigation keys, enter, cancel, configurable function keys below display, Power on off toggle button, Wi-fi and other status indication led’s.

The HTU display shall have colour LED’s for status indication besides audio/visual feedback/alarms.

The readers in the HTU should be able to read cards at a distance range of at least 0cm to 3cm from the reader but shall not operate at a distance that introduces a risk of spurious operation.

The HTU should have capability of GPRS interface. The HTU shall have an 802.11b/g compatible Wi-Fi module connected to an external antenna for data transfer and communication of high volume of data and application down loads to the depot system.

A maintenance engineer with maintenance access card shall be able to access maintenance mode of the device which shall allow the maintenance engineer to diagnose the faults and update the device settings when required.

On-board printer should be able to print penalty tickets.

ii) Operational requirements:

The unit should have capabilities to link to central control application.

The unit shall have sufficient memory storage to allow 5 days transaction data on a busy route, device configuration data for the depot, maximum of 50,000 black listed card data.

HTU shall be able to store additional configuration sets with designated future time and date for activation to enable PBMS to implement changes to fares and business rules on all buses at once.

The print time per ticket should be less than 2 seconds and not more than three key strokes.

The validation & read/write cycle time for smart cards should be less than 300ms.

The reader should read cards at a distance between 0mm to 30mm and shall not operate at a distance that introduces a risk of unintentional operation (tolerance limit + 10%) .

The HTU shall read, write and verify all required data for the transactions associated with SC to permit the application of all the PBMS’s business rules and the collection of all records required for the PBMS’s accounting and reporting purposes.

iii) Interface requirements:

HTU shall use serial ports, hi-speed LAN, WLAN, GPRS communication protocols appropriately to achieve optimum performance.

It should have suitable Wi-fi and GPRS hardware built in to it so that the communication can be established at the terminal to download the data into Bus Terminal Management System database or CCC.
iv) Tech Specs:

**Handheld Device Specifications:**

- PCI PED2.0 certified
- EMV 4.0 L1 and L2 certified
- 32 bits high speed microprocessor
- Open architecture Linux Operating System/Windows/Android
- Large backlit LCD Display for optimum viewing
- Portable design with handset and base unit

<table>
<thead>
<tr>
<th>Processor</th>
<th>32 bits secure Microprocessor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
<td>Internal Memory:</td>
</tr>
<tr>
<td></td>
<td>Flash: 32M</td>
</tr>
<tr>
<td></td>
<td>SDRAM: 32M</td>
</tr>
<tr>
<td></td>
<td>SRAM: 2M (Optional)</td>
</tr>
<tr>
<td></td>
<td><strong>External Memory:</strong> Micro SD socket</td>
</tr>
<tr>
<td>Display</td>
<td>128 x 64 graphical LCD with white backlight</td>
</tr>
<tr>
<td>Ticket Type Readers</td>
<td>Smart Card:</td>
</tr>
<tr>
<td></td>
<td>1.8V/3V/5V smart card</td>
</tr>
<tr>
<td></td>
<td>ISO7816 Class A, B and C</td>
</tr>
<tr>
<td></td>
<td><strong>Contactless:</strong></td>
</tr>
<tr>
<td></td>
<td>Mifare®,</td>
</tr>
<tr>
<td></td>
<td>ISO 14443 Type A/B</td>
</tr>
<tr>
<td></td>
<td>Working frequency 13.56MHz (Optional)</td>
</tr>
<tr>
<td></td>
<td><strong>Barcode Reader:</strong></td>
</tr>
<tr>
<td></td>
<td>1D / 2D</td>
</tr>
<tr>
<td>SAM</td>
<td>Min 2 SAM slots</td>
</tr>
<tr>
<td>Crypto</td>
<td>TRNG, DES, T'DES, AES, RSA, MK/SK, DUKPT, T'DES DUKPT</td>
</tr>
<tr>
<td>Host</td>
<td><strong>GSM/GPRS:</strong> Support 900/1800/850/1900 MHz</td>
</tr>
</tbody>
</table>

PUNJAB BUS METRO SOCIETY
### AFCS TECHNICAL SPECIFICATIONS FOR AMRITSAR BRT

| Interface | Local Wireless: ZigBee/Bluetooth  
USB: USB OTG  
Dial-up Modem: Build in V.90 bis Fast Connect Modem and Support Sync HDLC  
Ethernet: 10/100 Ethernet  
RS232: RS232 (Communication speed: up to 115200 bps) |
| --- | --- |
| Handset | Up and down navigator  
Standard 15 keys EMV keypad  
4 programmable function keys  
Backlight: Optional |
| Base | | |

| Keypad | LED: 3 LEDs (optional)  
*In case of LED display, the indicators can be provided on screen  
Sound: Buzzer |
| --- | --- |
| Printer | Paper width: 58mm  
Max paper roll: 40mm  
Max printer speed: 100mm/sec |
| Power | Power consumption: |
| Handset | Normal: 250mA  
Max: 5A (Print duty)  
Battery: Li-Polymer 7.2V/1A built in battery charger with the protector  
Input: AC100V/240V 50/60 Hz 2A Adaptor  
Output: 9V/5V |
| Indicative Dimensions | 175mm (L) x 79mm (W) x 62mm (H) |
| Handset | 149mm (L) x 75mm (W) x 40mm (H) |
| Base | *Dimensions can vary within reasonable limits |
| Weight | 450g (Approximate) |

PUNJAB BUS METRO SOCIETY
AFCS TECHNICAL SPECIFICATIONS FOR AMRITSAR BRT

| Environment | Temperature:  
|             | Operating temperature: 0 °C to 40 °C  
|             | Storage temperature: -20 °C to 70 °C  
|             | Humidity:  
|             | Operating humidity: 5% to 90%  
|             | non-condensing  
| Certifications | Security: PCI PED, EMV L1, L2, PTS, TQM  
|                | Safety: CE, FCC, BSMI  
| Software | SDK, KMS, TMS, Simulator, CTOS library, ISO 8583 library, Crypt library  

The service provider shall advise PBMS on provisions in the Contactless Smart Card data structure to permit other transit service providers to process the PBMS Smart card for transactions with a common transit purse. The service provider shall also assist in the integration activity with other transit service providers.

The service provider shall assist with necessary information required to be presented to the banks in accordance with RBI to obtain regulatory approvals for operations of an e-purse.

The service provider shall assist PBMS in preparing technical and operating specifications to be provided to other transit service providers for them to follow to ensure compatibility with the PBMS AFCS.

The service provider shall give consideration to integrate the systems later with other mass transit service providers in AMRITSAR and other cities operators and operate the central clearing house.

The service provider shall also design website of PBMS and same shall be operated and maintained by the service provider during the tenure of the contract.

3.5 Call Centre Management

Service provider shall be required to implement a call management system which shall enable people to communicate internally and externally. Call centre system shall act as a communication carrier mechanism and shall help different stakeholders within the system to respond to desired activities in a pre-determined systematic manner for resolution. This system shall include call management system including PC’s, Call handling equipment and EPABX.

4. Central Control System (CCS), Data Centre (DC) and Disaster Recovery (DR)

Central Control System will act as a live hub to manage and monitor service related data which will be viewable through a centralized application. Activities at the control centre will comprise of monitoring services, incident management and all other features defined below in this document with defined escalation procedures, activities to include monitoring health of all components.
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(hardware, software etc.) of AFCS project through automatic monitoring system. Service Provider to provide manpower personnel to manage and maintain the CCS.

In case of emergency or critical situation in DC, data backup procedures from Disaster Recovery (DR) site should be clearly followed.

a. The Central Control System of PBMS is to be located at PBMS Project premises in Amritsar. PBMS will make provision of allotting an area for the purpose of setting up the Command Control Center.

b. Service Provider can choose to set up the Data Center (DC) either at above mentioned PBMS location or cloud based at any location within India. DC must be a minimum Tier-III level Data Center guaranteeing 99.982% availability and uptime equipped with dual-powered IT equipment, sufficient cooling accommodation for collocating servers, multiple Internet links, common servers, storage with high availability etc.

While bidding for the project Service provider shall clearly state which options they have opted and add the cost for one of the two i.e. either physical or cloud based DC. All features, operational requirements, functionalities, service level (relevant) defined in this document are by considering DC has physical set up in PBMS Amritsar location and for combined features of DC and CCS. In case bidder opts for cloud based DC, features, operational requirements, functionalities, service level requirements remains the same.

c. Deleted

d. System Provider will train the PBMS staff for using the systems and appoint personnel for troubleshooting activities

e. All applications that are part of AFCS should be accessible from the CCS. The Work Stations will be web-enabled, provide for appropriate User Access (Role based, Read only/ Read write) and other security controls. All monitoring stations shall be able to receive alerts from the on field devices and display on screen on a dashboard.

DC will receive transactional data from on board and on field devices applications into servers and Decision Support/ Business Intelligence (BI) Applications respectively to generate alerts and reports on revenue and operational parameters.

4.1 Functional Requirements

The Central Control System shall generate the necessary management reports from all transaction information received from the AFCS field equipment.

The DC shall manage, update, hold and upload Configuration data (SC parameters and fare table information) to all field AFCS equipment.

The CCS shall automatically collate all transaction data; authenticate security features of transaction data from the AFCS to provide secure and accurate audit and traffic statistics for the Buses / Routes of the depot.

There shall be a data link between the Card Initialization and Personalization Devices and the CCS such that the CCS shall control all operations performed by these centrally located...
devices. The CCS shall allocate encoding and validity dates and other information required for the encoding of fixed data on SC and shall monitor and record all operations performed by the devices.

4.2 Revenue Collection integrity

PBMS shall conduct a thorough sanity check on the final released/ deployed ITS platform to ascertain revenue collection integrity. The service provider shall be required to go through an authorized change management or upgrade request in order to change any parameters on the system. The service provider shall also provide a day end reconciliation reporting application to PBMS which shall have access rights only to PBMS authorized persons only. The modification to this system shall be allowed only through authorized process. The service provider shall also provide log to ticketing activities as is generated by the fare collection devices directly to the PBMS audit system so as to allow PBMS to independently review revenue integrity.

4.3 System Description

The Central Control System shall collect data from DC and process the data to provide overall audit, statistical and operational information by start of next day.

The service provider shall consult with the PBMS on proposals for the type and range of operational, maintenance and financial information to be prepared. The final content and format of presentation of processed data shall be discussed and finalised with PBMS.

The operator interface to the CCS shall facilitate the preparation of ad hoc reports and shall permit both scheduled and ad hoc reports to be produced with data corresponding to user selectable short time periods within an operating day.

The service provider shall provide sufficient number of CCS workstations to facilitate finance, audit, engineering, operations and maintenance functions.

A hierarchical Access control system shall be incorporated across the system to ensure that persons can only gain access to the information or facilities that are relevant and authorised to their specific job.

The CCS shall be capable of connectivity with various suitable communication service providers providing GPRS / CDMA / fixed line connectivity through leased lines. All communication networks shall be set up, managed and maintained by the service provider through appropriate contracting terms with communications service providers.

The CCS shall be protected by appropriate fire walls from external access and outside world connections.

The data transferred from the field AFCS to the CCS shall include, as minimum, information such as usage of various equipment, number and cash value of all types of SC issued and topped up, on bus revenue, STT shift revenue, fault reports and passenger origin and destination traffic data, SC type and period pass type and time of day.

The CCS shall have facilities to generate, update blacklists for SC and Employee Passes and to download these lists to the station and on bus equipment. Where the devices are on line
either through wired broadband or mobile wireless data connection, these lists shall be downloaded immediately.

The CCS shall download configuration data to the AFCS equipment for updatation. The information shall include system parameters, card parameters, device parameters the fare tables, validity times for SC, date and time synchronisation, sub-system application updates, of SC and employee identification number and password updates.

The CCS shall be able to support SC replacement and refund (online only) applications from designated full function STT devices and from terminals located in the Administration Building. If a SC is corrupted, the operator shall input its engraved or printed card identification number to retrieve the remaining value of the SC, and the recent usage. It shall also provide printing functions on the details of any selected SC that is stored in the CCS with levy of approved fees.

The CCS shall be designed for autonomous operation of the various components of the AFC system to ensure that a failure in any one component of the AFCS shall not disrupt the system as a whole.

The CCS shall also provide fall back facilities, in the event of prolonged communication failure with the AFC systems. Such facilities may include updating on bus equipment via communication channels set up at Bus terminals and other means for Bus station equipment.

Depot configuration data files on the CCS shall be copied onto a backup media and hand carried to the Depots for Bus AFCS devices, if necessary.

The system should additionally provide ad-hoc query based interface for the analysts to perform complex analysis. The system should provide functions to create new analysis / reports based on the user needs and same shall become part of the user report bin.

4.3.1 CCS Communication Links:

The Service provider shall provide a reliable method of verifying the integrity of the data and programme files sent from the CCS to the AFCS and the correct reception of data uploads received from the AFCS at the CCS.

4.3.2 CCS hardware and software

The proposed set up should be capable to cater to meet the needs of a Real time Transit system involving more than 500 STT’s, 1000 access gates and 1,000,000 transactions per day. Additionally, the system should be capable of expanding and scaling with additional deployment of hardware and necessary amendments to software for operations of 3 to 5 times the sizing stated above.

4.3.3 Software:

The software deployed shall include a package consisting of computer operating system software, diagnostic, testing, development and support software and AFCS application
software, including software to manage and safeguard security keys for SC and software for the generation and modification of report contents and presentation.

Security features shall be incorporated to prevent tampering with any data, programs, or other facilities of the CCS.

All computer software documentation for the CCS including workstations shall be provided by the service provider. Necessary technical information, concerning hardware, software and firmware including system architecture, shall be provided to PBMS by the service provider upon full deployment of the system.

Scope of software includes full functional AFCS, as mentioned in RFP Document. The service provider shall provide asset / inventory management system managed through RFID based tagging process. All equipment which form part of hardware supply other than smartcard shall have RFID tags attached to them.

4.4 Configuration Data Management

Configuration data (CD) is the information transmitted from CCS to each AFCS equipment which as a minimum package shall contain

1. Equipment Operations parameters,
2. Fare table, SC configuration parameters (Add Value etc.,)
3. Black list
4. Application updates

The CCS shall be capable of checking and handling exception, missing, duplicate, delayed and fabricated data. The system shall be able to track the continuity of all types of data of system devices in case the above problems occur.

The CD Parameters shall have an effective date and time which may be any time in the future such that they are applied with immediate effect. If the effective date and time is set in the future, these parameters shall take effect on the specified date and time without further operator intervention. All the devices in the AFCS shall be able to handle at least one version of future CD parameters. However, there shall only be one current CD parameter list in the system and the system shall ensure that only one version of parameters takes effect in the system at any one time. Once a version of the CD parameters is deployed, it shall be locked to prevent any modification.

The system shall allow only authorized staff to maintain parameters. A facility shall be provided as part of the CCS whereby the operational parameters can be modified and once verified and AUTHOURISED can be transmitted to the AFC Systems for implementation at a date and time to be specified. It shall be possible to use back-up media to allow for change in operational parameters to be implemented in the event that the communication links are down.

Parameters shall be grouped in files according to the different levels of validation required such that, for example, device over ride parameters can be sent separately from fare tables and without the same level of validation. The system shall allow CD parameters to be highly directive to the level of individual devices by the device ID and IP address.
The CD parameters shall be communication media independent, Shall be able to be sent via depot WAN / WiFi or via GPRS connections so that items like blacklist / action list can be sent immediately.

The Configuration database shall be provided with a reporting tool to produce reports of various parameters and groups of parameters set on the system, sub-systems and devices

4.4.1 Data Storage

The design of the database system shall be arranged to keep track of all valid SC in circulation. This information shall aid in reporting any abnormal usage of stored value or trips and in providing refunds for corrupted SC.

The database system shall satisfy the following requirements:

Full-function RDBMS to Support complicated data structure will be deployed, multi-user, multiprocessing, large capacity operation, Offer data integration, data recovery and security, Support parallel processing, Provide disk mirroring functions, Authority control shall be independent of that of the operating system and Offer multilevel security management of database.

Data storage capacity shall be sufficient to maintain six months transaction data available on line for ad hoc report generation and other investigations. The volume of data to be calculated for this requirement shall assume 1,000,000 transactions per day. The database shall be easily expandable to handle another 1 million transactions a day minimum.

To maximise the utilization of the disk space of the system, system data shall undergo a regular housekeeping process. Housekeeping shall cover the files created by the CCS and the files relative to each subsystem. Any out dated or invalid files shall be archived. Duplicated records in the database and records where only the latest data need to be retained shall be merged and archived.

The system shall be able to backup and recovery of data according to different modes and periods of backup required based on their criticality and data volume. The system shall have the functionality to backup and recover all key data (usage data, system data) and files.

4.4.2 CCS Security

The Central Control System shall implement security systems to manage equipment authentication and administer the control over authority given to administrators of the operating system and others. It shall also manage the operating authority of SC devices at Depots.

A stand alone, highly protected, access control system shall control access to every part of the system to the authorised personnel

Card security shall take the form of CST keys downloaded to the AFC devices in the form of a Software Security Module.
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4.5 Clock Management

The Central Control System shall obtain the standard date and time and synchronize its clock automatically from PBMS or its designated master clock system. The CCS shall synchronize its clock at least once every 15 minutes. If the clock is not synchronous to the standard time, the correction shall be completed in one second.

The clock information shall be downloaded to all AFC equipment and all SC devices. When the clock time of an AFC component or SC device is different to the downloaded clock time, the device’s clock shall be corrected automatically to the downloaded clock time. The correction shall not happen with the trip of a bus to avoid incomplete transactions due to time variation.

When the hosts or the SC devices of the system are restarted, they shall be able to download or receive the clock data and synchronize their own clock automatically.

4.6 Reports

The system as a minimum shall be delivered with capability to generate following reports; a comprehensive list of reports further than the mentioned below shall be finalized at the time of requirement finalization stage:

a. Average Total Commuters and revenue per Route, per Bus station, per shift
b. Revenues collected on same bus station, same route, same trips by different Conductors
c. ROI route wise, trip wise, shift wise
d. Passengers boarding bus at a Bus station – Time of day
e. Daily pass usage and its ROI for the passes validated
f. Student pass usage and the Cost of the subsidy that has to be refunded by Government- daily, weekly, monthly, yearly.
g. Origin – Destination
h. SC Usage By Route Number
i. Test Card Usage by route Number
j. PBMS employees usage of services
k. En-route Ticket Inspector Summary
l. Boarding and Alighting Service
m. Boarding and Alighting statistics
n. Passenger KMS analysis per trip configurable by the user
o. Bus Rides and Revenue Statistics By Fare Code
p. Cash Revenues as per PBMS MIS
q. SCs not used for the week , Month
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r. Half-Hourly Bus Usage Summary
s. Total Patronage
t. Bus Patronage And Revenue Statistics By Service Number
u. Bus Service Revenue And Passenger Statistics Summary
v. Boarding Ride Bus Station
w. Summary Of Bus Passengers Boarding By Service Number
x. System, Depot, Devices, STT CD parameters set current and pending future CD sets
y. Transfer Statistics

The above state reports are only indicative, actual list could be exhaustive based on PBMS’s requirements.

The Service provider shall provide PBMS a GRAPHICAL DASHBOARD to have visual view of all / some key reports/ parameters enabling quick decision making.

4.7 Business Intelligence Platform for Reporting

The specification given below is not for supply purposes but for reference only for integration of data and reports. BI tool is part of AFCS project and AFCS data needs to be integrated for reporting and dash boarding purposes.

BI platform shall enable PBMS to build reports from operations data to perform multi-dimensional analysis enabling to have better insight into parameters and enable PBMS to take business decisions leading to higher operational efficiency. The BI tool hence should offer following:

4.7.1 Management Dashboard

Interactive Visualization

1) Display information in an easy-to understand format and use intuitive and interactive visualization to enable management users within authority to quickly navigate, understand, and investigate data elements to make informed decisions.

2) Allow users to capture and export the current display through electronic reports and in different printer-friendly formats, including, at a minimum, MS-Excel, PDF, and Web formats.

3) Have a default configuration and landing page for each user or user-group that are editable.

4) Allow multiple visual elements to be laid out on the same display.

5) Have the ability to display dashboards and reports using different visual elements including charts, maps, calendars, gauges, images, tables, visual and textual lists, and alerts as follows:
   - All visual elements shall have editable titles, labels, legends, axes, icons, and colors, where applicable.
   - Interactive visualization component shall display the overall aggregate status of a SMC’s KPI with proper color coding (green, yellow, red, or as defined by SMC’s preferences). It will allow the user to drill down and switch between different KPIs (e.g. KPI for average vehicle utilization, average vehicle duration, etc.)
o Display clickable contextual information related to the metrics being viewed and allows the user to drilldown on contextual information as required. Charts shall support at least the following chart types:
   a) Bar Charts
   b) Histograms
   c) Line Charts
   d) Heat Maps
   e) Pie Charts
   f) Grids
   g) Area Charts
   h) Timeline Charts
   i) Bubble Charts
   j) Radar Charts
   k) Scatter Plots
   l) Doughnut Charts
   m) Pyramid Charts

6) Maps shall have GIS Maps extension to allow plotting different mark-ups and indications on a map view using base and spatial map layers and allow the user to zoom and pan freely through the map, and be able to present heat map visualizations on GIS map data.

7) Calendars shall allow the user to intuitively navigate through calendar fields, such as day, month, and year. Calendars shall allow the user to intuitively navigate through calendar fields, such as day, month, and year. Gauges shall have the look and feel of an analog gauge (needle) with configurable level markings (green, yellow, red, or as defined SMC’s management preferences) that gives a visual display of the amount, level, and measure of defined KPI.

Tables shall be able to:
   • Hold a large amount of data.
   • Allow the user to scroll through the data in all directions.
   • Freeze the header columns and rows when the user scrolls.
   • Allow the user to enlarge/decrease the font.

Visual and textual lists shall allow the user to scroll through all of the available list items with smooth scrolling. Allow the user to choose the proper visual element required to display the required KPI data and allow the user to easily switch between alternative visual elements.

8) Have view-management tools, allowing the user to move, reorder, enlarge, shrink, open, and close visual elements with intuitive interaction.

9) Allow the user to create a new visual element based on the available visual element types and customize an existing visual element with an easy-to-use graphical interface.

10) Allow the user to save any customization done on a visual element.
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11) Have zero-programming mashup capability that allows the user to configure queries and data mashups visually through drag-and-drop functionality.

12) Allow the user to drill down to display increasingly detailed data on various data elements.

13) Allow intuitive visual filtering, focusing, and selection of the displayed data and information.

14) Automatically update the parameters and filters of the displayed data when the user drills down through visual elements and update the other visual elements accordingly. Also, enable selection of filters through the visual elements and propagate selection to all visual elements in the dashboard.

15) Allow the user to filter and sort the presented data based on a number of attributes including the time period or on multiple attributes simultaneously.

16) Allow the user to search through visual elements that display numerous data entries such as tables and lists.

17) Allow the user to save the current filter and selection parameters.

18) Understand different types of structured data including numbers, percentages, fractions, general text, coordinates, and objects.

19) Store the user configuration and customizations information.

20) Have the ability to mashup different types of data from multiple sources with automatic detection of relationships between the data components and an option to manually define/overwrite relationship.

21) Run mathematical, statistical, and analytical operations on available data.

22) Compute trends and projections from data based on available historical data and based on data from external systems to enable informed decision-making.

4.7.2 Searching & Filtering

(1) Allow the user to drill down and search through the large amounts of data easily and quickly by time periods and other search criteria defined by the user. Also, provide user guidance for searching & filtering through data.

(2) Generate reports from the current view in different electronic formats including at least MS-Word, MS-Excel, PDF, and Web formats and that are printer-friendly. Not require programming knowledge or knowledge of SQL or databases to perform searches, queries, and filters.

(3) Allow reports to be sent directly to a network printer.

(4) Display a huge amount of data in a clear and organized view.

(5) Allow the user to hide or show parts of the data.

(6) Offer the capability to search multiple data sources effortlessly through a GUI.

(7) Allow the user to search, filter, and sort the presented data based on any attribute or on multiple attributes simultaneously.
Allow the user to graphically define complex queries that contain multiple parameters and span different data sources.

Allow the user to search through historical data

Allow the user to save the current queries, filters, and selection parameters

Have data-pivoting capabilities

Understand different types of structured data including numbers, percentages, fractions, general text, coordinates, and objects

Store saved custom queries

4.7.3 Reporting

The system shall have the ability to allow the user to generate reports based on predefined report templates or by manually selecting the data and the corresponding visual elements.

The system shall have the ability to provide a GUI with drag-and-drop functionality for creating custom formatted reports that include visual elements, objects, and formulas.

The system shall have the ability to display the list of available report templates, saved reports, and recently used report templates when the user logs in.

The system shall have the ability to allow the user to create, load, modify, delete, and save report templates graphically.

The system shall allow reports to be generated and published on an ad-hoc or scheduled basis with the ability to predefine a list of recipients and a regular schedule through a GUI.

The system shall be able to generate reports in different electronic formats including at least MS-Word, MS-Excel, PDF, and Web formats and that are printer-friendly.

The system shall allow reports to be sent directly to a network printer.

The system should have the ability to generate planning and forecasting reports for providing the information related to planning for no of buses to be transported.

The system shall have the ability for the reports to have the ability to drill down to multiple levels.

Reports should have the ability to print

Publish reports and dashboards for planned Vs. actual data, for example the system should allow the management user to view the planned budget vs. the actual revenue spent for a particular route.

The system shall allow to publish reports and send them to recipients through email attachments and to a central data store to be accessed by different users.

The system should not require any programming knowledge, knowledge of SQL, or dataset to create self-service ad-hoc reports.

The system shall allow the user to use previously defined objects and formulas or create new custom objects and formulas and save them for repeated use.
The system shall allow the user to save any configuration done on a visual element.

The system shall have the ability to display data elements using different visual elements including charts, maps, calendars, gauges, images, tables, visual and textual lists, and alerts as follows:

- All visual elements shall have editable titles, labels, legends, axes, icons, and colors where applicable.
- Display the overall aggregate status of KPI with proper color coding (green, yellow, red, or as defined per SMC’s preference) and allow the user to perform an interactive visual drilldown and to switch between different KPIs.
- Display clickable contextual information related to the KPI being viewed and allows the user to drill-down on contextual information as required.
- Charts shall have different types including: Bar Charts, Histograms, Line Charts, Heat Maps, Pie Charts, Grids, Area Charts, Timeline Charts, Bubble Charts, Radar Charts, Scatter Plots, Doughnut Charts, and Pyramid Charts.
- Maps shall have capabilities to show different mark-ups and KPIs on a map and allow the user to zoom and pan freely through the map.
- Calendars shall allow the user to intuitively and visually change the selected day, month, and year.
- Images shall allow the user to zoom and pan within an image and move between images intuitively.
- Tables shall be able to hold a large amount of data, allow the user to scroll through the data in all directions, freeze the header columns and rows when the user scrolls, and allow the user to enlarge/decrease the font.
- Visual and textual lists shall display an unlimited number of entries and allow the user to scroll through them.
- Alerts shall be configurable allowing for different alerts with various icons and colours to be defined and displayed.

The system shall allow conditional formatting, based on thresholds or data ranges, for any cell/object in the report.

The system shall allow the display of multiple data elements and result sets in the same report.

The system shall allow the user to display historical data side-by-side or overlapping in views where applicable.

The system shall display the generated report on screen.

The system shall have zero-programming mashup capability that allows the user to configure queries and data mashups visually through drag-and-drop functionality.

The system shall automatically update the parameters and filters of the displayed data when the user drills down through views.
(23) The system shall allow the user to display historical data for the current filter and selection.

(24) The system shall offer the capability to add new data sources easily through a GUI.

(25) The system shall allow the user to filter and sort the presented data based on any attribute including time period.

(26) The system shall allow the user to filter and sort the presented data based on one or multiple attributes simultaneously.

(27) The system shall have mathematical capabilities to be used to manipulate data, including basic and advanced arithmetic and statistical operations.

(28) The system shall allow the user to filter and search through the different data sources.

(29) The system shall allow the user to save the current queries, filters, and selection parameters.

(30) The system shall have data-pivoting capabilities.

(31) The system shall store the report templates and generated reports.

(32) The system shall understand different types of structured data including numbers, percentages, fractions, general text, coordinates, and objects.

(33) The system shall have the ability to mashup different types of data from multiple sources with automatic detection of relationships between the data components and an option to manually select the required relationship.

(34) The system shall run mathematical and statistical operations on available data.

(35) The system shall compute trends and projections from data series.

4.7.4 Data Retrieval & Management

General Data Retrieval

(1) Provide fast, secure, reliable, and easy mechanisms to retrieve information and data from the different data sources to meet the dashboard KPI requirements.

(2) Provide different mechanisms for retrieving data from different data sources including ETL, File Transfer, and Real-time integration.

(3) Log all received information from entities.

(4) Allow the user to define and connect new data sources and data stores effortlessly through a GUI.

4.7.5 ETL

(1) Perform ETL to extract, transform, and load operations to move the data from internal and external data sources to the staging environment and from the staging environment to the Storage environment.

(2) The system shall have the ability to perform multiple transformations on data including but not limited to
a. Selection
b. Translation
c. Encoding
d. Derivation
e. Sorting
f. Joining (merging)
g. De-duplicating
h. Aggregation
i. Transposing (pivoting)
j. Splitting
k. Lookup

(3) Provide the ability to define, configure, and manage ETL jobs

(4) Support import and export wizard and supporting connections with source and destination adapters including but not limited to OLEDB, flat files, and XML formats

(5) Have scheduling capabilities based on time, events, and triggers

(6) Offer the capability to define and connect new data sources and destinations effortlessly through a GUI

(7) Provide a user-friendly GUI to allow the user to handle ETL processes including:
   a. Modifying data feeds
   b. Changing of business logic used for data ETL
   c. Modifying ETL parameters
   d. Creating
   e. Editing
   f. Executing a large number of transformation rules

(8) Allow the user to view the data at different stages

(9) Allow the user to search, filter, and sort the data by stage, source, and type

(10) Allow the user to search the metadata

(11) Support batch data extraction, transformation and loading

(12) Store ETL rules and schedule

(13) Store the data at different stages including the raw data

Real-Time Integration with data sources

(1) The system shall have the capability to integrate with data sources on the real time basis to fetch the information
(2) The system shall be able to quickly retrieve the data with minimal time lag
(3) The system shall have the ability to capture the failed transaction

**File Transfer**

(1) The system shall support data retrieval through transferring files automatically using secure file transfer protocols such as the Secure File Transfer Protocol (FTP over SSL) protocol.
(2) The system shall support automatic file upload capabilities that can detect a new file and upload it.
(3) The system shall automatically rename the uploaded file to a proper filename including the source, date and version, based on configurable file-naming rules
(4) The system shall properly manage duplicate submissions by keeping the old file and applying proper versioning and renaming
(5) The system shall provide an intuitive graphical interface to AVLS Backend Users to:
   - Define the methods and rules for the file transfer such as maximum file size and supported types.
   - Define and manage the connections, file sources, file destinations, file processing, and file storage.
(6) The system shall allow the Backend Users to view file transfer history with filter and sort capabilities
(7) The system shall perform quality management on data provided through file transfer including validation and verification of file type and size and return errors and required corrections accordingly.
(8) The system shall be able to receive and store large files as specified in the configurable file transfer rules
(9) The system shall be able to store a history of uploaded files information and content

**4.7.6 Data Quality Management**

(1) Perform data cleansing, verification, validation, and reconciliation automatically and based on defined rules
(2) Allow the user to manage the data quality process workflow and rules using a GUI
(3) Compare the data to historical data as reference data for detecting anomalies
(4) Rank the completeness and validity of the processed data
(5) Store data quality verification rules and process workflow
(6) Store historical data

**Data Stores**

(1) Retrieved data from different data sources should be temporarily stored and processed in separate Operational Data Stores (ODSs).
(2) Data used to perform visualization, reporting, and searching operations should be stored in appropriate Storage environment (e.g. Data warehouse)

4.7.7 BI Configuration and Management

BI Configuration Management

(1) The system shall allow the authorized user to complete the following functions:

- Manage the different KPIs available by adding, modifying, or deleting KPIs or KPI groups areas using a GUI.
- Enable or disable KPI which activates or inactivates it but does not delete it (soft deletion).
- Configure a KPI including its ID, name, description, area, data source, format, unit, frequency, and formula.
- Configure the user access level required to view each KPI.
- Choose the default and alternate views for displaying a KPI.
- Drill down by clicking on a KPI to view its details and edit it.
- Search, sort, and filter KPIs by ID, name, frequency, measure, and indicator area.
- Show/hide disabled KPIs from the KPI management screen.
- Manage data sources for the KPIs easily through a GUI.

(2) The system shall have the ability to present an intuitive GUI allowing the authorized user to configure the threshold values and levels (green, yellow, red, or as defined per management preference) for a KPI by defining score card algorithms.

(3) The system shall have the ability to clearly present multiple KPIs in the same view

(4) The system shall have the ability to Configure KPIs that are aggregates of multiple other KPIs from different areas

(5) The system shall have the ability to instantly and automatically update the other dashboard components with any new KPI or changes to the configuration of current KPIs

(6) The system shall have the ability to Store each KPIs current and historical measure

(7) The system shall have the ability to Configure KPIs with multiple data sources

(8) The system shall have the ability to run algorithms to calculate the measure of a KPI based on data from subset KPIs

(9) The system shall have the ability to Store the different access levels for each of the authorized users
4.8 Dashboard and Reporting Requirement for AFCS, AMRITSAR BRTS

The list of reports given below is partial list and is being provided for the sake of understanding from the perspective of providing your insight into the type of solution required to meet PBMS’s business process requirement.

List of Daily Reports needed for the service performance monitoring:

4.8.1 Category: Station and Passenger Information

- Arrival and departure per station by individual trip

The report should be generated to give arrival and departure information per station for individual trips. Then for each station, the average dwell time should be calculated and measured against the total number of boarding if available.

- Using Smart Card
  - Origin and destination of a trip and length of trip
  - Boarding and alighting information by individual stations by direction of route
  - No of trips per day and per month
  - No of trips per day and per month of individual smart card user
  - Per station Revenue
  - Per Bus Revenue
  - Ticket Consolidation report
  - Settlement report

Data for fare and revenue shall be provided by the fare collection software provider agency and Service provider shall be required to incorporate the same in dashboards and reporting.

4.9 Transit Performance Measures

<table>
<thead>
<tr>
<th>Service Offered / Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Daily Ridership</td>
</tr>
<tr>
<td>Total Monthly Ridership</td>
</tr>
<tr>
<td>Average Trip Length</td>
</tr>
<tr>
<td>Week day</td>
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<tr>
<td>Week End</td>
</tr>
<tr>
<td>Vehicles operated in Maximum Service / day</td>
</tr>
<tr>
<td>Vehicle utilization / day</td>
</tr>
<tr>
<td>Total no. of passengers travelled in a month / No. of days</td>
</tr>
<tr>
<td>Total no. of passengers travelled in a month</td>
</tr>
<tr>
<td>Total of (Passenger * Kms travelled) in a day / Total passengers travelled in a day</td>
</tr>
<tr>
<td>Total no. of buses operated during peak hours</td>
</tr>
<tr>
<td>Total kms travelled by a bus in a day</td>
</tr>
</tbody>
</table>

Economics
4.10 Data centre

The data centre shall be secured access control and operated by authorised personnel only.
The data centre shall have adequate bandwidth and established DMZ for WEB casting
The data centre shall be capable of handling a minimum of 500 transaction packets per second
The data centre shall have fault tolerant UPS system powering all the equipments. (The service provider has to recommend if any changes are required).
The data centre shall have back up power from a diesel generator set and same shall be provided by PBMS.
The data centre shall be protected from fire hazards by suitable fire extinguisher system.
The data centre servers shall work on reliable / stable / multi tasking operating systems
The data centre shall have reliable communication, processing and web hosting software packages for the transit management application
Secure data centre facility shall be provided by PBMS and Service provider shall be required to carry out all ITS related installation.

5. Financial Management System

The Financial Management system shall be standard corporate financial management system including P/L and Balance sheet management. The section below describes in detail the requirements of FMS.

5.1 Central Accounting System

The central Accounting system shall consist of following sub-systems/ modules.
- Payments Accounting Module/Sub-system (Treasury section)
- Receipts Accounting Module/Sub-System (Treasury section)
- Daily Receipts and payments
• Cross Verification (Daily Sheets) (Accounting Section).
• Bank Reconciliation.
• Investment Module.
• Liability module.
• Suspense (Advances) Module.

5.2 Receipts Accounting Module (RAM)

The receipt of funds shall be a centralized/de-centralized activity in PBMS and shall be managed by central financial management system. The receipts from the transportation and allied activities of PBMS shall be managed in the central accounting system. The RAM shall cover the following major activities:

• Receipt of Funds (Treasury Section)
• Posting in Daily Sheets
• Consolidation into Classified Registers
• Cross Check with Collection Centres and Treasury Section
• Trial Balance (monthly & annually)

5.3 Payment Accounting Module (PAM)

Payment accounting module shall allow both centralized and de-centralized activity and hence payments shall be made from the Central Accounts Department as well from the other operational centres as shall be decided by PBMS. The payees shall be able to put up their requests by means of credit bill or Performa invoice to the department, which has placed an order for supplies or for the work or service provided. After due verification of the supplies received or the work done, the concerned department shall prepare ‘payment-memo’, debits it to the appropriate budget-head and then the head of that department or the person who has budget-drawing powers shall signs it. This payment-memo is then sent to the Central Accounts Department. The PAM shall cover the following major activities:

• Real-time settlement system including electronic fund transfer
• Payment Memo Approval
• Payment
• Daily-sheet preparation/posting
• Posting in Bills/Budget Ledgers
• Consolidation into Classified Register
• Trial Balance Preparation
5.4 Daily Receipts and Payments Cross-tally

Central accounting system shall provide facility for Item-wise receipts and payment statements (Daily-Sheets) under RAM and PAM every day. These shall be prepared on the basis of paid vouchers and receipt challans, while bank-book (Journal) and cash-book (Journal) shall be written as and when challans are received along with cash or cheques or voucher is paid in cash or by cheque.

In order to ensure correctness of daily accounts (receipts and payments) the cash and bankbooks (or main journal) shall be cross-tallied with the sum of the budget item-wise daily statement. If the gross receipts & payments of the day (as per journals) tallies with the sum of the daily sheet, the accounts are presumed to be correct.

6. Enterprise Management System & Security Solution

The specification given below is not for supply purposes but for reference only for integration. All products supplied as part of AFCS need to be integrated with EMS system supplied as part of AFCS project.

6.1 EMS solution consists of the following core modules:

i) Network Fault Management System - Provides fault and performance management of the network infrastructure that various services operate in. It provides Network Discovery & Reporting, Fault Analysis, Configuration Management, Advance IP Services Management, Service Management and Integrations with other modules.

ii) Integrated Performance Management System - Provides comprehensive end-to-end performance management across key parts of the IT infrastructure. It allows identifying trends in performance in order to avert possible service problems and consists of:
   a. Network Performance Monitoring - The Network Performance Management consoles provides a consistent report generation interface from a single central console. This central console also provides all required network performance reports (including latency, threshold violations, packet errors, availability, bandwidth utilization etc.) for the network infrastructure.
   b. Integrated Network Traffic Analysis System –provides details of applications, hosts, and conversations consuming WAN bandwidth to isolate and resolve problems. Traffic monitoring system is able to track 100% of all flow traffic on the network and identify malicious behavior with all IP conversations. It uses non-intrusive monitoring to reduce the impact on the monitored network and improve scalability.
   c. Server Performance Monitoring - integrates network performance management systems and give the unified performance state view in a single console. The performance state of the entire network and server infrastructure is visible in an integrated console.
   d. Database Performance Monitoring - integrates network and server performance management systems and provides the unified view of the performance state in a single console. It automates monitoring, data collection and analysis of performance from single point.

iii) Application Performance Management System

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a. Application Transaction Performance Monitoring System - determines if the root cause of performance issues is inside the monitored application, in connected back-end systems or at the network layer from a single console view. It proactively monitors 100% of real user transactions; detect failed transactions; gather evidence necessary for triage and diagnosis of problems that affect user experiences and prevent completion of critical business processes.

b. End-user Experience Monitoring System - measures the end users' experiences based on transactions without the need to install agents on user desktops. It detects user impacting defects and anomalies and reports them in real-time: Slow Response Time, Low Throughput, Partial Response, Missing component within transaction.


7. Training Room and Test AFCS

7.1 Scope:

The service provider shall set up training and test facility adequate for training all staff of the service provider. Each staff member shall be deployed on the front end or at CCS centre only after certification jointly by Service provider and PBMS.

Service provider shall create training manuals and other necessary aids to ensure the perpetual need for training as and when required for PBMS/Operator Personnel is required.

The training room shall be general training room pertaining to all ITS components and operational requirements.

7.2 Handover/Takeover

The service provider shall ensure that PBMS is sufficiently trained and skills are continuously upgraded to ensure complete takeover of the system at completion of the contractual agreement.

The service provider is required to impart training and necessary tools in-order to take-up operations whenever necessary. Service provider shall six months before the end of the contractual period go through a process of hand-over take-over with PBMS personnel’s and act in supervisory role for smooth take over.

7.3 Functional Requirements:

The devices and sub-systems shall be connected to the test CCS by an independent LAN / WAN that will permit the exchange of controls and data in a similar manner to that implemented for AFCS equipment installed in Depots.

The service provider shall ensure that this equipment operate with cards which carry test keys and does not create an opportunity for fraudulent encoding of SC in the production system.
7.3.1 Use as Prototype

The service provider shall develop software applications / manufacture equipment or accessories at the AFCS training and testing facility for testing as a prototype. Deployment will follow after joint evaluation by PBMS and the service provider.

8. Cash Handling

Requirements:

PBMS shall appoint cash Management Company to collect the cash from respective sales locations within the system.

This sales information along with all the transaction details for the shift shall be transferred to the back end where the data is analysed for shift operational reports and cross verification by PBMS for transactions against cash receipts at consolidator.

The figure below gives the process outline for cash handling and transaction data verification by PBMS.

9. Off-Site Sales

The Service provider shall facilitate the issue of SC from other locations, which are not included as paid services as part of this contract, but are extensions of PBMS operations,
which may include commercial kiosks within the Terminal concourses and outside agencies. Equipment and procedures for the issue and topping-up of SC from outlets, which are external agencies to PBMS or the AFSC service provider, shall be proposed for the PBMS’s approval. Such procedures shall ensure that the movement of SC to external agency locations takes place prior to the encoding of any value to ensure security of revenue.

The service provider shall assist PBMS in discussions with potential operators of offsite sales outlets for the PBMS SC with a view to achieving compatibility of equipment systems and reliable and secure capture of offsite transaction records.

10. Non-Transit Service Providers

The service provider shall advise the PBMS on provisions in the SC data structure to permit non-transit service providers to process the PBMS SC for e-purse transactions and implement clearing and settlement process for the same.

The service provider shall assist PBMS in preparing technical and operating specifications to be provided to non-transit service providers for them to follow to ensure compatibility with the PBMS’s AFCS.

The service provider shall assist the PBMS in discussions with potential non-transit service providers with a view to achieving harmonisation and compatibility of equipment systems and the rules for use of SC.

11. Human Resource Management

There shall be a Project manager as a representative of the service provider at the time of implementation followed by an Operations manager, employed as the head of operations by the service provider, after the start of commercial operations. Project manager shall act as the single point of contact and shall be responsible for all the deliverables of this agreement. The operations manager shall be the single point of contact with PBMS after the start of operations.

11.1 Central Control System

All the manpower required for Central Control System including the hardware maintenance shall be arranged by the service provider. Required database, SW and report experts shall be organised by the service provider. The proposal must include the costs for these operational personnel. Any shortcomings shall be made good by service provider, and if needed, deploy additional personnel to ensure satisfactory services.

11.2 Commercial Operations and Maintenance - Bus stations, Bus Terminals, Buses

Resources for Station ticket terminals & Bus Fare Collection, including manning the stations are to be provided by the service provider. The service provider shall provide cost of such services on annuity basis, payable monthly. This should be clearly indicated in the financial proposal. The personnel shall be responsible for the smooth functioning of the STT, validation equipment and its connectivity to CCS. They shall attend to the problems with
STTs, card validation equipment, connectivity problems and any other hardware related at stations and bus terminals. Service provider personnel shall also attend to any problem with equipment on bus installed by it. Service provider shall place its personnel on bus to manage fare collection using handheld ticketing unit.

At least second and third line maintenance shall be provided and may take the form of remote connectivity and help desk.

12. AFCS cloud based Disaster Recovery / Business Continuity Plan

The service provider has to provide Cloud computing services for disaster recovery to mitigate risk of any outages on account of Hardware / Software / Connectivity failure. The service provider has to guarantee up time of 99.9%. In event of the primary AFCS DC failure, the system should automatically route the AFCS field equipment to alternate/DRC site for service continuity. The service provider shall provide reporting access to DRC server to PBMS authorized officials to cross verify day end reports sent from primary DC. The DRC is expected to be on auto pilot mode in normal circumstances and act as a primary source of reporting need for PBMS.

13. Lead Time

The successful bidder will initiate the Project activities within a maximum period of 8 weeks as defined in Part -1 of this RFP. The successful bidder shall have to set up a pilot demonstration at one bus station with respect to Automatic Fare Collection. This pilot demonstration shall be done within 8 Weeks as defined in Part -1 of this RFP.

The Project Implementation shall be done in timeline specified in Lead Time. The Lead Time for each phase/Request Order of AFCS Project shall to be stipulated in discussion with the Service Provider before implementation order is given. Authority’s decision in this regard shall be final but reasonable time would be given. This will form the basis for application of Liquidated Damages.

The service provider shall give PBMS a clear project implementation plan within 20 days after signing the service agreement, in consultation with and to the satisfaction of PBMS. This plan shall include details of the project implementation team and benchmarks of delivery of equipment, installation of equipment, integration and setting up of the Central Control Centre. Upon completing the set up, the service provider shall do a test run for the entire system, remove any shortcomings and resolve any bugs in hardware, software, communication network and Central control system and have the system ready for commercial operations one month from the completion of set up.

14. Application and System Audit

PBMS shall appoint a third party auditor capable of auditing IT systems envisaged as part of ITM implementation. The service provider shall be required to provide necessary information to the third party auditor to facilitate testing and audit of hardware, software and processes related to AFCS.
15. Scope of Pilot Implementation

15.1 Automatic Fare Collection System

a) BQS
- Ticketing Terminal (POS) with Software, Smart Card / Coin Interface to issue card and token for station entry and exit, Receipt Printer
- Bus Card Validator at Flap Barriers configured for different stations
- Local LAN at Bus Station
- Usage of valid and invalid card demonstration for station entry and exit
- Usage of valid and invalid token demonstration for station entry and exit

b) Central Computer System
- Central Computer System
- One System with the required software will be installed at Bus Station
- Card Initialization and Card Personalization Devices
- Upload data from Field equipment to Central computer system
- Processing the data and generating the reports
- Backend Hardware and Software Setup (Not needed on actual configuration systems)
- Issuing of Single Journey Tickets (Tokens) against Cash and Smart Card
- Reports and MIS will be generated

c) Financial Management System Demonstration


Any changes having technical or commercial implications will have to be mutually agreed upon in advance, prior to making the change. In case of situations, that the impact is not dependent on one or both parties’ agreement, the revised commercials will be effective from the date of impact.

For avoidance of doubt, the parties expressly agree that
- Change Request shall not be effective and binding unless agreed in writing and signed by both PBMS and Service Provider.
- The payment of any additional cost agreed under a Change Request shall be in addition to the payments agreed upon under this Agreement.
Upon a Change Request becoming effective, the Project Schedule shall automatically stand adjusted by the additional time required for implementing the Change Request.

17. Computerised Call Management System

The service provider shall be required to implement service call management system capable of logging service request call within the enterprise of PBMS ITM. The system shall uniquely identify all calls by way of assigning ticket numbers and resolution procedure. This system shall provide PBMS a computerised log of all incidents logged as part of the ITM operations. The system should further provide analytical reports to evaluate problem areas and escalation system to ensure problems are reported properly and resolved.

18. Project Management Requirements

The scope, duration and size of this project require the service provider to create an effective Project Management team to assure the success of the work. The following Project Management elements shall be incorporated as a key component of the project.

a) Project Management Personnel

The Service Provider shall establish a Project Manager, who shall be highly responsive to the needs of PBMS as required in these Specifications and subject to PBMS acceptance. The Project Manager shall coordinate design and engineering activities and provide a technical liaison to PBMS. This person shall be highly competent and fully qualified in all aspects of the System. Where support is provided from individuals or groups outside the project, the support personnel shall be under the control of the Project Manager during the period of support, and support groups shall be required to provide support as their highest priority. An organization structure that diffuses responsibility and does not require that resources be assigned at management request is not responsive to this Contract and will not be accepted or tolerated by PBMS. To accomplish the above, the Service Provider shall assign a permanent Project Manager and Senior Technical Staff Member (STSM), subject to PBMS approval and assure compliance with the project management requirements of the Specifications and Agreement.

b) Project Manager

The Project Manager shall be identified to PBMS, within seven (7) days after notice to proceed.

c) Authority

The Project Manager shall have the contracting authority to issue and approve purchase orders and to contractually bind the Service Provider. The Project Manager shall have the authority to assign and schedule Service Provider to perform all of the Work required by this Agreement, and act as Service Provider’s representative for dispute resolution.

d) Responsibility
The Project Manager shall provide a single point of contact for PBMS to resolve all issues related to this Contract. The Project Manager shall be responsible for directing all Subservice providers’ designs and work.

e) Project Understanding

The Project Manager shall have a full and complete understanding of the Contract Documents and site conditions sufficiently to provide adequate direction for coordination of work.

f) Qualifications

The Project Manager shall have at least 10 years of experience in design and management of AFCS projects, with at least one completed project assignment for 50 BRT Bus stations. PBMS shall be the sole determinant of the suitability of the proposed Project Manager’s qualifications. PBMS reserves the right to have the service provider replace the Project Manager if qualifications are not met.

g) Availability to the Project

The Project Manager shall be available to PBMS on a twenty-four hour per day, seven days per week basis and shall respond promptly to any reasonable PBMS request. Coverage of this requirement by any alternates shall be subject to approval by PBMS.

The Project Manager shall be on site during all significant project events, as necessary to facilitate meetings, project activities, and information flow between the service provider and PBMS, and as requested by PBMS.

h) Senior Technical Staff Member

The STSM shall be available to the Project within seven days after LOI issuance.

i) Responsibility

The STSM shall act as a technical resource for coordinating all system design and implementation issues. The STSM shall check each technical submittal prior to it being sent to PBMS for approval. The STSM shall all technology related work to assure quality.

j) Project Understanding

The STSM shall have a complete understanding of the technical requirements of the Contract Documents and site conditions sufficiently to provide design direction and to determine compliance of the service provider’s design submittals and work.

k) Qualifications

The STSM shall be a Professional Engineer, who qualifies as acceptable to PBMS. The STSM will have a minimum of 10 years of experience, including three years or equivalent experience in coordinating engineering and administrative support activities for AFCS. PBMS shall be the sole determinant of the suitability of the proposed STSM’s qualifications. PBMS
reserves the right to have the service provider replace the STSM if these qualifications are not met.

I) Availability to the Project

The STSM shall be on site during all significant project events, as necessary to facilitate meetings, project activities, and information flow between the service provider and PBMS, and as requested by PBMS. In no case shall it be considered acceptable for the STSM to be on site less than ten (10) days per month. Coverage of this requirement by any alternates shall be subject to approval by PBMS.

m) Project Meetings

i) Attendance

The service provider’s Project Manager and STSM shall attend Progress Meetings held weekly.

The service provider’s Project Manager and STSM shall conduct a Project Kick off Meeting with PBMS stakeholders, Steering Committee, and the PBMS Consultant Manager.

The service provider’s Project Manager and STSM shall attend additional meetings, as requested by PBMS and the PBMS Consultant pursuant to the coordination of the Work.

ii) Location

Progress meetings shall be held at PBMS facilities unless otherwise specifically approved by PBMS. Other meetings shall be held at a mutually agreeable location, conducive to the topic of the meeting. For any project meetings conducted by conference call, service provider shall, at the service provider’s expense, provide a conference call-in number.

iii) Meeting Minutes

The service provider shall prepare minutes for each meeting, unless specifically instructed otherwise by PBMS. The Service provider shall prepare the minutes and distribute them to the attendees within two working days after the meeting. Minutes of Meetings shall include names of attendees, significant proceedings, decisions, unresolved issues, and a list of information requested by PBMS. The minutes shall be of sufficient detail to record any decisions made at the meeting and any follow-up actions required. The minutes shall include a summary of open action items, the party responsible for each, scheduled date for the action, and the respective resolution. Service provider shall provide a rolling project report, adding and deleting items as necessary.

iv) Agenda

The Service provider shall prepare the agenda for each progress meeting. The Service provider shall provide a draft agenda to PBMS at least one week prior to each meeting and request that PBMS add any additional items. Review of the previous meeting minutes and any outstanding action items shall be included on the agenda for each meeting. Each progress meeting agenda shall also include the item, “Additional PBMS Issues and Concerns.”
n) Schedule

Detailed Contract Schedule

The detailed contract schedule shall be a critical-path-method schedule constructed using Microsoft Project or other software application acceptable to PBMS. The detailed contract schedule shall show each activity, including interface activities, for completion of the Work, and shall be properly ordered and sequenced. Six printed copies and one electronic copy of the detailed contract schedule shall be submitted for PBMS approval within 15 calendar days after LOI.

Task Duration Limits

The detailed contract schedule shall be sufficiently detailed to preclude the use of activity durations greater than 15 working days. Activity durations shall include allowances for lost time and inefficiencies.

Task Designations

Each task designation shall delineate the phase or stage of the work and the component of the work such as design, submittal, submittal review, procurement, fabrication, delivery, installation, and testing.

Task Details

Where appropriate to the understanding of the task, additional details shall be provided, such as:

- A clear description of the activity, including its location.
- The duration expressed in full working days.
- A responsibility code denoting the Service provider, a subservice provider, PBMS, a government Agency, or a utility performing the activity.
- The quantity of material, in units.
- The integer percent complete representing the installed progress.
- The actual start and finish dates when applicable.
- Unless specifically agreed to in writing by PBMS, Service provider is responsible for all Work to complete any task.

Critical Path

The detailed contract schedule shall show a clear and definable critical path(s) for the Work and each specified milestone. Requirements and events which impose limitations, as well as dates and milestones which constrain the time, shall be clearly identified. Days of float time shall be shown. Items that require PBMS inputs and response shall be clearly identified.

Updates

The detailed schedule shall be updated every 15 days to show actual progress and changes to projected dates. Each update shall include a narrative describing the changes made since the last update. Each update shall be provided to PBMS within 5 working days from the month end cut-off date and submitted with each invoice. hardcopies and one electronic copy shall be provided.
Four-Week Rolling Schedules
The four-week rolling schedule shall show one week of historical information and two weeks of planned activities in support of and consistent with the detailed contract schedule.

Format
The four-week rolling schedule shall be presented as a chart with tasks along the left side and days along the top of the table. A shaded bar or “X” entered in the chart shall indicate work to be performed on each day for that task.

Task Detail
The level of detail shown on the four-week rolling schedule shall be greater than the level shown on the detailed contract schedule. In general, it shall show the Work to be done each day and the location(s) where the work will be done and by whom. Work that requires PBMS input or response shall be clearly identified.

Updates
The four-week rolling schedule shall be updated weekly and provided to PBMS by the end of the first day of the active week. Printed copies and one electronic copy shall be provided.

Submittals
General
This Section describes general requirements and procedures for preparing and transmitting information to PBMS for review, acceptance or approval.

Scheduling of Submittals
Transmit submittals sufficiently in advance of Contract requirements to permit at least Ten (10) calendar days for review, checking and appropriate response by PBMS or designated representative.

Transmittal Forms
Furnish the transmittal forms sequentially numbered and clearly indicate the Project Name; Project Number; Date; "To:"; "From:"; names of subservice providers, suppliers or manufacturers; required Specification references; category and type of submittal; purpose; description; distribution record (for transmittals and submittals); and signature of transmitter.

Checking of Submittals
Examine and check the submittal for accuracy, completeness, and compliance with the Contract before delivery to PBMS. Stamp and sign each submittal with the statement reading as follows: "Having checked this submission, we certify that it conforms to the requirements of the Contract in all respects, except as otherwise indicated". By reviewing, approving, and submitting a submittal, the Service provider has determined and verified materials, field measurements, and field implementation criteria related thereto, and has checked and coordinated the information contained within such submittals with the requirements of the work and the Contract.

Record of Submittals
Maintain at the worksite a complete up-to-date, organized file of all past and current submittals including an index and locating system, which identifies the status of each submission.
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- Assign sequential numbers to each submittal.
- Assign revisions levels (A, B, C, etc.) to all re-submittals. Assign new transmittal numbers and cross references to previous submittals.

**Electronic Format**

All submittals shall be provided in electronic format as well as hardcopy. File formats for electronic copies shall be subject to PBMS approval. Current version, industry prevalent software shall be utilized for preparing all submittals. Drawings shall be submitted in AutoCAD format. Drawings or studies involving geographic information shall be submitted in a format that can be viewed by GIS software.

**PBMS Review**

PBMS and/or designated representative will review and approve or take other appropriate action upon the Service provider's submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract requirements. PBMS's action will be taken as to cause no delay in the Work or in the activities of the Service provider. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of Equipment or systems, all of which remain the responsibility of the Service provider as required by the Contract. PBMS's or designated representative's review will not constitute approval of safety precautions or, unless specifically stated by PBMS or designated representative of any construction means, methods, techniques, sequences, or procedures. PBMS's or designated representative's approval of a specific item does not indicate approval of an entire assembly of which the item is a component.

**PBMS Review Stamp**

All Service provider's submittals will be stamped by PBMS or designated representative with (a) the date of receipt, and (b) one of the following dispositions (see Review Stamp Exhibit hereafter), and two sets will be returned to the Service provider. (Submittals for record of the Authority will not be returned).

1. **APPROVED**: Work may proceed, provided it complies with the Contract. The approval of shop drawings and samples is not construed;
   a. As permitting any departure from the Contract requirements;
   b. As relieving the Service provider of responsibility for errors and omissions, including details, dimensions, and quantity of materials; or
   c. As approving departures from details furnished by the Contracting Officer or designated representative.

2. **APPROVED AS NOTED (Correct and resubmit)**: Work may proceed, provided:
   a. It complies with the Contract as well as the corrections on the submittals, and the Service provider resubmits within fifteen (7) days corrected copies of the specifications, working drawings, or miscellaneous submittals for final approval; and
   b. Work performed by the Service provider prior to receiving final approval will be at the Service provider's risk.

**DISAPPROVED (Revise and Resubmit)**: Work not recognized as being able to proceed.

Revise submittal in accordance with notations thereon, and resubmit without delay. Handle re-submittals in the same manner as first submittals, except designated with suffix A, B, C,
etc. to indicate 1st, 2nd, or 3rd re-submittals. On re-submittals, direct specific attention in writing on re-submitted documents, working drawings, samples, mock-ups, sample panels, or miscellaneous submittals to revisions other than the corrections required on previous submissions. Make corrections required by PBMS or designated representative.

**Actions Following Review**

If APPROVED, each of the documents will be identified as having received such approval by being so stamped and dated. Documents stamped DISAPPROVED and with required corrections shown will be returned to the Service provider for correction and re-submittal.

Service provider will be returned one copy of each document duly stamped, signed, and dated.

**p) Drawings**

**Quality of Drawings**

The Service provider shall be responsible for accuracy and correctness of all drawings. The Service provider's Project Manager and STSM shall initial each drawing after checking it, indicating that it complies with all requirements of this Specification and accurately reflects intended or actual field conditions.

The Service provider shall check each drawing for:

- Conformance with Contract Documents
- Logical grouping and arrangement
- Accuracy
- Legibility
- Neatness
- Line Quality
- Lettering Quality
- Reproduction Quality
- Completeness

**Product Data Submittals**

**Quality of Submittals**

A submittal shall be prepared for each major piece of material or Equipment that the Service provider intends to furnish. These submittals shall be known as "Product Submittals". Copies of each product submittal shall be furnished. Each submittal shall be accompanied by a cover letter with reference number, signed by the Project Manager. Each submittal shall contain a list of any parameters for which the submitted products do not meet the Specifications and a description of how these changes will affect system design. Each submittal shall contain a description of any changes in design or products that the submitted products will cause.

**Content**

Each submittal shall contain sufficient information to determine that the System Component complies with the Specifications and Agreement. Actual values of all specified parameters shall be listed; a simple statement that the product complies will not be sufficient. Each product submittal shall be accompanied by Engineering Drawings necessary to determine the product's applicability to PBMS ITM design. All closely related products shall be
submitted as a single package. When pre-printed material is used in a submittal, the specific model number and options to be furnished shall be clearly identified. Standard data sheets can be used, subject to the following:

- Modify manufacturer's standard and/or schematic drawings to delete information, which is not applicable to the Contract. Supplement standard information with additional information applicable to this contract.
- Modify manufacturer's standards, diagrams, schedules, performance charts, illustrations, calculations, and other descriptive data to delete information, which is not applicable to the contract. Indicate dimensions, clearances, performance characteristics, capacities, and any other diagrams, as applicable.
- Modify installation, erection, application, and placing instructions to delete information, which is not applicable to the Contract.

Test Procedures

The Service provider shall submit copies of each test procedure description, accompanied by a cover letter with reference number.

Submittal Organization

Each test procedure description shall include the following information:

- A statement of the purpose of the tests.
- The location, date(s) and time(s) tests will be performed.
- The quantity of units to be tested.
- The test equipment to be used, identified by manufacturer and model number.
- A step by step description of the procedure to be performed.
- Specific pass/fail criteria for each test.
- A sample of the form(s) to be used to record test data. Each test form shall include the following information:
  a. Test title
  b. The manufacturer, model number and calibration date of each piece of test equipment.
  c. A table to record individual readings taken and inspections performed for each unit tested, identified by the serial number of the unit tested.
  d. An indication that the unit has passed or failed each individual test.
  e. A line for signature of the technician performing the test and date.
  f. A line for signature of the Project Manager and date.
  g. A line for signature of PBMS representative witnessing the test.
  h. Drawings illustrating the configuration of the Equipment tested and all test equipment utilized.

q) Test Results

Content

One original and copies of the results of each test shall be submitted. The original of the test results shall contain the original test forms filled out by the technician(s) performing the
tests and original signatures. Test forms shall be filled out in ink and no erasures shall be made. Errors shall be crossed out with a single line and initialled by the person making the correction. Each set of test results shall be accompanied by a cover letter with reference number.

Organization
Each set of test results shall include the following information:

• The complete test procedures used.
• The completed, signed test forms.
• A summary of the test, indicating quantity tested, quantity that failed, quantities that failed each individual procedure, and a statement of the remedy to be applied for failed units.

r) AS-BUILT DOCUMENTATION
As-built documentation shall include drawings and software documentation. As-built documentation shall include:

• Design and Installation Plans of the AFC system

As-Built Drawings

Drawings Content
As-built drawings shall provide a permanent record of the finished system. Each design document that was submitted for approval shall be modified to reflect the actual installed condition and shall become an as-built drawing. These drawings shall be supplemented with site specific information. Where a document is typical for more than one location, the locations shall be explicitly listed on the drawing & documents:

• All nomenclature and labels shall correspond to the actual labels on installed Equipment.
• Each connection to each piece of equipment, junction box, or terminal block shall be identified by function and color code.
• All dimensions, physical details, connections, and other information pertinent to system diagnostics, maintenance or troubleshooting shall be shown.

Organization of Drawings
All drawings pertaining to a subject shall be submitted as a package with cover sheet, index, and symbols and abbreviations table. A master index of as-built drawings shall be provided that organizes the drawings by package and drawing number.

Submittal of Drawings
A pre-final version of the as-built drawings shall be submitted to PBMS prior to maintenance training and prior to acceptance testing. The Service provider shall correct any inaccuracies and add plans to correct any deficiencies as identified by PBMS or as necessary to document changes made during acceptance testing. Final versions of as-built drawings shall be submitted within two weeks after acceptance testing or maintenance training, whichever is later.

As Built Software Documentation
AFCS TECHNICAL SPECIFICATIONS FOR AMRITSAR BRT

The Service provider shall provide all "Computer Software" and "Data" to allow PBMS to fully maintain and update all "Applications Software". "Computer Software" and "Data" shall include as-built versions of AFCS:

- Software Requirements Specification;
- Software Version Description Document, or equivalent;
- All "batch" or equivalent files, and all object libraries and "include" files, for editing, compiling, linking, and installing application software. Corresponding instructions shall also be provided;
- All files required to define, allocate, and load the database, and any other data files required to define, configure, load, or operate the system. Corresponding instructions shall also be provided.

Copies of each document shall be submitted in electronic form (CD-ROM, DVD ROM or other media and in a format that is accessible by PBMS) in order for it to be incorporated into PBMS’s Electronic Document Library.

The Service provider shall be required to provide source code and sufficient documentation including source code documentation in Escrow to permit modification of the delivered software without the necessity of contacting the Service provider in the event the Service provider is unwilling or unable to undertake such modifications. Proposers shall explain, in detail, the documentation to be supplied, provide samples, and guarantee of content with proposals.

PROJECT CLOSEOUT

Project closeout shall include an initial survey and a final survey.

Initial Survey

Pre-Requisites

Prior to requesting an initial closeout survey of AFC, the following conditions shall have been met:

- The systems acceptance test has been conducted.
- The Service provider has listed those items yet to be completed or corrected and has submitted a detailed plan of action and schedule for completion of the outstanding items.
- The Service provider has submitted special guarantees, warranties, maintenance agreements, final certifications and similar documents.
- The Service provider has obtained and submitted operating certificates, if required, final inspection and test certificates, and similar releases enabling full and unrestricted use of the work.
- The Service provider has submitted operations and maintenance manuals and final as-built documentation.
- The Service provider has delivered tools, including special tools, test equipment, standby equipment, and similar items.

Conducting the Survey

Upon receipt of the request for initial survey, PBMS will prepare a listing of any additional work items that are outstanding.
Final Survey

Pre-Requisites
The Service provider shall perform the Work necessary to complete and correct the items noted during the initial survey. The Service provider shall provide written notice to PBMS that the items have been completed and ITM is ready for final survey.

Conducting the Survey
Upon receipt of the notice, PBMS will schedule a final survey to verify that all of the Work items have been completed satisfactorily.

t) SYSTEM DELIVERABLES
AFC deliverables provided by the Service provider shall include all work required to deliver the System and System Components in accordance with this Specification and Agreement.

Manuals, Training, and Training Tools
The Service provider shall provide manuals, training, and training tools for the proper operation, maintenance, and repair of AFC equipments and applications. Delivery of the manuals, training, and training tools shall be accomplished per the Service provider-provided and PBMS-approved schedule.

Design Submittals
The Service provider shall provide preliminary and final design submittal packages, as well as individual design details for all elements specified herein. The Service provider shall provide detailed cut-over plans and procedures. All submittals shall be in both hardcopy and electronic format.

As Built Documentation
The Service provider shall provide As Built Documentation. Delivery of the As Built documentation shall be accomplished per the Service provider-provided and PBMS-approved schedule. All as-built documentation shall be provided in both hardcopy and in electronic format.

Monthly Status Reports
Monthly status reports shall be submitted to PBMS on the 7th of each month detailing the previous month’s progress. The monthly status report shall contain a description of the activities and accomplishments, an updated schedule showing the progress, and any issues or concerns. Service provider format is acceptable.

Test Plans/Procedures and Test Results
Service provider shall provide all Test Plans/Procedures required for the AFC project and the Test Results. The Test Plans/Procedures and Test Results format shall be submitted to PBMS for approval.

u) System Support

Prior to System Acceptance
Support for the maintenance and operation of installed AFCS subsystems shall be provided after incremental acceptance and prior to System Acceptance. It is PBMS’s intent to begin operating AFC after completion of the first incremental acceptance.

• Support shall be provided on-site at PBMS during testing and cut-over of Equipment on a continuous basis.
• Support for in-service AFC Equipment shall be provided twenty-four hours per day, seven days per week. A request by PBMS for assistance shall be answered within SLA parameters as required by PBMS.

Post System Acceptance

The Service provider shall provide end-to-end support during the contract period of 5 years.

v) QUALITY ASSURANCE

The Service provider shall submit to PBMS within 15 days of the Notice To Proceed (NTP) or LOI a comprehensive Quality Assurance (QA) Program Plan designed to ensure the quality of all activities, including design, purchasing, inspection, handling, assembly, fabrication, testing, storage, shipping, and warranty/repair work. The plan shall describe all quality control procedures of the Service provider and any sub-suppliers. The Service provider shall conduct regular inspections in accordance with guidelines defined by the QA Program Plan. Performance of any manufacturing or construction work shall not commence until the Quality Assurance and Control Plan relating to such Work has been accepted by PBMS. The Service provider shall update the QA Program Plan as necessary, when any deficiencies in the Work are discovered.

PBMS will, at its own discretion, perform QA monitoring of work done under this Contract, including monitoring of the Service provider’s or Subservice provider’s QA activities. Upon request, the Service provider’s QA records shall be made available to PBMS for inspection. Such QA activities performed (or not performed) by PBMS shall not reduce nor alter the Service provider’s QA responsibilities or its obligation to meet the requirements of this document.

At any time during the manufacturing process, PBMS may choose to visit the Service provider’s facility or a Subservice provider’s facility during normal working hours to audit the manufacturing and quality control processes.

w) Technical Documents

A key component of the ITM implementation is the accuracy and value of all deliverables. The technical documents prepared by the Service provider during the course of this project will include design reports, installation drawings, test plans, test reports, progress reports, and other technical memos. A review process shall be established by the Service provider to assure all System Components are checked for accuracy, correctness, uniformity, and compliance with standards of practice. The various tiers of the review cycle are detailed below:

• The Service provider’s Project Manager shall review project products for adherence to the standards of care common to the profession.

• The Service provider’s Project Manager shall be responsible for assigning qualified professionals to check all work products for accuracy, uniformity, and clarity. Responsibility for interface, control, and integration of disciplines into a uniform and coordinated document set is also included in this role.

• The Senior Technical Staff Member and individuals assigned as technical discipline leaders within the Service provider team shall provide another review. The reviews shall be initiated by the Project Manager and shall focus on a technical discipline review of selected project products.

• PBMS will provide a final review. This review will occur only after the Service provider’s internal review cycles have been completed. When review comments result in a change to any technical document, the Service provider’s Project Manager shall be responsible
for change coordination and document back-check. In addition to the formal and on-going quality control review, timely coordination meetings with all project staff shall be held to provide for interdisciplinary liaison and interface coordination. These meetings shall be utilized to schedule work assignments, identify and resolve coordination issues, and track progress associated with any problems encountered and their resolution.

Document Management

Due to the substantial amount of documentation involved in this project, Service provider shall work with PBMS’s Project Manager to develop and submit to PBMS a Documentation Management System. The Document Management System shall include an organized electronic library of all versions of all submittals and a log of the contents. This shall be completed within 30 days after Notice to Proceed. PBMS and the Service provider shall mutually agree on a documentation file index that shall provide an overall methodology for referencing documents generated in the course of the project. File type and organization of electronic versions of documentation shall be mutually agreed on by PBMS and Service provider. All subsequent documentation shall be referenced to the file index, and Service provider and PBMS shall mutually maintain the file index in current condition so as to show all documents that have been generated and their status.

Documentation in the DMS should be readily available to PBMS’s Project Manager, designated personnel within the Service provider’s organization, ITM Consultant, and PBMS-designated additional personnel. Security methods shall be available to restrict access by others.

System Components

The Service provider shall conduct regular inspections and audits in accordance with guidelines defined by the QA Program Plan. The Service provider’s Project Manager shall establish a quality assurance process and be responsible for assigning qualified professionals to check all system Components for compliance with the AFC Specifications and consistency in production quality. This quality assurance program shall supplement the formal testing requirements to verify that:

• Prior to installation, all System Components delivered by the Service provider shall pass rigorous screening that complies with standards of practice.
• All delivered System Components shall be tested after installation. Testing shall include hardware and software interface tests.

Manufactured Products

The Service provider shall utilize products manufactured by companies that utilize formal, documented quality assurance practices that meet or exceed the standard of care established by the industry. The Service provider shall proactively monitor each supplier’s quality system. Quality systems that conform to ISO/CMMI practices are preferred.

x) MANUALS

This section identifies the manuals to be provided to support training and give on-going documentation needed for PBMS staff to manage, maintain, and expand the AFCS.

GENERAL REQUIREMENTS FOR MANUALS

Development Process

The Service provider shall prepare a complete plan for providing the manuals described herein.
The plan shall include at least the following:

- Service provider shall submit for approval the outline of each manual as a part of the Preliminary Design Review.
- Service provider shall develop and submit a draft version of each manual submitted with the Final Design Review.
- Service provider shall deliver one complete set of manuals prior to the start of the acceptance testing.
- Service provider shall incorporate information gathered during installation and acceptance testing, throughout the maintenance and warranty period into the manuals for the updated and final submittals.

Content
Manuals shall contain all of the information material required to support the area of activity.

All Manuals
All manuals shall:

- Be in concise form, with minimal redundancy.
- Be organized in clear, logical fashion, and indexed and tabbed for rapid access.
- Be in English.
- Be written for comprehension by persons with a high school education.
- Contain table of definitions for all abbreviations and special terms.

All Operations Manuals
All operations manuals shall contain:

- Instructions on navigation from one function to another.
- The meaning of all display symbols and labels.
- The meaning and interpretation of all alarms and messages, and the recommended remedial action for each alarm and message.
- A reference card defining each cursor command, control key, and status indication.

All Equipment Maintenance Manuals
All Equipment maintenance manuals shall contain:

- A section on safety procedures and precautions necessary to prevent damage to equipment, injury to personnel, and unsafe operational conditions.
- A section with an overview of the test equipment and tools necessary to troubleshoot and maintain AFCS equipments.
- Wiring diagrams and physical layout drawings for all equipment
- A section addressing the intervals and procedures for all preventive maintenance including level adjustments and cleaning.

Medium and Formats for Delivery
Hardcopy
The Service provider shall deliver to PBMS the manuals for all sub-systems in hardcopy form, with appropriate binding and labelling.
• Manuals shall be designed for continuous, long-term service in a maintenance shop or vehicle environment.

• Manuals shall lie flat when opened

• Pages shall be printed on both sides.

• Manuals shall permit adding and replacing pages.

• Covers shall be oil, water, and wear resistant.

**Softcopy**

In addition, the Service provider shall deliver to PBMS in electronic form all manuals and manuals components that are developed by the Service provider, or by vendors in response to the requirements of this Contract.

• The electronic form shall consist of two good copies of each final manual on an electronic storage medium (CD-ROM or other approved media).

• The format of the storage medium shall be one that is widely used and easily available to PBMS.

• The manuals shall be stored as MS Word, Portable Document File, or other PBMS-approved format.

**SUPERVISOR MANUAL**

The Service provider shall provide a manual for supervisors. The manual shall provide a clear and concise description of supervisor interface with AFCS and related PBMS operating policies and procedures. It shall include:

• Overview of the AFCS System

• On-Bus Subsystem Overview

• Procedures for radio calls using mobile and portable radios.

• Procedures for sending and receiving text messages.

• How the supervisors are to perform all communications and bus fleet management functions provided at the CCC.

• Help guide for functional failures and problems

**FIXED COMMUNICATIONS MAINTENANCE MANUAL**

The fixed communications and radio subsystem maintenance manual shall complement the maintenance training provided. The manual shall supplement the maintenance manuals provided by the manufacturers of the fixed radio subsystem equipment. Manuals shall include the following topics, as a minimum:

• ITM Overview

• Radio Subsystem Functional Description

• System diagnostic procedures

• Identification of the source of a problem to a specific replaceable element, provide a logical procedures for isolating a problem. Provide a description of self-diagnostic features and system administrator reports.

• How to replace an element. Contain detailed procedure, or reference to a manufacturer manual detailed procedure, for removal and replacement of each fixed radio subsystem element.
Verification of correct operation of the repaired radio subsystem. Include instructions for setting and verification of options, programming, and testing of the replaced unit and associated equipment to verify correct operation.

This requirement shall apply only if the Service provider provides the fixed data radio system.

**AFCS OPERATIONS ANALYST MANUAL**

The Service provider shall provide a manual for handling and analyzing AFC data. It shall provide a clear description of features of bus AFC equipment characteristics, data capture methods, data anomalies and their detection, data management processes, and database organization. Provide instructions on database maintenance, data anomalies correction, using data management tools, and AFC report.

**COMPUTER SYSTEM ADMINISTRATOR MANUAL**

The Service provider shall provide a system administrator’s manual that provides a clear, organized description of all of the configurable computers of ITM, the tools and procedures for managing their configuration, and for diagnosing their performance and problems. It shall contain at least the information described below.

**Configuration Management and Operation**

The Configuration Management and Operation section shall contain at least:

- Procedures and tools for defining ITM users, function access and privileges, and console function assignments.
- Computer startup, interconnected systems communications restart, and shutdown procedures.
- Maintaining, updating AFC databases.
- Monitoring, analysis, and optimization of computer/LAN/WAN performance

Manual shall include procedure for configuring ITM for each separate fleet, setting access privileges for PBMS personnel and PBMS service provider personnel.

**y) Diagnostics and Troubleshooting**

The Diagnostics and troubleshooting section shall contain at least the following:

- Equipment and operating system error messages and diagnostics, with remedial action for each.
- Tools and procedure to troubleshoot equipment and software problems on all AFCS equipment
- Procedures to manage and diagnose interfaces with connected systems.

**z) COMPUTER SOFTWARE MAINTENANCE MANUAL**

The Service provider shall provide a programmer’s guide for each of the programmable computers in AFCS. For each, the guide shall:

- Provide an overview of software organization.
- Define external interfacing data format, semantics, and protocols.
- Define internal modules, data interfaces, tasking, and considerations for timing, priorities, and resource use.
- Provide complete source code listings.
• Identify and detail use of programming and database maintenance tools used to create the software.
• Include complete documentation of non-application components such as operating system, communications handlers, database, and report generators.
• Detail the procedures for building and managing software configuration.
• Describe the metrics embedded in ITM to evaluate its performance.
• Identify the error conditions detected within the software, and the messages or indications for those conditions.
Annexure 1:

Urban Bus Specifications – II, Ministry of Urban Development, Government of India

Refer UBS-II and subsequent addendum issued by MOUD at www.moud.gov.in
## Annexure 2:

<p>| Safety of information technology equipment, including electrical business equipment. | EN 60950-1:2006 |
| Power Transformers                                      | IEC 60076, EN 60076 |
| Protection Class for Components                          | As specified for individual equipment in this document. |
| Surge Protective Devices                                 | IEC 61643 – 1 |
| EMC – Immunity                                           | IEC 60801, EN 60801 |
| EMC – Emission                                           | VDE 0875, IEC 60555, EN 60555 |
| Electromagnetic compatibility Testing and Measurement Techniques | IEC 61000-4, EN 61000-4, BS EN 50121 |
| RFI Suppression                                          | EN55022A or VDE 0878 |
| Level measuring systems utilizing ionising radiation with continuous or switching output | IEC 60982 |
| Sound Level of Noise Source                              | ISO 3746, BS 4196–6 |
| Flammability Tests                                       | IEC 60707 |
| Valve Regulated Sealed Lead Acid Rechargeable Single Cells | IRS: S93-96, DOT: TQS10G 92 |
| Low-voltage Switchgear and Control gear Assemblies       | IEC 60439 – 1, EN 60439–1 |
| Low-voltage Switchgear and Control gear                  | IEC 60947, EN 60947, IEC947-3, IEC 60898 or EN 60898 |
| Specification for contactors                             | IEC60947 – 4, EN 60947-4 |
| Code of practice for Earthing                            | IEEE1100, NFPA 780, IEC1024 |
| Transient Protection                                     | MIL-STD-7041A |
| Lightning Protection                                     | BS-6651 |
| Quality                                                  | ISO9001 |</p>
<table>
<thead>
<tr>
<th>Specification</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specification for Safety of Information technology equipment including electrical business equipment.</td>
<td>BS EN 60950-1:2006</td>
</tr>
<tr>
<td>Electromagnetic Compatibility (EMC) : Generic standards immunity for Industry environments.</td>
<td>BS EN 61326 (Annex A)</td>
</tr>
<tr>
<td>Specification for safety requirements for equipment to be connected to telecommunication networks.</td>
<td>BS EN 41003:1999</td>
</tr>
<tr>
<td>Safety requirements for electrical equipment for measurement, control &amp; laboratory use. Part 1: General requirements.</td>
<td>BS 61010-1:2003/A2:1995</td>
</tr>
<tr>
<td>Secondary protectors for Communication Circuits.</td>
<td>Underwriters Laboratory safety std 497A</td>
</tr>
</tbody>
</table>
Annexure 3:

A. Service Level Agreement

1. Management of Services/General principles

Definitions

In this Agreement, unless the context otherwise requires:

“Account Manager” means the IT AFCS Service Provider employee designated by AFCS Service Provider to deal with the Customer’s account as notified from time to time to the Customer;

“Call Close Time” means in respect of any Fault the time at which that Fault is cleared and notified to the Customer.

“Call Open Time” means the date and time which is recorded by the AFCS Service Provider Representative as the time the Fault Call is logged;

“Customer” means an artificial person created under the law(PBMS) whose order for Services is accepted by AFCS Service Provider in accordance with the Terms of Service Provider Agreement;

“Customer Components” means such of the Components as are delivered to the Customer;

“Customer Representative” means the individual nominated by the Customer from time to time to represent the Customer in all matters relating to the Customer’s and the End User’s use of the Services;

“AFCS Service Provider Representative” means any employee of AFCS Service Provider or its sub-contractors nominated by AFCS Service Provider from time to time to be responsible, in liaison with the Customer Representative, for delivering the Services;

“Fault” means any recorded failure of any part(s) of the Services;

“Fault Call” means any telephone call, fax or e-mail from the Customer to the AFCS Service Provider Representative;
“Fault Duration” means the length of time between the Call Open Time and the Call Close Time for a Fault or, if any Fault is re-opened after the Call Close Time, the length of time between the Call Open Time and the final Call Close Time;

“Hours of Cover” means the hours of cover specified in Appendix A below;

“Response Time” means the length of time between the Call Open Time and the time at which an engineer arrives at the Customer’s premises or any other premises agreed between the parties with the aim of restoring the normal operations of the services to the customer including rectifying any Fault;

“Service(s)” means the service(s) provided by AFCS Service Provider

“Time to Restore” means the target time to restore specified for each Component;

“Technical Helpdesk” means those AFCS Service Provider Representatives available to respond to Customers’ requests for assistance from time to time;

“Terms of Business” means AFCS Service Provider’s standard terms and conditions in force from time to time.

2. **Scope**

   This SLA describes the target performance levels which AFCS Service Provider shall aim to deliver for the Services, AFCS Service Provider’s procedures for managing unavailability of the Services, and the penalties which will be applied if AFCS Service Provider fails to deliver any service performance targets in accordance with this Agreement.

3. **Targets and availability**

   Because of the varying nature of the Components each Component has an individual target set for performance and availability. However PBMS expects AFCS Service Provider to guarantee 99.5% availability of the Services.

4. **Service monitoring**

   AFCS Service Provider will put in place a monitoring mechanism to monitor all Components of AFCS. AFCS Service Provider through its monitoring system should provide data which is sufficient to allow analysis and reporting of Component performance and availability to the detail and frequency described in this Agreement.
AFCS TECHNICAL SPECIFICATIONS FOR AMRITSAR BRT

AFCS Service Provider will additionally use data gathered from its monitoring of the Components to inform & take approval from competent authority its decisions in respect of any changes to its infrastructure which it, in its sole discretion, deems necessary to maintain or improve the availability and performance of the services delivered to PBMS.

5. **Performance reporting**

AFCS Service Provider shall record performance and availability of each of the Customer Components and report this information to the Customer, as described in below. Where periodic account reviews are agreed by both parties to be held between the Customer and AFCS Service Provider, these reports will form an agenda for such reviews. If the Customer Components include access to AFCS Service Provider’s service system, AFCS Service Provider will enable the Customer to view the reports via AFCS Service Provider’s service system.

6. **Complaints procedure**

If the Customer has any complaints about the way in which AFCS Service Provider’s support facilities are being managed, the Customer Representative shall initially contact AFCS Service Provider, in writing.

7. **Non-delivery of Services**

**Planned suspension**

AFCS Service Provider will, on occasion, need to suspend part(s) of the Services in accordance with the Terms of Business. In such cases, the unavailability of any part(s) of the Services will not constitute a Fault. Where practical, any such suspension will be arranged to fall outside the Customer’s normal working hours and AFCS Service Provider shall use its reasonable commercial endeavours to see that the following procedure is followed:

AFCS Service Provider should by e-mail or other means give the Customer Representative reasonable notice of the time and duration of the suspension;

After completion of the planned work, AFCS Service Provider will report the outcome to the Customer Representative by updating the call management system on AFCS help desk system / incident management system; and

All work at the premises of Customers or End Users will be carried out in accordance with Both local and national health and safety regulations.

8. **Service failures**

Any Faults arising from failures of components which are not Customer Components or failure of any End Users’ system (for instance, the failure of a local telecommunications line) shall not be a Fault for the purposes of this Agreement.
9. **Managing Service Failure**

**Fault Calls**

**Notification of faults**

The PBMS Representative will report a Fault during the Hours of Cover by notifying AFCS Service Provider’s Technical Helpdesk by telephone, fax or email or Service System.

**Setting Fault priority**

The priority of a Fault reported by the PBMS will be categorised by agreement between the PBMS and the AFCS Service Provider Representative taking the relevant Fault Call. In the absence of agreement PBMS will determine the Fault priority. Faults will generally be categorised as follows:

**Table 1**

Severity Definition Chart

<table>
<thead>
<tr>
<th>Support Category</th>
<th>Criteria</th>
<th>Resolution</th>
<th>Maximum Response Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical</td>
<td>The system is unable to be used for normal business activities. There is certainty of financial loss to PBMS.</td>
<td>90 Minutes Escalated after this period to – Stage 2 Escalated after 2 hour (cumulative) to - Stage 3 Escalated after 3 hours (cumulative) to - Stage 4</td>
<td>15 Minutes</td>
</tr>
<tr>
<td>Urgent</td>
<td>There is a problem with part of the system, which impacts on PBMS’s decision making. No viable Work around is available. There is a likelihood of financial loss.</td>
<td>3 Hours Escalated after this period to - Stage 2 Escalated after 4 hours (cumulative) to - Stage 3 Escalated after 5 hours (cumulative) to - Stage 4</td>
<td>1 Hour</td>
</tr>
<tr>
<td>High</td>
<td>The efficiency of users is being impacted, but has a viable workarounds.</td>
<td>6 hours Escalated after this period to - Stage 2 Escalated after 8 hours (cumulative) to -</td>
<td>2 Hours</td>
</tr>
<tr>
<td>Priority</td>
<td>Description</td>
<td>Escalation Time</td>
<td>Resolution Time</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
<td>-----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Medium</td>
<td>A low impact problem that affects the efficiency of users but has a simple workaround</td>
<td>12 Hours Escalated after this period to - Stage 2 Escalated after 14 hours (cumulative) to - Stage 3 Escalated after 16 hours (cumulative) to - Stage 4</td>
<td>8 Hours</td>
</tr>
<tr>
<td>Low</td>
<td>A fault, which has no particular impact on processing of normal business activities.</td>
<td>One Week</td>
<td>8 Hours</td>
</tr>
</tbody>
</table>

**Recording the Fault**

The AFCS Service Provider Representative will ask PBMS Representative for information about the Fault to obtain a clear description of its nature and the circumstances in which it occurred and confirm eligibility or non-eligibility of support for the Fault.

**Faults initially reported by AFCS Service Provider**

**Notification of Faults**

AFCS Service Provider will notify the Customer Representative, either by e-mail, fax, telephone or other method, within a reasonable period of time of any Fault of which it is aware, unless that Fault is cleared before it can be notified to the Customer Representative.

**Setting the Fault priority**

AFCS Service Provider will allocate a priority to any Fault notified by the Customer Representative in accordance with the Fault designations set out in Table 1 above. The Customer should notify AFCS Service Provider’s Customer Services Manager by telephone if it disagrees with the allocated priority.

**Recording the Fault report**

AFCS Service Provider will record the date and time at which AFCS Service Provider notifies the Customer of any Fault and the other details.
10. **Fault rectification**

**Fault handling and escalation**

AFCS Service Provider will allocate to any Fault a Response Time in accordance with the details set out in Table 2 below. Faults which remain unresolved at the end of the Response Time will be escalated as shown in Table 2. Descriptions of the activities associated with each stage are shown in Table 3.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Response Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>The AFCS Service Provider Representative on the Technical Helpdesk will acknowledge the Fault Call and advice on tests and actions required in order to resolve the problem, consulting as necessary with other AFCS Service Provider Representatives and third parties. Should the AFCS Service Provider Representative be unable to resolve the problem or provide an action plan suitable to the Customer, the Fault Call will be escalated to AFCS Service Provider’s Operations Team and AFCS Service Provider’s Account Manager will also be informed.</td>
</tr>
<tr>
<td>Stage 2</td>
<td>AFCS Service Provider’s Operations Team will determine a suitable action plan and agree it with the Customer. Where appointed, the Account Manager will be notified. AFCS Service Provider’s Implementation Team may also be involved at this point and third party manufacturers and/or AFCS Service Providers may be contacted for additional technical support.</td>
</tr>
<tr>
<td>Stage 3</td>
<td>If unresolved following Stage 2, the Fault will be escalated to AFCS Service Provider’s Customer Services or Operations Managers, as appropriate. They will involve all necessary resources, Both internally and externally, to ensure an acceptable resolution for the Customer. AFCS Service Provider’s Technical Services Director will also be informed.</td>
</tr>
<tr>
<td>Stage 4</td>
<td>If unresolved following Stage 3, then AFCS Service Provider’s Technical Services Director will take responsibility for the call and involve all necessary senior and management resources, Both internally and externally, to ensure an acceptable resolution for the Customer. AFCS Service Provider’s Managing Director will be appraised of the situation.</td>
</tr>
</tbody>
</table>

Response Times will start to run at the Call Open Time. The AFCS Service Provider Representative may amend any Fault priority by agreement with the Customer. All telephone calls may be recorded or monitored for training purposes.

Should the same Fault re-occur within 48 hours, the original call will be reopened with the same log number and the same Response Time will apply from the time that the call is reopened.

AFCS Service Provider reserve the right to ‘stop the clock’ should a third party AFCS Service Provider be unable for any reason to issue or release pertinent details or information. Any dispute on the accountability of fault shall be escalated to PBMS steering committee and the decision of committee shall be binding to both parties.
11. **Progress recording**

**Mechanism for notification of progress, escalations and resolution**

Appendix below sets out how AFCS Service Provider will notify the Customer Representative about Fault progress, escalation and/or resolution. In the event that the Customer Representative cannot be contacted by one of the methods set out in Appendix below, the AFCS Service Provider Representative shall be entitled to use any other method that it deems appropriate for any such notification.

In respect of any priority one Fault, the Customer Representative will, upon request, be updated with regular progress reports during the Hours of Cover. Such progress reports, where issued, will not be produced more frequently than hourly.

12. **General Assistance**

AFCS Service Provider will aim to provide assistance to the Customer in the resolution of difficult “end-to-end” Faults. This will include incidents where the location of a particular Fault is unclear, and may not eventually lie in AFCS Service Provider’s area of supply. Such incidents may require the active co-operation of AFCS Service Provider, the Customer and third parties, in order to undertake the tests necessary for successful Fault isolation and resolution. AFCS Service Provider reserves the right to charge for time and materials where the Fault does not lie within the Service boundaries described in, Appendix B.

13. **Closing a Fault**

Any Fault will remain open until the Call Close Time is notified to the Customer.

In the event that the Customer reports that a Customer Component remains out of operation after the Call Close Time has been noted, then the Fault will be re-opened.

14. **Guaranteeing a Fault Duration Time**

Although AFCS Service Provider will use its reasonable commercial endeavours to clear any Fault within the shortest possible time, the Customer should be aware that it is impossible for AFCS Service Provider to guarantee any time limits.

15. **Recurring and intermittent faults**

AFCS Service Provider will use its reasonable commercial endeavours to record the cause of all Faults and monitor them to try and isolate recurring or intermittent Faults.

AFCS Service Providers Representative may request certain Fault details from the Customer in order to rectify a recurring or intermittent Fault. The Customer may be asked to record
certain information relating to recurring or intermittent Faults; the Customer must comply
with any such request.

A Fault may be closed by AFCS Service Provider if it is found to be and recorded as “no fault
found” or “right when tested,” even if an investigation is ongoing to isolate a recurring or
intermittent fault.

Chart 1: Escalation

Escalation Procedure Flow Chart

Stage 4

Technical Director

Sales and Marketing Account Manager

Stage 3

Customer Services

Technical Manager

Operations Manager

Stage 2

Implementation Team

Manufacturer/Supplier

Operations Team

Stage 1

Vendor

Technical Helpdesk
### Service Level Acceptance (SLA) Matrix and Proposed Penalty Amount for Default/s

**a) Minimum Service levels to be maintained for AFCS system operations by the AFCS Service Provider.**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Service Parameter</th>
<th>Service Level</th>
<th>Validation</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Management Submission of monthly Project Status reports &amp; Conducting Status meetings</td>
<td>100%</td>
<td>Minutes of Meetings Approval of Status reports by Project in-Charge</td>
<td>2% of monthly CCC charges for every default</td>
</tr>
<tr>
<td>2</td>
<td>Helpdesk Resolution of ticket logged as per the Severity definition chart</td>
<td>99%</td>
<td>Generated from Ticket logging system. Measured monthly.</td>
<td>95%-99% calls resolved in specified time: 2% penalty on the monthly charges 90% - 95% calls resolved in specified time: 5% penalty on the monthly charges Less than 90% will form the basis of liquidity damages and may lead to termination</td>
</tr>
<tr>
<td>3</td>
<td>Installation Should be part of Monthly project status report</td>
<td>95%</td>
<td>Report. Installation is not as per agreed installation plan. Deviation in plan because of delay from the service provider side.</td>
<td>For delay between 7 to 30 days INR 2000 per day per station delay. For more than 30 days delay: will form the basis of liquidity damages and may lead to termination</td>
</tr>
<tr>
<td>4</td>
<td>Asset / Inventory Management Provide monthly MIS Asset Inventory</td>
<td>95%</td>
<td>Report. Inventory not maintained to provide agreed service levels</td>
<td>0.2% of monthly charges</td>
</tr>
<tr>
<td></td>
<td>Conduct Annual Physical Asset</td>
<td>100%</td>
<td>Management approval of Physical Asset Verification</td>
<td>0.5% of Yearly Charges</td>
</tr>
<tr>
<td>Verification</td>
<td>Report</td>
<td>Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>--------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3</strong> AFCS Application</td>
<td>Evaluation of AFCS Service Provider Performance On monthly basis</td>
<td>Low performance – 99% to 99.98% of monthly Operations time Critical Less than 98% of monthly Operations time 1% of monthly charges till 99.9%, 3% of Monthly Charges till 99% and 5% of monthly charges till 98% Less than 98%: will form the basis of liquidity damages and may lead to termination</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>POS offline and other application availability</td>
<td>Status of tickets logged with AFCS Service Providers Low Performance: 08 to 12 days Critical: More than 12 days Per fault 0.071% of monthly charges</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MIS reporting on during Contract Period</td>
<td>Agreed report submission to client as per fixed schedule 0.2% of monthly charges</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4</strong> Desk Side Technical support Services</td>
<td>Resolution of ticket logged as per the Severity definition chart</td>
<td>Reports 1% of monthly charges</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5</strong> Antivirus Management</td>
<td>Rollout of latest anti-virus definition file On workstations and Servers on being made available on</td>
<td>Reports generated from Anti Virus software console 1% of monthly charges</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AFCS Service Provider’s website</td>
<td>LAN &amp; local server administration</td>
<td>Resolution of ticket logged</td>
<td>99%</td>
</tr>
<tr>
<td>---</td>
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<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6</td>
<td>AFCS Service Provider’s website</td>
<td>LAN &amp; local server administration</td>
<td>Resolution of ticket logged</td>
<td>99%</td>
</tr>
<tr>
<td>7</td>
<td>Network Monitoring, Management and Restoring (Connectivity between DC and station, DC and fleet) in a month</td>
<td>Network Monitoring, Management and Restoring (Connectivity between DC and station, DC and fleet) in a month</td>
<td>SP to monitor the availability of the network link for 99% uptime. SI should measure link availability on a monthly basis.</td>
<td>99%</td>
</tr>
<tr>
<td></td>
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<td>----------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td></td>
<td><strong>Resolution of ticket logged related to Networks</strong></td>
<td><strong>99%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><strong>Data Centre Operations</strong></td>
<td><strong>MIS reporting on physical and environmental conditions controls</strong></td>
<td><strong>99%</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Reports generated from Ticket logging system</strong></td>
<td><strong>Report</strong></td>
<td><strong>0.2 % of monthly charges</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MIS reporting of health check-up of all systems &amp; modules installed</strong></td>
<td><strong>95%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Report</strong></td>
<td><strong>0.2 % of monthly charges</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>Server Administration / Management</strong></td>
<td><strong>Rollout of patches (OS, infra level) on Workstations and Servers after patch being approved on test environment</strong></td>
<td><strong>98%</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Patch update report</strong></td>
<td><strong>0.5% of monthly charges</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Uptime of DMZ servers</strong></td>
<td><strong>99.8%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Report</strong></td>
<td><strong>2% of monthly charges for less than 99.8%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2% of monthly charges for less than 99.8%</strong></td>
<td><strong>3% of monthly charges for less than 98%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>3% of monthly charges for less than 98%</strong></td>
<td><strong>5 % of monthly charges for less than 95%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><strong>Database Administration services</strong></td>
<td><strong>MIS report of database scheme, disk space, storage and user role</strong></td>
<td><strong>99%</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Report</strong></td>
<td><strong>0.5% of monthly charges</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## AFCS TECHNICAL SPECIFICATIONS FOR AMRITSAR BRT

<table>
<thead>
<tr>
<th></th>
<th>Backup/ Restore Management</th>
<th>The Service Provider should take backup as per the backup schedule defined</th>
<th>99%</th>
<th>Report</th>
<th>If the negligence is found in monthly audit, the Bidder would be penalized a sum of INR 5,000/- per negligence.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PBMS would periodically (once a quarter on a random day) request the Service Provider to restore the backup data</td>
<td>100%</td>
<td>Report</td>
<td>INR 5000/- for every restore test failure</td>
</tr>
</tbody>
</table>
| 12| Mail / Messaging System     | Uptime of email server                                                      | 99% | Report | 2% of monthly charges for less than 99%  
3% of monthly charges for less than 98%  
5% of monthly charges for less than 95% |
<p>|   |                             | Provide monthly MIS of user account and mailboxes created/delete d.          | 95% | Report | 0.2% of monthly charges                                                                                                                                 |
| 13| Management of PBMS's EMS    | Daily MIS of server and device health checkup (CPU, disk space, Memory utilization, I/O utilization, Central Storage) | 100% | 100% Reports generated from EMS system | 0.5% of monthly charges |</p>
<table>
<thead>
<tr>
<th></th>
<th>Incident management</th>
<th>Resolution of ticket logged in Incident Management tool</th>
<th>99%</th>
<th>Reports generated from Ticket logging system</th>
<th>0.5% of monthly charges</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Problem Management</td>
<td>Service Provider shall analyze all the incidents and provide a root cause report every month if there are more than 10 incidents of the same type. Service Provider shall take the needed corrective action to prevent further issues due to the same cause.</td>
<td>100% timely Submission covering all Incidents logged in that month</td>
<td>Root cause report Incident report stating Problems faced by the users Document detailing Corrective action</td>
<td>5% penalty on the monthly charges of that Project Area, if the Service Provider does not submit a problem report for that month. 5% penalty on the monthly charges of that Project Area, if the Service Provider does not perform the corrective action for more than one calendar month.</td>
</tr>
<tr>
<td>16</td>
<td>Change Management</td>
<td>Resolution of Change Management ticket logged in Change Management tool</td>
<td>99%</td>
<td>Reports generated from Change Management System</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Availability Management</td>
<td>Should be part of Monthly status report</td>
<td>95%</td>
<td>Report</td>
<td>0.2% of monthly charges</td>
</tr>
</tbody>
</table>

(PUNJAB BUS METRO SOCIETY)
### Performance Management

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Module</th>
<th>Measurement</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Performance Management</td>
<td>Should be part of Monthly status report</td>
<td>Report</td>
</tr>
<tr>
<td>19</td>
<td>Capacity management</td>
<td>Should be part of Monthly status report</td>
<td>Report</td>
</tr>
<tr>
<td>20</td>
<td>Security management</td>
<td>Should be part of Monthly status report</td>
<td>Report</td>
</tr>
<tr>
<td>21</td>
<td>Resource management</td>
<td>Number of shift days for which resource present at the designated location / Total number of shift days</td>
<td>Attendance track Call Log Audit calls/ visits Measured on a monthly basis</td>
</tr>
</tbody>
</table>

### Additional Service Levels for critical modules:

<table>
<thead>
<tr>
<th>S.</th>
<th>Module</th>
<th>Service</th>
<th>Measurement</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Resource provided is not as per specified certification / experiences</td>
<td>100% of the Resource given Experience certificate of personnel submitted by Service Provider to PBMS Per day deduction = 0.5 * (Monthly value for that manpower as per SOR) / 30</td>
</tr>
<tr>
<td>No.</td>
<td>Level Description</td>
<td>Duration</td>
<td>Minimum Performance</td>
<td>Critical Breach</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------</td>
<td>-----------</td>
<td>---------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Ticketing Terminals</td>
<td>Daily</td>
<td>99.90% of daily operation time</td>
<td>Less than 99% of daily operations time</td>
</tr>
<tr>
<td></td>
<td>Availability / Up time</td>
<td></td>
<td>99% to 99.90% of daily operations time</td>
<td>INR 200 for per terminal per hour unavailability after 99% of the daily operations time</td>
</tr>
<tr>
<td>2</td>
<td>Ticketing Terminals</td>
<td>Daily</td>
<td>(01/02)</td>
<td>(05/07)</td>
</tr>
<tr>
<td></td>
<td>Replacemen t time of Malfunction (Major (days) / Minor (days)</td>
<td></td>
<td>(03/05)</td>
<td>INR 200 per terminal per day delay till 5th day of Malfunctioning. After 5th day INR 500 per terminal per day delay</td>
</tr>
<tr>
<td>3</td>
<td>Ticketing Terminals</td>
<td>Quarterly</td>
<td>3 to 4 sec</td>
<td>9 to 15 sec</td>
</tr>
<tr>
<td></td>
<td>Ticket Printing Time</td>
<td></td>
<td>5 to 8 sec</td>
<td>INR 300 per terminal per day delay till 15 secs and INR 500 per terminal per day delay after 15 secs</td>
</tr>
<tr>
<td>4</td>
<td>Ticketing Terminals</td>
<td>Daily</td>
<td>4 hrs</td>
<td>Less than 3 hrs</td>
</tr>
<tr>
<td></td>
<td>UPS back up</td>
<td></td>
<td>3 hrs to 4 hrs</td>
<td>INR 700 per hour per UPS delay</td>
</tr>
<tr>
<td>5</td>
<td>Data Centre</td>
<td>Monthly</td>
<td>75%</td>
<td>&gt; 80%</td>
</tr>
<tr>
<td></td>
<td>CPU utilization must not cross beyond % at any time of processing</td>
<td></td>
<td>76% to 80%</td>
<td>More than 80% utilization shall be mutually agreed and any failure of system shall lead agreed penalties</td>
</tr>
</tbody>
</table>
6. **Uptime Calculation for the month:**

\[
\text{Uptime} = \left(\frac{\text{Actual Uptime} + \text{Scheduled Downtime}}{\text{Total No. of Hours in a Month}}\right) \times 100
\]

"Actual Uptime" means, of the Total Hours, the aggregate number of hours in any month during which each equipment is actually available for use.

"Scheduled Downtime" means the aggregate number of hours in any month during which each equipment is down during total Hours, due to preventive maintenance, scheduled maintenance, infrastructure problems or any other situation which is not attributable to Service Provider’s (or Service provider’s) failure to exercise due care in performing Service Provider’s responsibilities.

The PBMS would provide a maximum of 04 hours of planned downtime for the preventive maintenance (as part of scheduled downtime) per month per equipment/service.

The downtime for scheduled maintenance (patch application, upgrades – OS, Database, etc.) would need to be mutually agreed between PBMS and the Bidder. To reduce this time, various maintenance activities can be clubbed together with proper planning.

"Total Hours" means the total hours over the measurement period i.e. one month (24 * number of days in the month).

**Downtime Calculation:**

<table>
<thead>
<tr>
<th>6</th>
<th>Servers uptime</th>
<th>Monthly</th>
<th>100%</th>
<th>99.99%</th>
<th>99.98%</th>
<th>99.9 % &gt; Availability &gt;= 99.5% : INR 1,00,000/- from monthly payment b. 99.5 % &gt; Availability &gt; 98%: INR 1,50,000/- from monthly payment c. Availability &lt; 98%: INR 2,00,000/- from monthly payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Website uptime with all the features</td>
<td>Monthly</td>
<td>99%</td>
<td>99% to 98%</td>
<td>&lt;98%</td>
<td>Below 98% , Penalty INR 500 per incident per hour unavailability</td>
</tr>
</tbody>
</table>

---

**Server Uptime**

Monthly

<table>
<thead>
<tr>
<th></th>
<th>Uptime</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>100%</td>
<td>99.99%</td>
<td>99.98%</td>
<td>99.9 % &gt;</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>7</td>
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</tr>
</tbody>
</table>
The recording of downtime shall commence at the time of registering the call with Service Provider or Service Provider for any downtime situation for the equipment.

Downtime shall end when the problem is rectified and the application/service is available to the user.

Downtime will not be considered for following:

1. Pre-scheduled preventive maintenance and health checks (Scheduled Downtime).

2. Failover time (30 minutes) in case of cluster environment. Beyond which the service would be considered to be not available and appropriate penalty shall be imposed on the Service Provider.

3. Bug in any application which causes the non-availability of the service.

If the PBMS elects to continue the operation of the machine/equipment, when a part of the machine is giving problem and leading to downtime, the commencement of downtime shall be deferred until the PBMS releases the machine/equipment to the Bidder for remedial action.

a) The compliance report shall be submitted monthly, by the AFCS Service Provider.

b) These compliance reports shall be verified by PBMS officials or the nominated representatives of PBMS. Any disputes on the compliance report shall be escalated to a nominee of the senior management of PBMS and the decision of that nominee shall be binding on Both the parties.

c) Elaborate list of SLA shall be furnished to successful bidder at the time of agreement stage.

d) The compliance to the SLA metrics as listed above shall be monitored on the monthly basis.

e) If PBMS finds that AFCS Service Provider has breached any of the SLA Metrics more than three (3) times in a year then PBMS, in its sole discretion, may terminate the Agreement in accordance with the provisions thereof. Such termination of the Agreement shall be without prejudice to any other rights available to PBMS.

f) The compliance report shall be submitted along with the Monthly invoice by the AFCS Service Provider.

g) These compliance reports shall be verified by PBMS officials or the nominated representatives of PBMS. Any disputes on the compliance report shall be escalated to a nominee of the senior management of PBMS and the decision of that nominee shall be binding on Both the parties.

17. **Breach of SLA**

In case the Service Provider does not meet the service levels mentioned in document, for three (3) continuous time-periods as specified in the relevant clause, the PBMS will treat it
as a case of breach of Service Level Agreement. The following steps will be taken in such a case:-

1. PBMS issues a show cause notice to the Service Provider.
2. Service Provider should reply to the notice within three working days.
3. If the PBMS authorities are not satisfied with the reply, the PBMS will initiate termination process.

18. **Exclusions**

The Service Provider will be exempted from any delays or slippages on SLA parameters arising out of following reasons:-

Delay in execution due to delay (in approval, review etc) from PBMS’s side. Any such delays will be notified in written to the IT Team.

The network links if provided by a third party, in that case the Service Provider will monitor and report any problems on behalf of third party. If Service Provider notifies and PBMS approves that the delay or fault was due to the third party link services then such loss will not be considered for tracking Service Provider’s SLA parameters (Also reduced from total service time).

19. **Monitoring and Auditing**

IT Team of PBMS will review the performance of Service Provider against the SLA parameters each month, or at any periodicity defined in the contract document. The review / audit report will form basis of any action relating to imposing penalty or breach of contract. Any such review / audit can be scheduled or unscheduled. The results will be shared with the Service Provider as soon as possible. PBMS reserves the right to appoint a third-party auditor to validate the SLA.

20. **Reporting Procedures**

The Service Provider’s representative will prepare and distribute SLA performance reports in an agreed upon format by the 10th working day of subsequent month of the reporting period. The reports will include “actual versus target” SLA performance, a variance analysis and discussion of appropriate issues or significant events. Performance reports will be distributed to the PBMS’s IT Team.
21. **Issue Management Procedures**

**General**

This process provides an appropriate management structure for the orderly consideration and resolution of business and operational issues in the event that quick consensus is not reached between PBMS and Service Provider. It is expected that this pre-defined process will only be used on an exception basis if issues are not resolved at lower management levels.

**Issue Management Process**

Either PBMS or Service Provider may raise an issue by documenting the business or technical problem, which presents a reasonably objective summary of both points of view and identifies specific points of disagreement with possible solutions.

PBMS and the Service Provider’s representative will determine which committee or executive level should logically be involved in resolution.

A meeting or conference call will be conducted to resolve the issue in a timely manner. The documented issues will be distributed to the participants at least 24 hours prior to the discussion if the issue is not an emergency requiring immediate attention.

Management of PBMS and Service Provider will develop a temporary, if needed, and the permanent solution for the problem at hand. The Service Provider will then communicate the resolution to all interested parties.

22. **SLA Change Control**

**General**

It is acknowledged that this SLA may change as PBMS’s business needs evolve over the course of the contract period. As such, this document also defines the following management procedures:

1. A process for negotiating changes to the SLA.

2. An issue management process for documenting and resolving particularly difficult issues.

3. PBMS and Service Provider management escalation process to be used in the event that an issue is not being resolved in a timely manner.

Any changes to the levels of service provided during the term of this agreement will be requested, documented and negotiated in good faith by both parties. Either party can request a change. Changes will be documented as an addendum to this document and consequently the contract.

**SLA Change Process**
Both the parties may amend this SLA by mutual agreement in accordance. Changes can be proposed by either party. Normally the forum for negotiating SLA changes will be PBMS’s monthly review meetings.

**Version Control**

All negotiated SLA changes will require changing the version control number. As appropriate, minor changes may be accumulated for periodic release (e.g. every quarter) or for release when a critical threshold of change has occurred.

### 23. **Management Escalation Procedures**

The purpose of this escalation process is to provide a quick and orderly method of notifying both parties that an issue is not being successfully resolved at the lowest possible management level. Implementing this procedure ensures that PBMS and Service Provider management are communicating at the appropriate levels. Escalation should take place on an exception basis and only if successful issue resolution cannot be achieved in a reasonable time frame.

1. All issues would be raised to the project management team, which is completely responsible for the day to day aspects of the implementation. The project management team shall classify the issues based on their severity level and resolve them within appropriate timelines.

2. If project management team is unable to resolve an issue, the issue would be escalated to the top management with options/risks detailed for decision. Top management will make decisions based on the options/risks presented by the IT team.

### 24. **Service levels of Fare Gates and Ticketing Terminals**

**System Availability**

The System could be required to be functional round the clock, and the availability of the System should be in excess of 99.50% of the operations time, shall be calculated monthly basis. Any other service level metrics, as might be appropriately required, would be finalized during the contract signing stage.

**Service monitoring**

a) AFCS Service Provider will put in place a monitoring mechanism to monitor all Components AFCS Service Provider through its monitoring System should provide data which is sufficient to allow analysis and reporting of Component performance and Availability to the detail and frequency described in these Conditions.

b) AFCS Service Provider will additionally use data gathered from its monitoring of the Components to inform & take approval from competent authority for its decisions in
respect of any changes to its infrastructure which in its sole discretion, deems necessary to maintain or improve the availability and performance of the services delivered to Authority.

Performance reporting

a) AFCS Service Provider shall record performance and availability of each of the Customer Components and report this information to the Customer. Where periodic account reviews are agreed by both parties to be held between the Customer and AFCS Service Provider, these reports will form an agenda for such reviews. If the Customer Components include access to AFCS Service Provider’s service System, AFCS Service Provider will enable the Customer to view the reports via AFCS Service Provider’s service system.

Complaints procedure

a) If the Customer has any complaints about the way in which AFCS Service Provider support facilities are being managed, the Customer Representative should contact the AFCS Service Provider

General Maintenance Conditions:

a) The maintenance shall include both Preventive Maintenance and Corrective Maintenance.

b) This Service Level Conditions shall cover each and every part/component of the System. The AFCS Service Provider shall examine, clean, lubricate and adjust various Components /parts of the entire System including all parts and components every month and shall take necessary measures to maintain the units in proper working conditions in accordance with the Specifications in the Service Level Conditions.

c) The AFCS Service Provider shall supply and replace any part/components which are discovered to be potentially detrimental to the safety of the user and/or to the efficient and cost effective operation of the units and which require immediate replacement.

d) In case of need to replace any part/component, the AFCS Service Provider shall provide original make genuine parts/components of similar/higher quality.

e) In case of emergencies, the AFCS Service Provider shall respond immediately to take the necessary actions irrespective of the provisions regarding time limit in these SLCs.

f) The AFCS Service Provider shall be liable for any kind of damage to the user of the units caused by poor maintenance, delay in any repair/maintenance works and shall pay for the damage.

g) Repairs may be carried out generally during non-operational hours

Nature of Distress, Remedy Periods and Damages payable for Breach

The AFCS Service Provider shall during both the warranty period and the Operation & Maintenance period attain following standards of remedy for each nature of distress specified for flap gates. In the event of the AFCS Service Provider not being able to deliver the services, damages shall be payable by the AFCS Service Provider against default in service as shown as follows.

For Flap Gates :
## 25. Service Levels of Ticketing Terminals

### System Availability

The System could be required to be functional round the clock, and the availability of the System should be in excess of 99.50% of the operations time, shall be calculated monthly basis. Any other service level metrics, as might be appropriately required, would be finalized during the contract signing stage.

### Service monitoring

c) AFCS Service Provider will put in place a monitoring mechanism to monitor all Components. AFCS Service Provider through its monitoring System should provide data which is sufficient to allow analysis and reporting of Component performance and Availability to the detail and frequency described in these Conditions.

d) AFCS Service Provider will additionally use data gathered from its monitoring of the Components to inform & take approval from competent authority for its decisions in respect of any changes to its infrastructure which in its sole discretion, deems necessary to maintain or improve the availability and performance of the services delivered to
AFCS TECHNICAL SPECIFICATIONS FOR AMRITSAR BRT

Authority.

Performance reporting

b) AFCS Service Provider shall record performance and availability of each of the Customer Components and report this information to the Customer. Where periodic account reviews are agreed by both parties to be held between the Customer and AFCS Service Provider, these reports will form an agenda for such reviews. If the Customer Components include access to AFCS Service Provider’s service System, AFCS Service Provider will enable the Customer to view the reports via AFCS Service Provider’s service system.

Complaints procedure

b) If the Customer has any complaints about the way in which AFCS Service Provider support facilities are being managed, the Customer Representative should contact the AFCS Service Provider.

General Maintenance Conditions:

h) The maintenance shall include both Preventive Maintenance and Corrective Maintenance.

i) This Service Level Conditions shall cover each and every part/component of the System. The AFCS Service Provider shall examine, clean, lubricate and adjust various components/parts of the entire System including all parts and components every month and shall take necessary measures to maintain the units in proper working conditions in accordance with the Specifications in the Service Level Conditions.

j) The AFCS Service Provider shall supply and replace any part/components which are discovered to be potentially detrimental to the safety of the user and/or to the efficient and cost effective operation of the units and which require immediate replacement.

k) In case of need to replace any part/component, the AFCS Service Provider shall provide original make genuine parts/components of similar/higher quality.

l) In case of emergencies, the AFCS Service Provider shall respond immediately to take the necessary actions irrespective of the provisions regarding time limit in these SLCs.

m) The AFCS Service Provider shall be liable for any kind of damage to the user of the units caused by poor maintenance, delay in any repair/maintenance works and shall pay for the damage.

n) Repairs may be carried out generally during non-operational hours.

Nature of Distress, Remedy Periods and Damages payable for Breach

The AFCS Service Provider shall during both the warranty period and the Operation & Maintenance period attain following standards of remedy for each nature of distress specified for flap gates. In the event of the AFCS Service Provider not being able to deliver the services, damages shall be payable by the AFCS Service Provider against default in service as shown as follows.

<table>
<thead>
<tr>
<th>Nature of Distress</th>
<th>Maximum Turnaround / Remedy period (hours) allowed per incident</th>
<th>Damages payable for delay in restoring operations beyond remedy period.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations not possible/ jammed</td>
<td>2</td>
<td>0.02% of the value of the unit/s* not remedied per every hour of delay.</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Reader sensing issues</td>
<td>2</td>
<td>0.02% of the value of the unit/s* not remedied per every hour of delay.</td>
</tr>
<tr>
<td>Performance below capacity in terms of number of people being able to pass per minute</td>
<td>2</td>
<td>0.04% of the value of the unit/s* not remedied per every hour of delay.</td>
</tr>
<tr>
<td>Any other</td>
<td>To be specified by the AFCS Service Provider at the time of call login.</td>
<td>0.01% of the value of the unit/s* not remedied per every hour of delay.</td>
</tr>
</tbody>
</table>

*For the purposes, the value of the unit shall be the billed value of the unit.

In addition to the above, for any non-availability of the System below 99% of total operations time in hours, damages shall be recoverable separately on a pro rata basis per every hour of non-operations below 99%.

### 26. Training Requirements

Training is an important activity for the successful implementation of Work. To make the Work a success, the following training programs shall be arranged by the AFCS Service Provider from time to time depending on the requirement and understanding of the service centre operators, participating users, etc. For all these training programs, AFCS Service Provider shall provide adequate course material documents. The following are the trainings to be imparted by the AFCS Service Provider:

- **AFCS Service Provider** shall impart training to Authority nominated trainer staff, so that they are aware of the operations of the solution and further impart training to the relevant staff of Authority ensuring smooth running of System at the selected sites.

- **AFCS Service Provider** shall also be responsible for re-training the Authority nominated trainers staff whenever changes are made in the System and it shall be the responsibility of the AFCS Service Provider to ensure that the operators are familiar with new versions of system and its allied services.