# Standardisation/Indigenisation of Rolling Stock for LRT Metro Systems in India

03/11/2018

**L.NARSIM PRASAD**

**DIRECTOR – SYSTEMS & OPERATIONS**

**CHENNAI METRO RAIL LIMITED**

# Presentation

- **Introduction**
- **Key Objectives**
- **Standardization**
  - **Standardization for LRT systems**
  - **Specification of Civil structure**
  - **Specification of Rolling stock**
    - Specifications of Rolling Stock
    - Emergency Evacuation System
    - Train performance parameters
    - Coupling arrangement
    - Maintenance depot facility
    - Fire protection system in Metro Trains
    - Warranty clauses and maintenance
    - Service life and mid-life refurbishment
    - HVAC capacity
    - Train accessibility standards
  - **Specifications of Traction systems**
  - **Specifications of S&T systems**
  - **Specifications of AFC systems**
- **Indigenisation**

# Introduction

- Standardisation and Indigenisation of Light Metro for Tier 2 and Tier 3 cities in India is a relevant and currently important subject, which is taken up by the Ministry of Housing and Urban Affairs (MoHUA). With 20 or more Metros planning their launch all over India in a very short period of time, standardised specification will enable fast delivery of the project resulting into cost advantages.

- Reduction of construction cost by assessing and optimising the required space for structures of station buildings and alignment is to be planned.

- Additionally, reduction in the project execution period will result into early revenue generation and lower interest cost on investment

# KEY OBJECTIVES

- Identify the key issues of the present practice of procurement of Rolling stock and other systems by Metro Railways in LRT metros.
- Establish values and determine best practices to be followed as a standard practice in the future procurements by Metro Railways in LRT metros
- Prepare guidelines covering the major aspects, to be followed by Metro Railways for future procurement of systems in LRT metros

# STANDARDIZATION FOR LRT SYSTEM

- LRT system can also be named as Metro Grade-3 and would be applicable for Tier-2 and Tier-3 cities in India as well as for feeder routes in Tier-1 cities.

- Essentially, the objective would be to undertake Metro 3 projects at a lower civil cost which is possible by largely going in ***"AT GRADE".*** The cost per kilometer ***"AT GRADE"*** would be 1/3$^{rd}$ to 1/2$^{nd}$ of Elevated and 1/10$^{th}$ of Underground in CAPEX.

- Operationally also ***"AT GRADE"*** would give considerable benefit over Underground.

# STANDARDIZATION FOR LRT SYSTEM

# STANDARDIZATION FOR LRT SYSTEM

- The road width occupied by a LRT (Metro Grade-3) system *"AT GRADE"* for both up and down lines is 9 m (3.4 + 3.4 + 1.12 + 1.12)

- In case the road width does not permit, one line only can be provided on a particular road and the other line can be provided on a parallel road also.

- It was also noticed by the Committee in a few cities, the entire road was closed for road transport and only LRT (Metro Grade-3) rolling stock on wheels was operated with pedestrian plazas.

# SPECIFICATIONS OF CIVIL STRUCTURE

# ELEVATED STATION

- Road space occupied at the median shall be in maximum 2.2 m
- Platform width of 1.12 m shall be proposed on either side (NFPA 101)
- Access to the FOB could be planned with one entry/exits on the road
- A portion of the same FOB shall be used for road crossing for general public through unpaid area
- Concept of Concourse can be avoided and the Platform area to be used for paid and unpaid area. Station will be at single level at platform with a FOB at below the rail level.
- Conceptual layout of the elevated station is attached with Annexure 1

# ELEVATED STATION

- Station roof can be optimized to only platform area for one coach length instead of providing to the entire station area.
- Station area can be planned with more lighting and ventilation instead of heavy structures
- AFC gates shall be installed on the platform level separating the paid area with unpaid area

# AT-GRADE STATION

- The LRT system shall have a dedicated path
- As far as possible, At-Grade alignment to be planned to bring down the civil cost.
- Road space occupied shall be about 7 m on centre of the road (Except stations)
- Road space occupied shall be about 9 m on centre of the road including median (At stations) -

- Platform width of 1.12 m (NFPA -101) shall be proposed on either side of the track
- Conceptual layout of the At-grade station is attached with Annexure- 2

# AT-GRADE STATION

- Station roof can be optimized to only platform area instead of providing to the entire station area.
- AFC gates shall be installed on the platform itself separating the paid area with unpaid area
- Zebra crossings shall be provided on either side of the platforms for passenger movement from the side foot paths

# AT-GRADE STATION

# AT-GRADE STATION

# Track

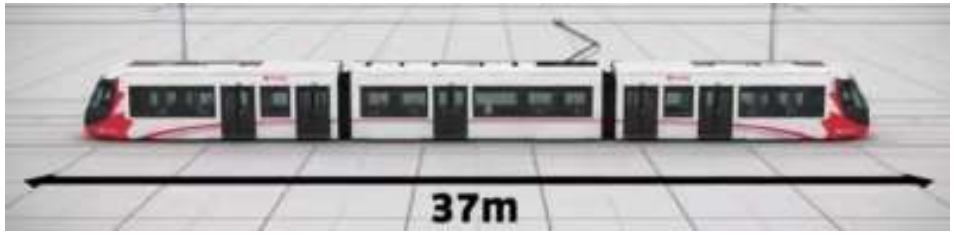
- Ballast-less track for elevated sections and embedded track on road for At-grade sections

# SPECIFICATIONS OF ROLLING STOCK

# SPECIFICATIONS OF ROLLING STOCK

- (Type 3): LRT Metro with maximum 12T axle load is normally adopted for passenger PHPDT capacity from 2,000 to 15,000.

- Unit shall consist of three non-separable coaches with low floor height of about 300-350 mm. Unit length shall be of minimum 37 m.




- The train configuration will be multiples of the above mentioned units. Number of units of train may be decided by the Metro Railway authority.

# SPECIFICATIONS OF ROLLING STOCK


# SPECIFICATIONS OF ROLLING STOCK

- Rail Gauge to be adopted is standard gauge of 1435 mm width.
- Train shall be capable of carrying full load passengers at a gradient of up-to 6 %.
- Passenger loading up-to 300 for 3 coach train unit. @ AW3 loading conditions
- Train capable of travelling in elevated, at grade and tunnel sections

# SPECIFICATIONS OF ROLLING STOCK

# SPECIFICATIONS OF ROLLING STOCK

- The Traction system shall be 750 V DC Over-head catenary system. Catenary free technology may also be opted in short stretches where ever absolutely needed

- The Metros authority may opt for the optimum number of units for the train formation (i.e. single unit or 2 units or 3 units in line with the civil structure/platform capacity from the first stage itself) to avoid interface issues on account of conversion at later stages and cost escalation due to additional scope changes.

- The track curves of radius normally up-to 25 m is adopted is such Metros. Hence, the car body width of 2.65 m is to be adopted as the standard dimension.

# Emergency Evacuation System

- The type of evacuation for units of 3 coaches and its multiples is **front/end evacuation.**

# Train performance parameters

- Motorisation:
  - Minimum 75 % motorized axles for the unit of 3 non-separable coaches with four bogies.
- Maximum speed:
  - Max. Operating speed is standardised to be 80 Kmph.

# Coupling arrangement

- Coupling between coach to coach is of articulated coupling
- The coupler at the end of train (for coupling train to train) - Semi-automatic coupler without electrical coupling

# Maintenance / Depot facility:

- Maintenance/Depot facility should have full train length / 3 coaches or 6 coaches or 9 coaches lifting facility with Synchronized jacks.

# Fire protection system in Metro Trains

- One fire extinguisher per coach need to be provided in the saloon area. One fire extinguisher per cab is to be provided.
- All materials used for construction of Metro car shall comply with International standards EN 45545 on fire & smoke.
- Fresh air intake to the saloon area of the car shall have smoke detection system to prevent entry of external smoke into the saloon area.

# Warranty clauses and Maintenance

- Maintenance with involvement of suppliers is an option which may be exercised by the Metro Railway concerned as an option especially in case of small metro.

- If opted for, maintenance contract to be made as part of the base contract a period of 5 to 7 years

# Service life and mid-life refurbishment

- The service life of the complete train is specified as 35 years.
- The mid-life refurbishment period shall be specified and obtained as part of the basic train data from the tenderers.

# HVAC capacities

- The Option is left to the concerned metros to be exercised as the environment conditions varies and also fluctuates widely over various cities of India.

- Coefficient of Performance should be at-least 2.5.

# Train accessibility standards

- All the regulations as per “The persons with disabilities [equal opportunities, protection of rights and full participation] Act, 1995” shall be followed for the train construction and features.

# SPECIFICATIONS OF TRACTION SYSTEM:

- Traction system shall be 750 V DC Over-head catenary system.
- Catenary free technology may also be opted in short stretches where ever absolutely needed

# SPECIFICATIONS OF S&T SYSTEMS:

- **Signaling:**
  - LRT metro System having exclusive Right of Way shall require full complement of Signalling & Train Control (Continuous ATC (GOA2), ATS & Interlocking's) primarily because of
    - Derailment prevention due to Over Speeding, especially when it is an Elevated and At Grade Section.
    - When more than one Train is required to run in one Section due to better Headway requirements/Congestion.

# SPECIFICATIONS OF S&T SYSTEMS:

- **Signaling:**
  - CBTC shall be the technology to achieve the Signalling & Train Control.
  - The CBTC medium shall provide additional medium for Train to OCC Rolling Stock Information transmission.
  - CBTC shall allow minimising of way side cabling requirements.

# SPECIFICATIONS OF S&T SYSTEMS:

- To reduce the cost of CBTC implementation, the following is suggested:
  - Instead of having Distributed Interlocking's at various Stations, go for Centralised Interlocking at OCC with Object Controllers at Point/Crossing Stations.
  - Reduce the number of On-Board ATP by having a Single Unit for the whole Train.

# SPECIFICATIONS OF S&T SYSTEMS:

- In case, the Metro needs to run through a Level Crossing Gate with Road Traffic, then the Metro Signalling System shall need to **interface with Road Traffic System** to provide safe interlocking and manage priority of Metro Traffic.

# SPECIFICATIONS OF S&T SYSTEMS:

- **Telecom:**
  - LRT metro type 3 uses CCTV cameras in platforms and train communication through Tetra radio.

# SPECIFICATIONS Of AFC SYSTEMS:

**AFC:**

- AFC gates are proposed at the platform level itself for segregating the paid and un-paid areas.
- Requirement of Excess fare office, Customer care center, X-ray baggage scanner and DFMD and space needed for their installation needs to be studied
- Capacity of the platform needs to be studied with respect to Headway, Ridership and Number of gates in view of possibility of congestion

# INDIGENISATION

- For larger quantities (ex. More than 100 coaches), the concerned metros may look at the possibility of stipulating local manufacturing of coaches and sourcing of certain components to the extent possible.

# Thank you