



## Editorial Message

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*Dear Reader,*

As India's urban population is expected to grow 40% higher by 2030, the demand for more efficient and future-proof mass public transport is likely to gain momentum.

While the need for Metro Railway was felt long ago, it took 22 years for the first Kolkata Metro to roll out for 17 km with a 14 times cost increase. However, taking lessons from the Kolkata Metro, the Delhi Metro Rail Corporation (DMRC) completed the 65.1 km, Phase 1 in a record time of 7 years & 3 months. The second phase of Delhi Metro was also commissioned well before Jan 2011.

Considering that Metro Railway is a fast, efficient and cost effective mode of travel, many new projects have been taken up in Gurgaon, Mumbai, Bengaluru, Hyderabad, Chennai, Jaipur, and Kochi while proposals are being drawn up for MRTS systems in Pune, Chandigarh, Ahmedabad, Kanpur, Ludhiana, Bhopal, Indore and Faridabad.

About Rs. 3 trillion has been committed for setting up or expanding Metro Rail and Monorail systems in 20 cities. This will bring diverse business opportunities in Rolling stock, Power Supply System, Signaling & Telecom, Automatic Fare Collection, Building Management System and other facility-related requirements.

In the direction of meeting Metro Railway's technology needs, L&T-C&A offers two solutions -- Integrated Automatic Fare Collection system and Integrated Building Management System.

Today, the public transportation systems such as Metro and Railways handle large numbers of passengers. Ticketing and fare collection play a vital role in the efficient operation of the system. The AFC system should be simple, easy to operate and maintain.

Metro facilities are equipped with a wide range of systems for monitoring and control like HVAC, Lighting, PHE, Fire-fighting, Access Control, Power Management and Lifts/Escalators. The integration of these systems is critical to improving operations, lowering costs, and achieving the security and comfort demanded in today's dynamic business environments.

Various technology alternatives such as Web Ticketing and Plastic cards are being used for ticketing in mass transit systems. Near Field Communication (NFC) is a currently emerging and yet promising area which will definitely impact the Metro System ticketing operations as NFC would be shortly available on major smart phones - this is detailed out in the 'Industry Trend' section.

In the 'What's New', we have shared highlights of our AFC system and IBMS. Do read our offering section for a better insight.

Under 'Case Study' section, we have featured the Mumbai Monorail Project where L&T-C&A has supplied the Automatic Fare collection system.

Looking forward to your feedback.

*Happy Reading !*



*Sandeep Bhat*



## *NFC Technology to transform Transport sector*

For many years, public transport operators have been using paper-based tickets. In the early 2000, smart card-based solutions were adopted for ticketing application because most of the IT systems were off-line and what was needed was a portable electronic ticket that could be authenticated off-line, be secure and not be easily replicated. Undoubtedly, the smart card was the solution at that time but had its own limitation of being transferable and requiring high investment.

Increase in demand for open payment solutions, need for virtually limitless fare policy/structure implementation and increase in the life cycle costs of contactless smart cards are driving the transit operators to focus on other cutting edge and patron-friendly technologies in the arena of Automatic Fare Collection (AFC) system. Near Field Communication (NFC) is one of the emerging communication technologies in this direction.

NFC enables electronic devices, including mobile phones and payment terminals, to communicate with one another for payment and other related transactions. The technology is simple; it is a short-range, low power wireless link evolved from RFID technology that can transfer data between two devices a few centimeters from each other. Its built-in security makes NFC an apt

choice for mobile payments, thus gaining prominence in the smart phones.

The smart phones are increasingly being equipped with NFC capabilities which can be used in contactless payment systems. This can replace the currently used Mag stripe cards, Chip cards, RFID-based cards, Paper tickets, etc.

For long, fare collection in public transport systems have been based on paper ticketing which comes with its inherent drawbacks like non-environment friendliness, patron inconvenience, and revenue loss due to no patron gating and inconvenience of cash handling.

To overcome such challenges, the combination of NFC with mobile

***NFC (Near-Field Communication) technology allows a sustainable business case for operators in public transport—taking customer convenience to the next level.***



connectivity enables an array of new digital services in the areas of ticketing system, payment systems and access control.

**How it works..**

Before the start of journey, a patron can check the fares online, buy ticket, reserve seat, pay for parking and download ticket to phone. Once the patron reaches the station, s/he can tap the phone on NFC terminal at the gate to park the vehicle. To start the journey, a patron can tap the phone on NFC terminal, redeem ticket and board the train. At the end of journey, patron simply taps the phone at the exit gate.

NFC-enabled phone can hold multiple payments applications, allowing traveller to select the method of payment such as Credit, Debit, Travel pass, Pre-paid tickets etc. This also facilitates payment in multi-modal transportation scenario enabling the patron to pay in Metro or Bus or any other transportation system available without the inconvenience of cash handling or long queues.

Operators are also benefitted with minimal investment on cards and tokens, unique identification of patrons, lesser staff for operation and cash handling.

**Benefits to all industry players and transport passengers**

- Fast, accurate and transparent ticket validation
- Greater passenger satisfaction – Ability to buy tickets via mobile & avoiding queue
- Lower investment by Operators for Cards and Tokens
- Lower Sales & Distribution and O&M costs
- Cross Promotion possibilities
- Supports Multi-modal transportation
- Environmental Friendly

Today, mobile phone manufactures, mobile networks operators, financial institutions like banks, information technology firms and automation companies are engaged in increasing their share of the pie. Also, pilot projects are being implemented in the transportation sector in Germany, UK, Italy, France, Spain and Japan. In general, they have demonstrated that the technology works in a public transportation environment.

A well-implemented mobile NFC solution could offer a compelling experience that will encourage patrons for greater use of public transport.



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## L&T-C&A offers comprehensive automation solution for Metro Rail infrastructure



The Government of India is investing heavily in Metro Railway infrastructure development with the plan of expanding metro network in cities with a population of over 2 million. Even Chandigarh, Ludhiana and Bhopal, with a population of less than 2 million, are making a case. The Indian urban transport system needs improved connectivity, easy access to the city's metropolitan areas, reduction in man-hour loss while travelling and cut down fuel consumption to reduce pollution levels.

With the need of handling city passengers efficiently while providing comfort and safety, Metro operators require to overcome the challenges in legacy systems in the area of revenue accounting arising out of fraudulent acts by passengers and some staff in different areas of operation.

To address these concerns, the operators are investing in advanced technologies like Automatic Fare Collection (AFC) system where patrons are gated. It comprises Automatic Gates, Ticket Vending Machines, Ticket Readers, Ticket Office Machines, Smart Cards & Tokens and Station & Central Computers.

### Integrated Automatic Fare Collection

Integrated Automatic Fare Collection system takes care of the complexities and challenges of this business requirement. The solution covers:

#### The solution covers..

- The Basic Design & Detail Engineering includes
  - Functional Design & Technical Specification
  - System Architecture
  - Calculation of RAMS (Reliability, Availability, Maintainability & Safety)
  - Formation of Business Rules

- Card & Token Layout Design
- Functional & Operation Philosophy
- FMEA (Failure Mode Effect Analysis)
- Equipment Layout at Station & Depot
- Local Sourcing & Manufacturing – Automatic Gates, Ticket Vending Machines, Ticket Office Machines, Ticket Readers, Portable Ticket Decoders, Station Computer Systems, Central Computer System
- Quality Assurance, Verification & Validation
- Integrated Factory Acceptance Test
- Installation, Testing & Commissioning and Life Cycle Support

#### Building Management System:

In order to establish a safe and reliable Metro system operation, it is important to control and monitor parameters related to facility management in the individual subsystems located at Depots, OCC, Stations and Administration Building. This involves control and monitoring of subsystems like HVAC, Lighting, PHE, Access Control, Surveillance, UPS, Lifts/Elevators and Fire fighting system, thereby providing energy saving and safety for Passengers and operating staff.

#### The solution covers..

- Integrated Building Management Software.
- PLC based Control System (preferred over DDC) to meet rugged requirements of
  - Vibration/shock
  - EMI, EMC and
  - Temperature
- Control Panels
- Instrumentation including
  - Temperature & Humidity Sensors
  - Pressure Sensors
  - CO2 Sensors
  - Seismic Sensors
  - Wind Speed & Direction Sensor
  - Level Switches & Transmitters
  - Flow Switches & Meters
- Electrical Panel Transducers
- Electrical Power Distribution System
- Asset Management
- IT Networking
- Life cycle Services including system upgrades and long term AMC contract



# Comprehensive Automation Solution for Mumbai Monorail



February 2, 2014, ushered in an era of world-class travel for Mumbai's commuters with Phase I of Mumbai Monorail being thrown open to the public, after it was inaugurated by Maharashtra Chief Minister Prithviraj Chavan the previous day. It enjoys the distinction of being the first monorail project in independent India since the Kudal Valley Railway and Patiala State Monorail Train ways were closed in the late 1920s.

Handling patrons efficiently while providing comfort and safety, the Metro operators today require to overcome the challenges faced in legacy systems in the area of revenue accounting arising out of fraudulent acts by passengers and some staff in different areas of operation. The Mumbai Monorail has addressed these challenges by implementing the Automatic Fare Collection (AFC) system supplied by L&T-C&A.

Considering the implementation challenges at Monorail project, the execution was planned in 2 phases. While Phase-I connects Chembur with Wadala which includes 7 stations and a depot, the Phase-II connects Wadala with Gadge Maharaj Chowk which includes the remaining 10 stations.

The monorail system along Chembur-Wadala and Wadala-Sant. Gadge Maharaj Chowk corridors has been designed for a ridership of 6000 and 10500 PHPDT in the year 2041 respectively.

### **Need & Objectives of AFC:**

- Prevent revenue leakage
- Flexibility for implementation of fare schemes
- O&M convenience

- Customer convenience
- Flexibility for Implementation of inter-modal transportation in future

### **Project Scope:**

The project's scope included design, supply, installation & commissioning and maintenance support of the AFC system comprising:

- Supply of Automatic Gates, Ticket Vending Machines, Ticket Readers, Portable Ticket Decoders, Station & Central Servers and clients machines and
- Services like identification & implementation of Business Rules, Fare Media Layouts, MMI finalization, System Availability and provision for future Interoperability; Interface co-ordination with third party systems; Quality Assurance comprising Software Verification & Validation and IP testing of equipment like TVM & TRs, Testing including FAT at vendor's works, Integrated FAT, Partial Acceptance Test (PAT) at Station for Station level equipment and Site Acceptance Test (SAT) with Operation Control Centre (OCC) integrating all stations.

In line with the design requirements, each typical station is equipped with minimum 8 numbers of Automatic Gates (AG), 2 numbers of Ticket Office Machine (TOM), 1 Ticket Vending Machine (TVM), 2 numbers of Ticket Readers (TR), 1 Station Computer System and 3 numbers of Portable Ticket Decoders (PTD) which are monitored and controlled by a Central Computer System at the Wadala Depot.

The ticketing solution is implemented with two-tier architecture design with an in-built capability of station hardware like AGs and TRs communicating directly with Central Server in the event of Station Server failure. Contactless smart cards and tokens are used as ticket instruments. The same can be bought manually from Ticket Office or TVM.

Tokens are meant to be used for single trip/journey and return trips for occasional users whereas Cards can be used by regular patrons for various options like:

- Electronic/Stored Value Purse (e-Purse)
- Trip Pass (with the options like 10/30/50, etc)
- Tourist Pass
- Period Pass (i.e. Weekly, Monthly Pass, etc)
- Holiday Pass

The proposed system comprises the following key sub-systems:

- **Automatic Gates:** Controlled patron passages located at each station in the form of arrays, which will separate the Paid and Unpaid areas at station concourse level. These gate arrays include the following types:
  - o Entry Gate
  - o Exit Gate
  - o Reversible Gate and
  - o Wide Reversible/Luggage Gate
- **Ticket Vending Machines** designed for the issuance of Token(s) and reload Smart Card.
- **Ticket Office Machines:** Manual ticketing counters, featured with issuance of Token(s) & Smart Card, Reload, Refund, Cancel and Gate Rejection Analysis operations.

- **Ticket Readers:** Remaining value check terminals located both, in paid and unpaid areas, to help patrons to know about the existing value and validity of Fare Media.
- **Portable Ticket Decoders:** Handheld terminals used by the roving ticket checkers. It can also be used as secondary Ticket Office Machines to handle the increasing traffic at stations during peak hours.
- **Station Computer Systems:** Located at each station to control and monitor the respective station level equipment and also act as a bridge between Central Computer and Station Level Equipment.
- **Central Computer System:** Located at Depot premises and is featured with Administrative, Control and Monitoring functions.

**System Features**

- Direct communication between Station Level Equipment and Central System in the event of station server failure
- In-built feature to depict acceptable bank note and coins to the patrons for the ongoing transaction in TVM.
- Planning and optimization of O&M services
- Flexible pricing schemes via Fare Tables
- RFID based counterfeit prevention
- Real Time Monitoring and Audit trail

**Benefits:**

- Prevents Revenue leakage
- Improves operational efficiency
- Increases customer convenience
- Enhances safety
- Upgrade capable to handle multi-modal transport and common mobility

**System Architecture**





# L&T-C&A bags Integrated Building Management System order for Hyderabad Metro

Control & Automation Business Unit (C&A) has been awarded a contract for Integrated Building Management system for the prestigious Hyderabad Metro Rail Project.

The Hyderabad Metro Rail Project is the World's Largest Public-Private Partnership Project (PPP) in the Metro Sector, being executed in a Design-Build-Finance-Operate-and-Transfer (DBFOT) basis by L&T.

The Hyderabad Metro Rail Project will include 61 ultra-modern stations with state-of-art depots and complete infrastructure to ensure seamless and comfortable travel between existing railway station, suburban railways network and bus station.

The scope includes design, supply, installation, testing, commissioning & Life cycle support of the Integrated Building

Management System (IBMS) for Elevated stations, OCC, BCC, Administrative Building and Depots to be executed in six (6) stages with the first nine (9) stations and Administration Building, OCC, BCC and Uppal Depot constructed in Stage 1.

The IBMS integrates Ventilation and Air-Conditioning Control Systems, Low Voltage Power & Distribution, Fire Alarm and Protection System, Hydraulic System (Sewage, Bore Well Pumps, storage tanks, etc.), Escalators (in Stations only) & Lifts that facilitates control, monitoring, and supervision of entire operation.

L&T-C&A is responsible for Project Management, Design, Engineering, Execution, Supply, Quality Assurance & integration with associated systems. In addition the Life Cycle support would also be provided by L&T-C&A.

