Chennai Metro ARE02A Project
Procurement Technical Specification
of Dual Mode Detrainment Door System

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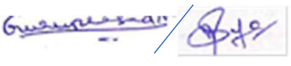
Checked By	Guruprasad N.C. / Saranya V	09.05.2025	
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1. Introduction

1.1. General

1) This Procurement Technical specification (PTS) specifies the technical requirements of Dual Mode Detrainment Door System to be supplied for cars under Chennai Metro Phase 2 ARE02A Project to Chennai Metro Rail Limited (herein after CMRL).
2) The Dual Mode Detrainment Door System shall comply in all respects with CMRL Employer's Requirements Technical Specification (ERTS-RS).
3) BEML will carry out all required works and activities as Contractor to the Employer for Chennai Metro ARE02A project, while the subcontractor shall be responsible for all works required in this PTS with regard to Dual Mode Detrainment Door System and shall be responsible for supporting the BEML activities as contractor for Chennai Metro ARE02A project.
4) The scope of work covers design, development, testing, manufacture, supply, commissioning and integrated testing of the Dual Mode Detrainment Door System suitable for UTO confirming to GoA4 as specified in IEC 62290-(1,2&3) & IEC 62267 and the training of Operation and Maintenance personnel of the CMRL on the Dual Mode Detrainment Door System as per ERTS-RS. The OEM is required to support for CMC as per the scope mentioned in the document.
5) The scope of work includes all items of work which may be required to meet the performance requirements, trouble free, reliable and efficient operation of trains and meeting the best international practices even if not specifically mentioned in this PTS. The trains have to be operated on three lines/corridors (Corridor 3, Corridor 4, Corridor 5) as per ERTS-RS 1.3.1. Based on operational requirement, rakes may have to be operated in GoA2 mode with driver / in GoA3 mode with attendant / in GoA4 (UTO). However, the Phase 2 project is planned with operations in GoA4 (UTO) from the initial passenger service inauguration itself as per ERTS-RS 1.4.3.

1.2. Train Configuration & Dual Mode Detrainment Door System Arrangement

1.2.1. Train Composition

a) The rake configuration is as follows.

3 Car Trainset:

DMC + TC + DMC

b) Operation of Trainsets that are formed of 6-cars shall be achievable through two (2) possible configuration options:
   i. The future provision of a single Consist trainset comprised of the following rake configuration *DMC + TC + MC + MC + TC + DMC* (67% traction power)
   ii. Multi-Consist trainset comprising of two (2) coupled 3-car consists having configuration *DMC +TC + DMC* *DMC + TC + DMC* (67% traction power)

Where,

* Fully Automatic Coupler (with electrical head)

\+ Semi permanent coupler

DMC : Driving Motor Car

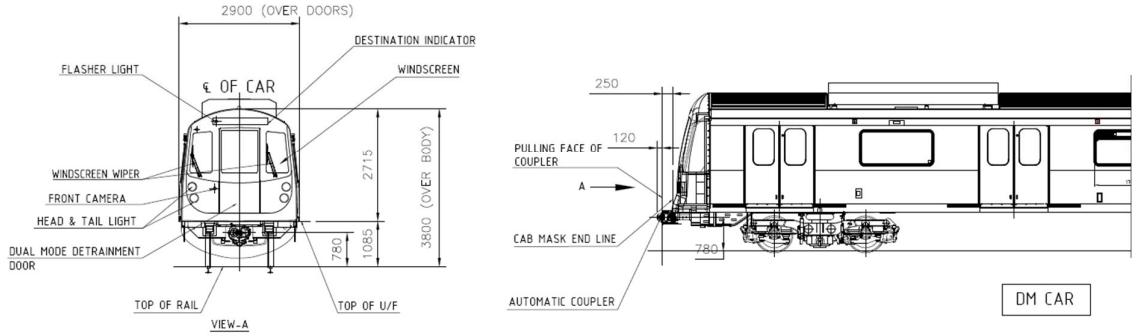
MC : Motor Car

TC : Trailer Car with Pantograph

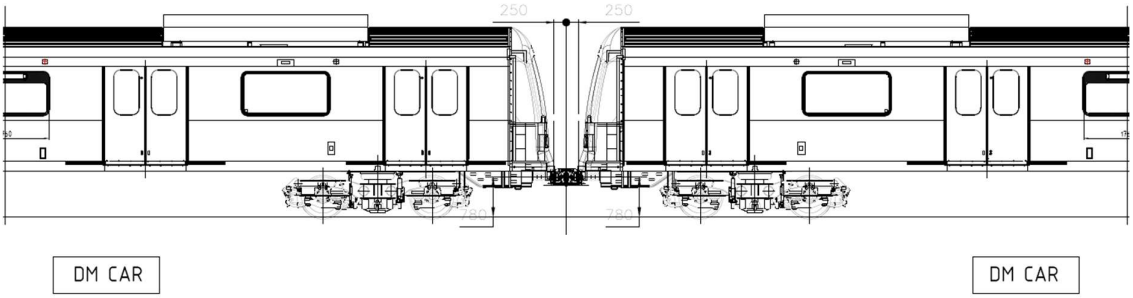
c) All DMC and TC supplied under this contract shall be totally interchangeable with all other DMC and TC respectively, supplied under this contract, without modification.

d) As per ERTS 2.2.31, Hardware of Dual Mode Detrainment Door System shall be automatically reconfigure as required whenever a coupling or decoupling command is initiated by OCC or the Train Operator.

1.2.2. Dual Mode Detrainment Door System Arrangement



DM Car Arrangement



Multi-Consist DM car + DM car

1.3. Car Weights

Approximate car weights are given in the below table:

	DMC	TC
AW0	39654.9 kg	39985 kg

AW1	39720 kg	40050 kg
AW2	51679.9 kg	52595 kg
AW3	56229.9 kg	57275 kg
AW4	60779.9 kg	62020 kg
Axle Load	16,000 kg	16,000 kg
Car Configuration	DMC-TC- DMC	

AW4: (8 passengers/m^2 plus AW1) with Average weight of each passenger estimated as 65 kg as per ERTS-RS clause 2.12.

Tare weights indicated above table are subjected to change by $\pm$ 2%, subcontractor shall accommodate the weight changes accordingly in the design and development of Dual Mode Detrainment Door System.

1.4. Environmental Conditions

The proposed system shall meet the climatic and environmental conditions as set out in ERTS-RS clause 2.11.

Environmental conditions for the on-board equipment shall conform to EN 50125-1. The rake shall be capable of being operated, stored, and maintained at specified performance levels within the environmental conditions of the Chennai area as shown in Table below. Following points are listed for reference as a minimum.

Condition	Maximum	Minimum
Climate	Tropical Wet, Dry, and humid	
Ambient temperature	45 °C	16 °C
Monsoons	October through December	
Rainfall	1333 mm average annual. (Very heavy/continuous with heavy lightning discharges).	
Relative humidity	100 % saturation during rainy season which may be as long as 3 ~ 4 months. Other times, 82 % humidity.	
Atmosphere during hot season	Extremely dusty	
Maximum wind speed	130 kmph	

SO2 level in atmosphere	5 ~ 40 micro g/m^3
NOx level in atmosphere	10 ~ 40 micro g/m^3
Respiratory Suspended Particles Matter in atmosphere (RSPM)	45 ~ 100 micro g/m^3
Total Suspended Particles Matter in atmosphere (TSPM)	150 ~ 320 micro g/m^3
Altitude	Sea Level
Conditions in stations	All underground stations will be A/C. Above ground stations will have A/C for certain designated rooms only.

Note:

1. The temperature of stationary rake exposed to sun for long periods may go as high as 70°C. The equipment shall not be adversely affected in any way due to exposure to such high temperatures.
2. As the Chennai Metro lines will have elevated and underground portions, there may be sudden change in the ambient temperature to rolling stock. The equipment shall be designed to take care of such thermal shocks.
3. The Rolling Stock must be able to operate regardless of the external conditions. They must also be so designed as to avoid abnormal wear due to adverse weather. They can be parked outdoors regardless of the atmospheric conditions.
4. The rakes shall be continuously exposed to highly corrosive, salty atmosphere along with industrial pollutants.
5. The equipment mounted on the under-frame shall be designed to permit propulsion of the train at 10 km/h through water up to a depth of 75 mm above rail level (with maximum allowable wheel and rail wear). Equipment shall be made splash proof in accordance with International Standards.
6. With maximum allowable wheel and rail wear, the rake must be able to operate successfully under the above conditions with no entry of moisture or other contaminants into any compartment, component, or device that could cause equipment on the rake to malfunction or be damaged; that could increase maintenance requirements; or that could cause premature wear or failure.
7. The Water used in Chennai for washing is likely to have a high level of dissolved matter which may aid corrosion.
8. Tunnel walls may be wet and seepage water will normally be present in the invert. Dual Mode Detrainment Door System supplied must therefore be capable of withstanding the effects of seepage (if any) and continue to operate in such wet, humid & flood conditions.

1.5. Vehicle Performance Requirements

The proposed system shall meet the vehicle performance requirements as set out in ERTS-RS clause 2.14. Following details are listed for reference only as a minimum.

Item	Values
Maximum permissive design speed of the train	90 kmph
Maximum permissive speed in operation on tangent and level track	80 kmph
Declared Schedule Speed (DSSP), with fully loaded(AW3 condition)	32 kmph
Minimum Design Average Acceleration rate for fully loaded (seating plus standees @ 8 passengers /sq. m) train on level tangent track shall be as under: 0 kmph to 40 kmph 0 kmph to 60 kmph 0 kmph to 80 kmph	 1.0 m/s^2 0.6 m/s^2 0.3 m/s^2
Minimum Operational Average Acceleration rate for (seating plus standees @ 6 passengers/sq. m) loaded train on level tangent track shall be as under: 0 kmph to 35 kmph 0 kmph to 60 kmph 0 kmph to 80 kmph	 1.20 m/s^2 0.65 m/s^2 0.35 m/s^2
Minimum Average Service braking rate from 80 kmph to standstill for fully loaded (seating plus standees @ 8 passengers / m2) train on level tangent track	1.0 m/s^2
Minimum Average Service braking rate from 80 kmph to standstill for - (seating plus standees @ 6 passengers / m2) train on level tangent track	1.1 m/s^2
Minimum Average Emergency braking rate from 80 kmph to 0 kmph for fully loaded train on level tangent track	1.3 m/s^2
Jerk rate (Maximum)	0.75 m/s^3

1.6. Track structure Parameters

The Track Parameters for At-grade, Elevated and Underground sections are set out in ERTS-RS Table 2-2. Following details are listed for reference only.

Description	Elevated and at-grade Corridor	Underground Sections
Track Laying Gauge	1435 mm	

Rail Type		
Main Line	60E 1 Head hardened as per IRS T 12 – 2009 With All Amendments / Correction Slips	
Depot	60E 1 (880 Grade) as per IRS T 12 – 2009 With All latest Amendments / Correction Slips.	
Rail Profile	60 E1 Profile	
Inclination Of Rail	1 / 20	
Rail Seat Spacing, Main line	Nominal 650 mm ± 5 mm	
Sleeper Spacing, Depot	650mm ± 20mm; Inspection Lines 1000 mm	
Ballast Cushion		
Depot	Ballast less Track in Madhavaram Depot Ballasted Track in Poonamalle Depot	
Rail Panel Lengths	Continuous welded rails	
Minimum Radius of Curvature	Depot – 100 m Main line (At grade and elevated) – 120 m	200 m
Minimum Turn Out Depot	1 in 7, R-140	
Minimum Turn Out Main line	1 in 7, R-140	
Maximum Cant Permissible in curves	125 mm	
Maximum Cant Deficiency Permissible	100mm	
Maximum Permissible Cant Gradient	1 in 440	
Turn-out Speed (Main line) 1 in 9, R300	45 km/h	
Turn-out Speed (Main line) 1 in 9, R190	35 km/h	
Turn-out Speed (Main line) 1 in 7, R190	35 km/h	
Turn-out Speed (Main line) 1 in 7, R140	25 km/h	
Maximum Gradient	4 % Including Grade Compensation	
Minimum vertical curve radius crest	1500m	
Maximum track axle load (AW4)	16.0 tonnes	
Widening of track Gauge on curves	Up to 9 mm	

1.7. Current Collection System

The details of the Current Collection System are set out in ERTS-RS clause 2.14.1. Following details are listed for reference only

System Particulars	For all sections and depot
Nominal Voltage	25 KV
Normal variation in voltage	19 ~ 27.5 KV
Occasional maximum voltage (Cut off)	30 KV

Occasional minimum voltage	17.5 KV
Cut off voltage	16 KV
Voltage for guaranteed performance	22.5 KV
Frequency variation	47 ~ 52 Hz

1.8. Platform Interface

The principal details of the Platform Interfaces are set out in the following table.

Particulars		Measurements
Length of Platform		136m (6 coaches)
Width: Island type		8.0 to 12.0m
Width: Side type		4.0 to 6.0m
Height above rail level	Ballasted Track	1090mm ± 5mm
	Ballast-less Track	1080mm ± 5mm
Distance between track centre and platform edge		In underground: 1510 mm – 1515 mm In Elevated and At grade: 1515 mm – 1520 mm
Minimum horizontal curvature at platform		1000m
Structural gauge and passing clearance in platform		Refer to Appendix D of ERTS-RS

1.9. Signalling System

The proposed system shall meet the principal details of the Signaling and Train Control System are set out as per ERTS-RS clause 1.3, 2.28 and Appendix C of ERTS-RS.

1.10. Car Dimensions

Dimension	Values
Length of DMC / TC / MC over coupler faces	22,600 mm
Width of car, overall	2900 mm
Wheel dimensions: New wheel diameter Wheel wear limit	 860 mm 80 mm (on diameter)
Height of car floor above top of rail at door threshold	1,130 mm (maximum) 1,100 mm (minimum)
Spacing between bogie centrelines	15,000 mm

2. Definitions and Abbreviations

The following definitions and abbreviations are applicable to the PTS.

2.1. Definitions

- "**Employer"** means Chennai Metro Rail Limited (CMRL), its legal successors and assignees.
- **"Subcontractor"** means the Supplier who supplies the required Dual Mode Detrainment Door System to BEML for CMRL ARE02A project. Subcontractor shall carry out the works in accordance with ERTS (RS & CMC) with regard to Dual Mode Detrainment Door System.
- **"Contractor"** means the persons or person appointed by the Employer to undertake the execution of the works for CMRL ARE02A project. In order to avoid misunderstanding of the roles of the Contractor in ERTS (RS & CMC), the term "Contractor" shall be read as "Subcontractor" in ERTS (RS & CMC) for those ERTS (RS & CMC) clauses referred to in this PTS.
- **"Contract"** means the contract between Subcontractor and BEML in relation to the supply of Dual Mode Detrainment Door System for CMRL ARE02A project.
- "**Engineer**" means any person nominated or appointed from time to time by the Employer to act as the Engineer for the purposes of the Contract and notified as such in writing to the Contractor.
- **Project Manager or Employer's Representative**" means any person nominated or appointed from time to time by the Employer to act as the Project Manager/ Employer's Representative for the purposes of the Contract and notified as such in writing to the Contractor.
- "**NIT**" means Notice Inviting Tender for Supply of Dual Mode Detrainment Door System for CMRL ARE02A Project issued by BEML.
- "**GTC**" means General Terms and Conditions for Dual Mode Detrainment Door System for CMRL ARE02A Project issued by BEML.
- "**SCC**" means Special Contract Conditions for Supply of Dual Mode Detrainment Door System for CMRL ARE02A Project issued by BEML.
- "**BEML**" means the Contractor to procure the Dual Mode Detrainment Door System for CMRL ARE02A project.
- "**ERTS-RS**" means Employer's Requirements Technical Specification – Rolling Stock for CMRL ARE02A project.
- "**ERTS-CMC**" means Employer's Requirements Technical Specification - Comprehensive Maintenance Contract for CMRL ARE02A project.
- "**PTS**" means BEML's Procurement Technical Specification.

2.2. Abbreviations

GOA	:	Grade of Automation
UTO	:	Unattended Train Operation
EMC	:	Electro-Magnetic Compatibility
ERTS	:	Employer's Requirements Technical Specifications
FMEA	:	Failure Mode Effects Analysis
FMECA	:	Failure Mode Effects and Criticality Analysis
FRACAS:		Failure Reporting and Corrective Action system
FAI	:	First Article Inspection
ISO	:	International Standards Organization
ITP	:	Inspection Test Plan
LRU	:	Least Replaceable Unit
MRTS	:	Mass Rapid Transit system
MDBF	:	Mean Distance Between Failures
MDBCF	:	Mean Distance Between Component Failures
MDBSF	:	Mean Distance Between Service Failures
MTTR	:	Mean Time To Repair
NCR	:	Non-Conformance Report
PHA	:	Preliminary Hazard Analysis
RDSO	:	Research Design and Standards Organisation (Ministry of Railways)
SOD	:	Schedule of Dimension
TCMS	:	Train Control Management System

For further abbreviations, please refer to APPENDIX-A of ERTS.

3. Precedence of Documents

1) The PTS shall be read in conjunction with the Notice Inviting Tender (NIT) General Terms and Conditions (GTC) & Special Contract Conditions (SCC) of the tender & ERTS (RS & CMC). To the extent that any provision of the PTS is inconsistent with any provision of the Commercial Specification, the provisions of the NIT shall prevail.
2) To the extent that any provision of NIT is inconsistent with any provisions of the ERTS (RS & CMC), the provisions of ERTS (RS & CMC) shall prevail.

3) This PTS in no way relieves the sub-contractor from any requirements specified in the technical specification. If a conflict is discovered among any of the above contract documents, the following order of priority shall govern:

Order of Precedence	Document title
1	ERTS (RS & CMC)
2	PTS
3	NIT/GTC/SCC

4) The complete requirements are those found in the above documents. It shall be the subcontractor's responsibility to ensure that equipment, documentation, and services furnished against this PTS are in full compliance with all the above documents.
5) Also, in the event of any conflict among the requirements of particular parts of the PTS, ERTS and NIT, the subcontractor shall seek clarification with BEML prior to making a contract. After making a contract, the subcontractor shall comply with BEML's Interpretation for any discrepancies.

4. Technical Qualification Criteria

1) Subcontractor shall be an Original Equipment Manufacturer (OEM) of Dual Mode Detrainment Door System for Railway Metro Rolling stock having experience in design, manufacturing, testing, commissioning, integrated testing and comprehensive maintenance. Company profile and the infrastructure details shall be submitted by the bidder.
2) Dual Mode Detrainment Door System designs shall be service proven. In general, "service proven" shall mean the system, subsystem, equipment or components, etc. which shall comply with requirement's specified ERTS-RS.
3) The proposed Dual Mode Detrainment Door System shall be in satisfactory revenue operation for minimum three (3) years, in a country other than the country of origin of manufacturer or in India, at the time of bid submission. The details shall be provided as per requirements of Form Sys-3 by the bidder. Also, duly filled & Signed Format for Submission of Vendor/Subcontractor/Suppliers Credentials: Rolling Stock (Enclosure 4) shall be submitted
4) Letter of authorization (Form MAN) to be filled and submitted by the bidder in accordance with the instructions indicated in the form and signed by a person with the proper authority to sign documents.
5) The credentials of the manufacturing plant shall also be submitted along with the technical offer.
6) The sub-contractor shall provide all the required documents for obtaining the vendor approval for the Dual Mode Detrainment Door System as per the tender. Selection of Vendor is subject to CMRL approval.
7) The firm should have designed, and supplied Dual Mode Detrainment Door System for project having GoA4 (UTO) level of automation. Such supplies should have been in

revenue service with satisfactory performance. Satisfactory performance certificate from the Metro operators needs to be furnished.

8) The subcontractor shall provide ISO 9001:2015/ IRIS certification or equivalent international certification along with the technical offer and shall manufacture the products accordingly.
9) The subcontractor shall submit Quality Assurance Plan (QAP), Inspection test Plan (ITP), company profile with infrastructure facilities, product range etc., along with technical offer.

5. Interface Responsibilities

5.1. Design Interface

1) At design stage, BEML shall be responsible for defining the technical requirements and the design constraints. The location of mounting points and the design of equipment installation comprising of Dual Mode Detrainment Door System shall be defined by the subcontractor and approved by BEML in order to avoid any mechanical interference with other equipment for the vehicle. The subcontractor shall be responsible for mounting methods and providing all requisite materials for mounting of the Dual Mode Detrainment Door System on the carbody.
2) Any changes of the components comprising of Dual Mode Detrainment Door System shall be defined by the subcontractor and approved by BEML in order to avoid the mechanical interference with other equipment for the vehicle.
3) In order to implement interface requirements, the subcontractor shall provide the information required by BEML or CMRL and shall provide the interface data voluntarily for ensuring the performance of the Dual Mode Detrainment Door System which need to be used for the mechanical and functional interface. The subcontractor shall have whole responsibility for problems which will happen without any information and notification used for engineering interface with other equipment or car body structure.
4) Even if technical information or drawings are approved by BEML or CMRL, the subcontractor shall have responsibility to change/ solve/ modify design failure of production, quality problems and safety issues on its own cost.
5) The subcontractor shall keep in mind that any Door system initially proposed by them should be customized to meet a situation of this project or the need of CMRL. So, the subcontractor shall implement it to Dual Mode Detrainment Door System without additional cost. Subcontractor shall solve all issues for proper operation of Dual Mode Detrainment Door System at subcontractor's own cost.

5.2. Space Envelope

The Dual Mode Detrainment Door assembly shall be designed for mounting within the car body space envelope without any interference.

In order to avoid the mechanical interference with other equipments of the vehicle following sub-assembly mountings shall be taken care during preliminary and pre-final design stage.

- Interface between Dual Mode Detrainment Door system and carbody frame
- Interface between Dual Mode Detrainment Door system and cab mask
- Interface between Dual Mode Detrainment Door system and cab interior: Emergency detrainment door ramp (in folded condition) shall be suitably covered from inside of driving console and space for keeping this detrainment door cover shall be ensured.
- Interface between Ramp of Dual Mode Detrainment Door system and cab mask , carbody and track
- Interface with Ramp and the driver desk and auxiliary desk shall be taken care without any gap (Ramp, driver desk and auxiliary desk shall be inline)
- Interface of Ramp support/legs shall be matched with the Civil structure of CMRL .
- Matching of Ramp Base plate mounting to car under frame brackets.
- Matching of Ramp frame with cab structure
- Interface between Dual Mode Detrainment Door system with track with curved radius of R100m in both operating modes of train to train and train to track.
- Interface between Dual Mode Detrainment Door system and Front Destination Indicator mounting and related electrical connections.
- Interface with coupler : Due to front & rear end evacuation design of train, the front end automatic couplers and its components shall not infringe any part of the train rescue operation or passenger de-boarding operation. Adequate vertical & horizontal clearance shall be maintained between couplers and walking ramp of the front-end evacuation detrainment door when the walking ramp is deployed on the track for de-boarding of passengers.

The design of the Dual Mode Detrainment Door system components shall consider the tentative carbdoy details provided in the enclosed sketch GR-5682 (Refer Annexure-2 of PTS) for the door leaf profile and the available space envelope. The specific details will be finalised during the preliminary design stage.

The Subcontractor shall provide the detailed longitudinal section drawing and the detailed drawing related to FEED during preliminary design stage.

5.3. Interfaces with other systems

5.3.1. Electrical/Communication Interface

1) The subcontractor shall provide the interface specification between TCMS, Propulsion system, Track work,depot maintenance equipment and vehicle equipment including signaling, such as ATP, ATO, UTO control and any other equipment.
2) Time to time BEML will facilitate direct face to face meeting between other sub-supplier either at subcontractors works, BEML works, other sub-supplier works or at customer place. Subcontractor is responsible to resolve the interface issues to achieve the ERTS (RS & CMC) requirements.
3) The following is a brief of requirements for Electrical Interface

   - Power requirements.
   - Technical specification.
   - Rated current, voltage characteristic and consumption.

- Cable specification (Power, control and grounding).
- Connector (male and female) with pin and socket part no.
- Signal input/output list and interface specification.
- Connector/terminal arrangement
- Both equipment side and car side mating connectors, pins & required tools etc. will be under subcontractor's scope.

4) BEML and the subcontractor will comply with and be responsible for the interface requirement and develop the interface specification on his scope of supply.
5) Subcontractor shall provide the necessary interface and participate in finalizing the TCMS Interface and carry out necessary testing on-site for successful integration and completion of the project.
6) Necessary Electrical interface shall be supported and implemented by subcontractor during execution phase for successful completion of project even if it is explicitly not mentioned in ERTS, PTS.

5.3.2. TCMS Interface

1) Subcontractor shall provide the necessary interface and participate in finalizing the TCMS Interface and carry out necessary testing on-site for successful integration and completion of the project.
2) The subcontractor shall meet the communication protocol requirements of the lead subcontractor (TCMS) in accordance with the interface document requirements for Dual Mode Detrainment Door System.
3) Interface with TCMS shall be based on service proven communication system and shall be compliant as per ERTS RS 14.3.3 and same shall be decided during design stage.
4) The sub-contractor shall meet the requirements but not be limited to ERTS Chapter 2,6,14, ERTS-RS Appendix-C with regard to TCMS interface, Signaling Interface.
5) Before the Type Test, commissioning of complete car at the vehicle level, the subcontractor shall meet the TCMS combination test between TCMS and their equipment as per ERTS-RS. One or several equipment including connectors, power, cables etc., should be delivered to TCMS supplier's test placement before the testing period by subcontractor. Subcontractor's engineer should attend the combination test for technical support, for example changes or equipment installation, in accordance with TCMS supplier's requirement.

5.3.3. Interface with On-Train Public Address System

The door control shall be suitably interfaced with On Train Public Address System as per ERTS RS 13 and shall be discussed during preliminary design stage.

5.3.4. Signalling Interface

Refer ERTS-RS Appendix C Chapter 2 for full details of the division of responsibility between the subcontractor and Signaling. The subcontractor shall comply with the requirements.

Subcontractor shall support and implement necessary interface for GoA2/GoA3/GoA4 during execution phase and carryout necessary fine tuning of his equipment & software during testing & commissioning and test trials on-site for successful completion and handing over of the trainsets for Statutory approvals and Revenue Service operations.

As per ERTS-RS Appendix C Chapter 2, Subcontractor shall provide necessary support to Signalling & Train Control contractor for Standalone door operation command to allow driver / cleaning staff to enter / exit the train from designated door in designated Depot area / Mainline siding. Necessary support to the Signalling & Train Control Contractor to be provided.

6. Technical Requirements

6.1. General

1) The subcontractor shall meet the Dual Mode Detrainment Door System requirements of ERTS (RS & CMC) for the design, development, manufacture, supply, testing, delivery, commissioning and integrated testing, suitable for UTO operation, including the training of operating and maintenance staff of the CMRL including comprehensive maintenance contract (CMC) of Chennai Metro Rail Project ARE02A.
2) Dual Mode Detrainment Door System shall fully meet the requirement of ERTS (RS & CMC) of CMRL ARE02A project and shall be compatible for operating 3-car, 6-car & multi-consist train formations.
3) The subcontractor shall support in all aspects in obtaining clearance for dispatch of the prototype trains after successful completion of tests. The subcontractor shall carry-out any modification/ alteration based on results of the tests on the prototype be required. The subcontractor shall carry out necessary modifications at no additional charge on all trains and shall support in delivering the prototype train
4) The subcontractor shall ensure that the train design incorporates and provides all necessary equipment, systems or sub-systems, facilities, interface etc., generally used/provided in recent operational UTO/GoA4 trains within quoted price, notwithstanding whether these have been specifically mentioned in the ERTS (RS & CMC) or otherwise. In case of any necessary provision required to be incorporated in conformance to this clause the subcontractor shall commit to incorporate the same into design at any stage for ensuring full compliance to this ERTS RS clause.
5) The subcontractor shall meet the system requirements of Dual Mode Detrainment Door System mainly in accordance with ERTS RS chapter 6.9.

6) Subcontractor shall consider all energy saving methodology and submit the measures taken for energy saving as part of tender bid submission. This is required since SEC at Train level has been specified in the contract and the same needs to be achieved to avoid imposition of penalty by employer. In this regard, subcontractor shall submit the details of energy consumption of Dual Mode Detrainment Door System.
7) Subcontractor shall provide the detail of projects interfaced with TCMS along with grade of automation GoA4.
8) The subcontractor shall comply the Train withdrawal scenarios for 3-car train specified at Appendix- I of ERTS-RS.
9) As per ERTS RS 14.7.1.3 & 14.7.2.2, Real-time fault data shall be available for Door system. Each car system shall perform its own diagnostics and shall log fault and status data. This information shall be provided to the DMS in real-time.
10) The various important parameters / signals of the equipment / subsystems (i.e. associated trace / environment data) shall also be recorded for pre-determined period before and after of occurrence of associated events/ faults with a view to enable proper fault analysis.

6.2. Standards and Codes

1) All equipment supplied shall be in accordance with the requirements of the standards and codes specified in the ERTS-RS and it's Appendix-B. The subcontractor may propose an alternative equivalent international standard during the design stage. The acceptance of alternative standard will however be subject to review by BEML/CMRL. When a Standard or Code is referred to, it shall be assumed that the revision that is current during the design finalisation shall be applicable, unless otherwise stated.

   Where no standard is identifiable, the subcontractor shall make a proposal, based on the best international practice, which shall be subject to review by BEML/CMRL.
2) During the preliminary design phase, the subcontractor shall submit a consolidated list of all the standards that he intends to use for the design, manufacturing and testing and other phases of the contract, for review of BEML/CMRL.
3) All drawings and design calculations submitted with the tender, or in accordance with the requirements of the contract, shall use SI units
4) The sub-contractor shall comply to latest version of standards in ERTS-RS and its Appendix-B.

6.3. Proven Design

The proposed Dual Mode Detrainment Door Systems by the sub-contractor against this PTS shall satisfy the "Proven Design" clause 2.4 of ERTS-RS.

6.4. Technical Information of Dual Mode Detrainment Door System

6.4.1. DUAL MODE DETRAINMENT DOOR (ERTS RS Clause 6.9)

1) Dual Mode Detrainment Doors shall be provided in the first and last car for

emergency egress of passengers in one (1) of two (2) modes of operation

2) Each Detrainment Door shall be a hybrid design, which offers the possibility of two (2) operating modes.

3) The two (2) required operating modes of the Detrainment Door are as follows: -

   a. Train to Track Evacuation Mode (will be configured this way when the DM cars are not coupled)
   b. Train to Train Evacuation Mode (will be configured this way when DM cars are coupled during multi-consist operation)

4) The hybrid design concept shall ensure that the same door is able to serve both operating modes; without the entire door assembly needing to be interchanged to convert the door between modes. However, a conversion process which involves interchange of the ramp (used for train-to-track evacuation mode) with a bridging plate (used for train-train evacuation mode) is acceptable.

   Such conversion process shall be undertaken at the depot under the guidance of an easy-to follow maintenance work instruction. It must be easy to accomplish by no greater than two (2) maintenance staff, in less than four (4) hours.

5) Additional Detrainment Door hardware which may be required for the Train-to-Train Evacuation Mode shall only be required in a quantity of one (1) per trainset.

6) The detrainment door shall be an aesthetically pleasing design which ensures a clear view of the track from driving car. The door shall aesthetically harmonize with front and side lookout glasses of the emergency operator's desk, shall not block the front view and shall give a look of single glass.

7) The material of front-end detrainment Door glass shall meet the specifications in ERTS RS clause 3.4.9.4 and 5.3. The visibility of the joint between the detrainment door and windshield look out glass shall be bare minimum.

8) The detrainment door system shall be SIL2 compliant and shall be provided with a sealed cover over the door actuating mechanism.

9) The clear width of the detrainment doorway and width of the ramp when operated shall be a minimum 700mm with a headroom not less than 1900mm.

10) During Train to Track mode of operation , there shall be a folding detrainment ramp for which provides a safe walkway for passengers to exit the saloon and reach the track plinth at elevated, at-grade and underground sections. The folding ramp shall be simple to operate to the extent that it may be operable by passengers without staff assistance during emergency.

11) The detrainment ramp shall have full length longitudinal handrail / guiding

straps as well as and fluorescent or photo luminescent material marking on both sides of passenger egress direction. The ramp shall be designed for load of 500 kg/m2 or more and it shall not excessively sag or have permanent deformation >1mm after loading The ramp angle shall not be more than 17.5 degrees. The ramp shall also be suitably supported to ensure there is no tilting on straight or curved sections of track.

12) The Contractor shall demonstrate safe use of the emergency detrainment door and ramp in the elevated, atgrade and tunnel section on different radius curves specified in chapter 2. The door design shall be consistent with the latest applicable fire safety standards.

13) The door shall be vibration free and sealed against water ingress and sound transmission. It shall be provided with a safe, simple and secure locking mechanism which shall be unaffected by a single point failure. The walking surface of the deployed detrainment ramp shall be of sufficient stiffness to remain safe and have an anti-slip surface to avoid risk to passenger during rainy conditions. The ramp surface shall also be suitable for the operation of wheelchairs.

14) The retrieval and stowage of ramp should be easily accomplished by a single member of trained staff without the need to dismantle any equipment. Re-stowage shall be possible both electrically and manually. Any tool, if required, for manual closing operation by a single person shall be provided in the emergency operator's desk area. In addition to manual arrangement operable by one-person, suitable portable power operated devices for stowage of door and ramp shall also be provided near to the detrainment door of each car. If battery of Portable power is weak, stowage of door shall also be achievable by a manual operation. All necessary ancillary equipment to enable the train to be moved after emergency detrainment shall be provided as part of this contract.

15) Multilingual (English & Tamil) Instructions shall be displayed in all the cars displays to enable passengers to understand the operation of the emergency detrainment door in case of emergency. It shall be able for OCC, BCC & DCCs to communicate with the passengers and provide audible instructions through Passenger Emergency Intercom (PEI) placed adjacent to each detrainment door.

16) The complete opening of the detrainment door (including deployment of ramps and/or bridging plates in each respective mode) shall be possible by an untrained passenger in under one (1) minute.

The Contractor shall propose a suitable type test procedure to demonstrate compliance with all requirements. Separately, an endurance test shall also be performed to demonstrate 200 open/close cycles of operation.

The detrainment ramp shall be tested with an uniformly distributed load of 750kg. The loading and unloading shall be repeated for 500 cycles. The detrainment ramp shall not deform after the test.

17) During Train-to-Train mode of operation, the bridging footplate and physical side barriers / straps (if required to mitigate risk of falls) shall deploy by a simple / mechanised action to avoid risk of passenger confusion.

It shall also be possible to open the detrainment door of the coupled train from its exterior so that passengers are able to safely evacuate to the coupled train, without requiring assistance from other persons located inside of the coupled train consist.

18) The Detrainment Doors shall be part of the Door Proving Loop that is monitored by ATP to prove that the doors are latched and stowed. Further monitoring of the latched, stowed and locked status shall be provided through TCMS. The displayed status of Detrainment Doors shall be integrated with the monitoring of the passenger doors.

19) Detrainment Doors shall include a magnetically operated lock bolt to prevent full deployment of the door. The lock shall only engage while energized so that the door does not remain in a locked condition when the feed (or train battery supply) is lost.

20) An unlock command to release the magnetically operated lock bolt may be sent by OCC / BCC / DCC. An unlock command may also be provided locally via a Pushbutton located in the emergency operator's desk.

21) When an attempt is made to operate the door actuating mechanism, or it is unstowed /unlatched the supervised interlock circuits shall trigger the following chain of events:

a) Emergency brakes are applied on the train.
b) An alarm is sent to OCC / BCC / DCC requesting permission (Unlock Command) for the Detrainment Door so it can be fully deployed.
c) Driving console light, Head lights and Flasher lights are automatically lit, and CCTV cameras shall automatically focus on this area.
d) Automatic Switching ON onboard CCTV to high-speed mode shall occur.
e) Appropriate audio & video messages though PAPIS system shall be broadcasted on the train speakers and displays to guide the passengers.

f) Video messages shall be descriptive enough for a passenger to understand the operation of the detrainment door & ramp. These messages shall show the direction towards the operated detrainment door to the passengers. These video messages shall be submitted to CMRL for approval.

g) Provide the train location in the CMRL section to OCC, BCC & DCC for further action by them.

h) Such an event shall be logged in TCMS and shall be communicated to RSC consoles of OCC, BCC & DCCs as audio visual alarms.

i) The detrainment process shall be monitored with CCTV cameras of the train. One CCTV camera dedicated to the detrainment process shall be provided. Flasher light shall automatically turn ON when detrainment door is open.

j) Provide an alert and Communication with the nearest station controller about the de-boarding of passengers, switch ON tunnel lights, elevated lights and switch ON suitable tunnel ventilation fans to enable proper ventilation to passengers in tunnel.

22) The detrainment door shall be suitable for multiple operations. There shall be no sagging / distortion of the door during the entire lifetime of the car body i.e. 35 years.

23) The Contractor shall furnish detail evacuation scenario covering the following conditions:

a) Evacuation in Emergency, e.g. Fire, collision.

b) Controlled evacuation e.g. failed train or failed power supply.

24) The Evacuation plan shall be compliant with the evacuation requirements specified in Railway Group Standard GM/RT2130 ‘Vehicle Fire, Safety and Evacuation’.

25) The Evacuation plan shall include study of evacuation time, the battery capacity calculation, the infrastructure of the complete CMRL network, time taken for coordination activities with OCC / BCC / DCC and station controller.

26) There shall be no draught, dirt or water entering through the detrainment door and it shall not generate any noise while the Train is in motion. The arrangement shall comply with BS EN 60529 IP65 or EN 14752.

27) Mechanism of Detrainment door shall have below four functions:

a) Door Unlatching – It shall be possible to remove the cover and operate the door actuating mechanism to unlatch / unstow the detrainment door regardless of whether it is locked, in a stationary or dynamic condition.

However, the door will not open or fully deploy whilst the magnetically operated lock bolt is engaged.

b) Door Opening – It shall be possible to open the detrainment door only after the magnetically operated lock bolt has disengaged; either through an unlock command or loss of electrical feed.

c) Door closing – It shall be possible to manually close the detrainment door from inside the train.

d) Door Locking – It shall be possible to manually re-latch and re-lock the detrainment door from inside the train after it has been deployed. Once the door is re-latched and locked, relevant communication shall be sent to TCMS, RSC consoles of OCC, BCC & DCCs.

28) Complete operation of detrainment shall be suited & complied for both GoA4 / UTO and all Non- UTO modes of operation.

6.4.2. Clearance (ERTS 4.2.11)

Due to front & rear end evacuation design of train, the front end automatic couplers and its components shall not infringe any part of the train rescue operation or passenger de-boarding operation. Adequate vertical & horizontal clearance shall be maintained between couplers and walking ramp of the front-end evacuation detrainment door when the walking ramp is deployed on the track for de-boarding of passengers.

6.4.3. Covers for Emergency detrainment Ramp (ERTS 3.4.3.9)

Emergency detrainment door ramp (in folded condition) shall be suitably covered from inside of driving console and space for keeping this detrainment door cover shall be ensured.

6.4.4. Windshield and detrainment door glazing (ERTS RS 3.4.9.4)

1) The windshield design shall be a two piece design with glazing and shall be clear in colour.
   The glazing material shall be laminated glass and it shall comply to IS 2553 or any International Standard. Structural requirements for rail vehicle structures shall be design, tested and conform with GM/RT2100, UIC 566, EN 12663-1, UIC 651, EN 15152.

2) Visible glare or reflections on the windshield, including reflections from interior lighting during night operation, shall be minimized. Glasses shall have high visible light transmission and low UV transmission.

3) Windshields shall be replaceable from the outside of the car.

4) Glazing shall also be provided on emergency detrainment door.

5) The glazing of emergency detrainment door at the middle of windshields shall be aesthetically aligned to give a continuous appearance when viewed from outside. At least three such designs may be submitted for CMRL's review and approval.

6) The Windscreen including glass of the detrainment door shall be constructed of toughened, laminated safety glass, and shall comply with the requirements of IS 2553 (Part-1 and 2), ECE Regulaion-43, EN 15152, and UIC 566. The inner and outer surfaces of the windscreens shall be scratch resistant. This design shall comply with ERTS RS Chapter 3.
7) Be clear laminated safety glass used for all front facing glazing (i.e. windshields and detrainment door). The Contractor is requested to follow IS 2553 or equivalent International Standard for Toughened Glass

6.4.5. Bill of Material (BOM)

1. All components and sub-components used in Dual Mode Detrainment Door System shall be highly reliable and should have been used and established their satisfactory performance and reliability on at least three mass rapid transit systems in revenue service over a period of three years or more (in each MRTS)
2. The subcontractor shall submit the complete Bill of Material (BOM) for Dual Mode Detrainment Door System including door panels, door electronics & controls, switches, mechanical drives, along with the list of Models /make and list of projects in which these items are used, along with the technical offer.

6.5. Weight

1. To minimize energy costs, great importance will be placed on achieving practical designs of minimum car weight whilst meeting specified structural and performance requirements. Accordingly, the weight of the Complete Dual Mode Detrainment Door System shall be kept to a minimum and shall not exceed 350kg including all accessories.
2. The subcontractor shall submit details of estimated weights and center of gravity for Dual Mode Detrainment Door System along with the technical offer.

6.6. Noise & Vibration

Subcontractor should devote particular attention to the design of Dual Mode Detrainment Door to get quiet operation condition and should ensure that the transmission loss is above the specified levels. All equipment should be designed to eliminate the rattling and resonance at all speeds up to maximum running speed and aerodynamic forces caused by ambient wind, train motion, or the passage of other trains.

The equipment, sub-assemblies and components shall also comply with the requirements laid down in 'Guidelines for Noise and Vibrations for Metro Rail Transit Systems' issued by the Ministry of Railways, Govt. of India (ERTS-RS Appendix D4).

Sound reduction index Rw of the door panel assembly measured as per ISO 10140-2 should be equal to or larger than 32 dBA. The estimated Rw value shall be indicated in the technical offer.

The complete Dual Mode Detrainment Door System shall be capable of withstanding shock and vibrations of the Rolling Stock satisfactorily such that they do not fail prematurely on this account earlier to the designed life. To establish this requirement, all of equipments, sub-assemblies and components shall be subjected to shock and vibration test as per IEC61373.

6.7. RAMS requirements

The sub-contractor shall comply every aspect with the requirements of RAMS (Reliability, Availability, Maintainability and Safety) as per ERTS-RS , ERTS-CMC & EN50126. During warranty period (standard purchase warranty), the values of the RAMS target shall be calculated from the records of all faults and service failures. In the event that the target is not achieved, the supplier shall, at his own expense, take whatever action necessary to meet the target specified. Also, the sub-contractor shall provide all information related to the RAMS requirements. The sub-contractor shall comply with, but not limited to, the following requirements

6.7.1. RAMS Deliverables

The sub-contractor shall submit the following RAMS Deliverables as a minimum as per the enclosed format during PFDR and FDR.

1) FMECA (Failure Mode, Effects and Criticality Analysis)
2) List of LRU
3) RAM Analysis (MDBCF, MDBCSF & MTTR)
4) Maintenance Schedule (Corrective Maintenance, Preventive Maintenance, Overhauling Maintenance)
5) Reliability Block Diagram (RBD)
6) Hazard Analysis
   a) Subsystem Hazard Analysis (SSHA)
   b) Interface Hazard Analysis (IHA)
   c) Operating Hazard Analysis (OHA)
7) Fault Tree Analysis
8) Safety Analysis
9) Life Cycle Cost (Corrective Maintenance, Preventive Maintenance, Overhauling Maintenance)

Sub-contractor shall submit the above RAMS deliverables in the format shared by BEML as a minimum requirement.

6.7.2. Reliability, Availability and Maintainability: General

1. Reliability, Availability and Maintainability (RAM) requirements and goals shall be developed in terms of Mean Distance Between Failures (MDBF), percentage Availability and Mean Time to Repair (MTTR). The Contractor shall perform RAM analysis up to the point of interface with other Contractor's systems.
2. The Subcontractor shall comply with the guidelines of EN 50126 (all parts), IEC 60300-1, IEC 60300-2 and IEC60571 for electronic equipment, and IEC 60300-3-5 or similar international standards in meeting the reliability, availability and maintainability requirements of equipment.
3. The Subcontractor shall submit Reliability, Availability and Maintainability Plan. The Contractor shall verify, after system design have been completed, that the reliability, availability and maintainability requirement will be met.
4. The Subcontractor shall demonstrate by quantitative methods achievement of the specified levels of reliability for the train and specific individual items of equipment.
5. An evolving reliability model consisting of reliability block diagrams and probability of success equations shall be developed and submitted to the BEML/GC-CMRL for acceptance. This model shall show the relationships required for system and equipment to operate successfully. The reliability block diagrams shall include all elements essential to the successful performance of the system and the interrelationships and interface of these elements.
6. Reliability apportionment and prediction analysis shall be in accordance with established techniques or standards, which will be submitted for acceptance by the BEML/GC-CMRL. The analysis shall provide predictions for each major equipment and sub-system. Predictions shall be based on actual commercial/revenue service results for identical equipment operating under service conditions and duty cycles equivalent to Chennai Metro Rail system, or more severe. The analysis shall be carried out in parallel with the design of the train. The relevant apportionment and prediction figures shall be part of the design submission documents for the individual equipment, sub-system and system.
7. Reliability Apportionment and Prediction Report shall be completed prior to build commencing and reports shall be submitted at this stage for acceptance by the Project Manager, who reserves right to require the Contractor to carry out field data collectionto verify the reliability model.
8. The design shall ensure that passenger deboarding cases in operational trains are bare minimum and avoided to the extent possible

6.7.3. Reliability Analysis

1. The reliability data shall be based on actual operating information for the equipment. In addition, the subcontractor shall submit a list of typical train withdrawal scenarios for review and acceptance by the BEML. The list shall include all anticipated failure scenarios, which can affect safety, punctuality and passenger comfort. Also, a list of typical train withdrawal scenarios should be based on the reliability analysis.

2. The Reliability Block Diagrams (**RBDs**) and prediction of reliability performance shall be submitted to BEML for acceptance. The reliability block diagrams shall include all elements essential to the successful performance of the system and the interrelationships and interface of these elements.
3. The subcontractor shall submit reliability prediction to demonstrate by quantitative methods above the achievement of the specified levels of reliability for the scope of supply.

6.7.4. Reliability Target

The MDBCF and MDBSF per 3 car train-set of the Dual Mode Detrainment Door System shall meet the following table, considering 150,000 train-km of annual running mileage.

Equipment	**Reliability Demonstration Period**			
	After 6months to 12months from start of revenue Service		**After 12 months from start of revenue Service**	
	MDBCF (train-km)	**MDBSF (train-km)**	**MDBCF (train-km)**	**MDBSF (train-km)**
Dual Mode Detrainment Door System	3,87,500	11,62,500	4,68,750	18,75,000

The Reliability performance shall be assessed by the following measure:

$$\text{MDBCF} = \frac{\sum \text{Traveled kilometer per train-set}}{\sum \text{Number of } \textbf{relevant Failures}}$$

Where,

Mean Distance Between Component Failure (MDBCF): The MDBCF of a system is the ratio of the total operating distance accumulated by the total population of identical items in the available fleet of the system to the total number of relevant failures occurring within the population identical items.

Please note the above mentioned MDBCF targets shall be followed as a minimum. It is the responsibility of sub-contractor to submit the MDBCF of their equipments for review of BEML/CMRL.

$$\text{MDBSF of Door systems including draft gear} = \frac{\sum \text{Traveled kilometer per train-set}}{\sum \text{Number of } \textbf{Service Failures}}$$

Where,

Mean Distance Between Service Failure (MDBSF): The MDBSF of a system is the ratio of the total operating distance accumulated by the total population of identical items in the available fleet of the system to the total number of service failures occurring within the population identical items

6.7.5. Availability Requirements

Availability Targets: The trains supplied shall achieve minimum average availability of 95% for fleet of trains. Penalties for not meeting Availability targets shall be imposed on the sub-contractor as per ERTS-RS & ERTS-CMC.

6.7.6. Maintainability Requirements

1. Design requirements

a. The design of all components will be such that maintenance is reduced to a minimum, substantially improving service intervals and components will be so arranged that those requiring attention are easily accessible, and readily removable. All equipment should be designed using the Least Replacement Unit (LRU) principle whereby the repair of a fault merely involves the replacement of a faulty module.

b. The design shall also minimize Mean Time To Repair (MTTR) and costs throughout design life. MTTR is the ratio of cumulative time, including the access time expended during a time interval to the total number of relevant failures.

c. The LRU replacement should be less than 30 minutes.

d. The subcontractor shall also comply with the maintenance requirement of Clause – 18.7.3 of ERTS-RS.

6.7.7. Maintenance Interval

Session	Interval (Minimum)	Manpower and downtime requirements (Maximum)	
		Downtime	Expected staff
A Service Check	15 days or 6,250km	2.5 hours	8 persons per train
B1 Service Check	45 days or 18,750km	10 hours	8 persons per train
B4 Service Check	180 days or 75,000km	20.5 hours	8 persons per train
B8 Service Check	360 days or 150,000 km	47.5 hours	8 persons per train
C1 Intermediate Overhaul1	Minimum 4 years+ or 600,000km+	5.5 days	4 persons per car
C2 Periodic Overhaul1	Minimum 8 years+ or 1200,000 km+	11.5 days	4 persons per car

Session	Interval (Minimum)	Manpower and downtime requirements (Maximum)	
		Downtime	Expected staff
C3 Intermediate Overhaul2	Minimum 12 years+ or 1800,000km+		
C4 Periodic Overhaul2	Minimum 16 years+ or 2400,000 km+		
C5 Mid-life refurbishment	Minimum 18 years+ or 2700,000km+		
Corrective Maintenance operations that do not require car lifting	-	4 hours	-
Corrective Maintenance operations that require car lifting, excluding time required for shunting	-	6 hours	-

Preventive Maintenance Interval should be compliance with the interval specified in the above table.

6.7.8. Component Change-Out Requirements

The Sub Contractor will design the Door such that the component changes out requirements listed in the below Table can be met. The person-hours are based on fully trained maintenance personnel using standard tools and test equipment.

Item	Maximum Person-Hours for interchangeability
Saloon Door (each)	0.75

In addition, the Sub Contractor will demonstrate that Door Mean Time to Restore (MTTR) that does not exceed 1.5 hours, with a maximum maintenance repair time of 3 hours, is achievable for at least 95% of all failures using the diagnostic tools and procedures provided by the Sub Contractor.

6.7.9. Master Maintenance schedule

1. The maintenance schedules shall be provided stating the parts needing attention at the basic service period and for major overhauls.
2. The subcontractor shall submit work instructions/manuals for all scheduled maintenance activities, fault finding, and corrective maintenance of all faults likely to be found during maintenance and servicing.

3. The master maintenance schedule should be incorporated in maintenance manual and sub-contractor shall provide the relevant chapter reference no in maintenance manual against each maintenance task in master maintenance schedule

6.7.10. Life Cycle Costs

The subcontractor shall comply with ERTS-RS clause 2.27 for the life cycle cost. The Subcontractor shall develop a life cycle cost plan in accordance with IEC 60300-3-3 with an aim to minimize the overall life cycle cost whilst meeting the safety, quality and reliability requirement of this particular specification. This plan shall be submitted during the PDR stage for approval by BEML/GC-CMRL.

6.8. Fire Safety

6.8.1. General

The sub-contractor shall comply with ERTS-RS 2.26 requirements for fire performance and fire safety flammability and smoke emission as per ERTS-RS 19.61. The subcontractor shall submit a Fire-safety Plan providing the list of Non-metallic material items, wires & cables that are proposed to be used in the Dual Mode Detrainment Door Systems with details of material, applied mass, fire safety compliance (Flammability, smoke, toxicity) and fire load calculations, during the preliminary design phase.

6.8.2. Material Properties

a) All non-metallic Materials used in the construction of Dual Mode Detrainment Door System shall be selected to reduce to the maximum extent practical the heat load, rate of heat release, propensity to ignite, rate of flame spread, smoke, emission and toxicity of combustion gases

b) All non-metallic materials used in the Dual Mode Detrainment Door System shall comply with fire safety requirements of EN45545 Part 1 to 7 (Category 4-A, Hazard level **HL3**) latest editions.

c) The subcontractor shall submit a Fire-safety Plan providing the list of Non-metallic material items, wires & cables that are proposed to be used in the Dual Mode Detrainment Door System with details of material, applied mass, fire safety compliance (Flammability, smoke, toxicity) and fire load calculations, during the preliminary design phase.

d) The sub-contractor shall also submit a Fire Safety analysis report for review and acceptance by the CMRL as required in ERTS-RS. Fire Performance Verification Type tests shall be according to the relevant standards shall be undertaken to establish fire ratings for all materials proposed. However, test certificates from any Testing Agency of international repute may be accepted in lieu by the CMRL at their sole discretion.

e) All the Fire reports / documents will be Verified and approved by an independent Fire Safety consultant appointed by BEML.

6.8.3. Wiring and Cables

a) Fire resistant cables shall be proposed for circuits, which should survive for long periods during fire, as per applicable international standards.
b) All wires & cables shall comply to ERTS-RS Clause 19.35, 19.36 19.37, 19.38, 19.39, 19.40, 19.43 & 19.44. The insulation of all wires and cables including those used within equipment / subsystem shall meet the flame and smoke test requirements of ERTS-RS clause 19.61 and shall be zero halogen.
c) Wires, cables, cable joints, connections, terminations, earthing system etc. shall comply to ERTS-RS 19.41 & 19.42 requirements.
d) The Cable markers provided shall be fire retardant heat shrinkable type. The cable markers shall be protected against fading by providing Fire retardant heat shrinkable clear sleeve.
e) Fire resistant cables shall be proposed for circuits, which should survive for long periods during fire, as per applicable international standards. As a minimum, the cables and wires for door opening shall be fire resistant in compliant to EN 50200. i.e., power and signal cables related to door opening circuit shall be considered. (ERTS-RS 19.36.13)
f) For general-purpose wire and cable, the insulation shall be of heat and moisture proof material suitable for use at conductor temperatures of 90ºC minimum in dry and wet locations. For high temperature applications, such as connecting to heaters and resistors, the insulation shall be suitable for a maximum conductor temperature of 110ºC and short circuit temperature upto 250ºC.
g) The proposed cables shall be proven on metro Rolling Stock. The Contractor shall submit the voltage grade, size and type of cable for different applications along with the proposed specification for the cables for review by the Project Manager.

6.8.4. Fire Load Calculation

The maximum heat release rate per car shall be restricted to low levels.

Fire load calculation for all non-metallic materials have to be calculated with heat release rate data tested in accordance with EN 45545 Part 1 to 7 HL3 and ISO 1716. The calculations shall be included in the Fire safety plan submitted as the source of heat value.

6.8.5. Fire Performance Deliverables

The fire performance deliverables shall be provided in accordance with following table before the production of proto Dual Mode Detrainment Door System.

Sl. No.	Deliverables	Remarks	Submission Schedule
1.	Fire safety plan	As per EN45545 HL3	Preliminary Design stage
2.	List of Non-Metallic Materials with details of	EN45545 Part 1 to 7 (Hazard level HL3)	Within the Pre-Final Design stage

	material, mass & calorific value	latest editions	
3.	Fire safety Test Reports of the items including heat release rate for standard items common with other projects of the subcontractor	As per EN45545 HL3	Pre-Final Design stage
4.	Fire safety Test Reports of the items including heat release rate for all other items	As per EN45545 HL3	Final Design stage

6.9. Quality Assurance Program

6.9.1. General

The subcontractor shall hold ISO 9001/ IRIS certification and shall manufacture the product accordingly. The subcontractor shall submit a copy of ISO 9001 / IRIS certification along with the offer. The subcontractor shall monitor and control the Quality systems as per ISO 9001/IRIS guidelines. BEML and/or CMRL's representative may periodically conduct compliance audits of the Subcontractor's Quality management system.

6.9.2. Quality assurance plan

The sub-contractor shall develop and submit a Quality assurance plan (QAP) to BEML/CMRL for review and approval based on ISO 9001 / 2000 / IRIS guidelines. The sub-contractor shall also comply with the Quality Assurance requirement of ERTS-RS Clause 18.8.

a. Process Control
b. Purchasing
c. Quality Audit
d. Inspection and Test Plan (ITP)
e. Quality Record
f. Design Control

6.9.3. Quality Audit

The subcontractor shall develop a quality audit program in accordance with the relevant Quality System and submit to BEML for information. The subcontractor shall submit the audit

report to BEML for information. In addition, a copy of audit report issued by the accredited ISO certification body shall also be submitted to BEML on demand

7. Scope of Supply

7.1. General

The subcontractor shall be responsible for the scope of supply of the Dual Mode Detrainment Door System, which shall comprise, unless specifically excluded,

1. The design, manufacture, testing, delivery, commissioning, integrated testing and rectification of defects during the Defects Liability Period
2. Supply Spares, special tools, jigs & fixtures, special test and diagnostic equipment, special training equipment and any other items required for the comprehensive maintenance of cars in sufficient quantities.
3. Documentation and support material associated with the operation and maintenance of the system
4. Technical support to rectifying the defects and deficiencies as communicated by the CMRL/BEML during comprehensive maintenance.
5. Training of engineers, operations and maintenance staff including providing the training materials, training kits and demonstration equipment
6. Initial supply and installation of all consumables and materials required for testing, Commissioning and operation.
7. Final drawings, design calculations and other documents including operations and maintenance manuals for review and acceptance by the BEML/CMRL.
8. The Subcontractor shall meet the system technical requirements for Dual Mode Detrainment Door System in accordance with ERTS-RS, as a minimum.

Note : If any special tools/equipments are required for installation of Dual Mode Detrainment Door system onto carbody, the subcontractor shall supply 3 nos. of such equipment at his own cost.

7.2. Hardware

Subcontractor shall provide all components related to Dual Mode Detrainment Door System, but not limited to, the following: Subcontractor shall provide all components related to Dual Mode Detrainment Door System, but not limited to, the following:

1. Door operating mechanism: Suitable mechanism shall be proposed to meet Dual mode detrainment requirement.
2. Door leaf Assembly complete in including windscreen glass (as per ERTS RS clause 3.4.9.4)
3. All round boundary of door panel shall be sealed by the rubber profile for water and air tightness
4. Door leaf exterior cover material & colour shall be same as cab mask(GFRP). Door leaf interior finish shall match to cab interior colour. Details of cab mask material will be furnished to the subcontractor during detail design stage.
5. Emergency Door Windscreen glass: Emergency Door Windscreen glass shall be identical as that of the carbody Windscreen glass. Design Details will be finalised during design stage
6. Pivoting plate, if required, to cover any small gap, if exists, between the support structure and ramp.
7. Service proven opening/ closing mechanism to control the opening/ closing of the ramp.
8. Ramp with anti-slip material and with full length longitudinal handrails and fluorescent material marking on both sides.
9. Suitable supports to support the Ramp on the track and to ensure no tilting of the ramp on straight and on curved sections.
10. Service proven locking system.
11. Service proven Door/Ramp locked/closed switches
12. Manual stowage handle -1 no. for each Dual mode detrainment door.
13. One no. Portable battery power operated device for stowage for each Dual mode detrainment door.
14. Support step/Foot step/Flap shall be provided at the end of ramp to guide the passengers to the ground level during emergency evacuation by considering interface with the curved rail.
15. Emergency door opening handle with breakable cover
16. Detrainment light for Evacuation.
17. Outside Emergency device to open the Dual mode detrainment door from outside of the car in case of emergency.
18. Dummy covers: In UTO mode, Emergency detrainment door ramp (in folded condition) shall be suitably covered from inside of driving console by dummy covers (as per ERTS RS clause 3.4.3.9)
19. Electrical relays/ sensors
20. Electric Latch
21. Limit switches
22. Grease for Dual mode detrainment door Lubrication

23. Tools and Jigs required for door setting.
24. Installation jig for Dual mode detrainment door on to the carbody
25. Relevant quality stainless steel hardware such as bolts, nuts, spring washers, plain washers and other items required for installation of Dual mode detrainment door.
26. All types of shims both metallic and non-metallic required for installation of Dual mode detrainment door.
27. All mating connectors between Emergency detrainment door system and car body.
28. Cable insulation sleeve – Wires/cables routed shall be protected with Fire safe insulation sleeves to protect the cables from direct metal contact.
29. All required contacts/pins, lugs, Tools for carbody side wiring.
30. Dust protective caps for unused slots / connector .
31. The transient current source (coil, magnet valve, contactor, relay and etc), the suppressor shall be included.
32. All cable terminations shall be of the crimped type and soldered connections shall not be used.
33. Fire retardant heat shrinkable Cable markers shall be provided for the dual mode detrainment door internal wiring. Also, fire-retardant heat shrinkable Clear Sleeves shall be provided over the Cable marker for avoiding fading of the cable marking.
34. A minimum of 10 percent spare terminals shall be provided on each connector or terminal assembly.
35. Equipment side connectors for Di-electric test - Subcontractor shall supply one full set of Terminal blocks/connectors and its contacts as mounted on the equipment to carry out vehicle level voltage withstand test at BEML factory. Detailed list shall be decided and finalised before first supplies."
36. Necessary special tools if proposed during design stage by CMRL shall be designed and submitted by subcontractor
37. Any other item deemed essential by the subcontractor, for installation & proper functioning, testing, commissioning and integrated testing of the Dual Mode Detrainment Door.
38. Complete Dual Mode Detrainment Door system shall be in ready to fit condition.
39. Gold contacts shall be used / provided for the signal cables by Detrainment Door supplier.
40. Detrainment door latched, stowed & locked status for TCMS monitoring to be provided as Potential free contact.
41. Emergency Detrainment door status shall be monitored by Signalling as safety/vital input. Suitable input to be provided.

7.3. Engineering Support

1. Subcontractor shall depute mechanical and electrical engineer(s) for following activities to BEML/ CMRL

2. The subcontractor shall provide sufficient staff and equipment to be able to present designs and conduct design review meetings and assist in other technical and administrative matters whenever/ how long required. Following meetings need to be attended during design approval and testing.

    a. PDR meeting
    b. PFDR meeting
    c. FDR meeting
    d. Testing and commissioning at BEML factory, depot & mainline.

7.4. Design Submission and Approval Responsibilities

7.4.1. General

1. The objective of the design submission process is to ensure that the proposed resulting works comply with the specifications, are capable of being produced consistently to exacting quality standards, achieve low life cycle costs and can be operated safely to the satisfaction of the Engineer.

7.4.2. Design Submission & Approval Responsibilities

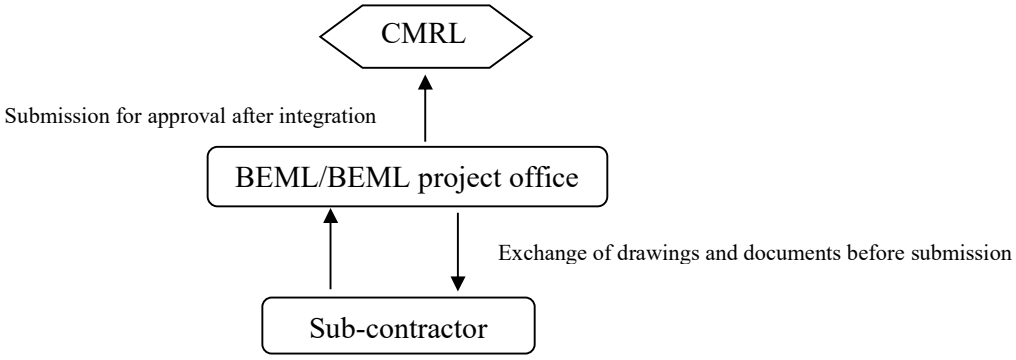
BEML & sub-contractor shall obtain approval of their respective drawings and design documents from CMRL in accordance with ERTS-RS Appendix G - “Documentation and CAD drawing requirements” and ERTS-RS Chapter-15 “System Support”.

BEML & sub-contractor shall be responsible for the approval of design documents and drawings for respective scope of areas. BEML and sub-contractor will exchange their documents and drawings & review the same before submission to CMRL for a preliminary interface checking of mechanical and electrical parameters.

The drawings and documents related to interface shall be combined and integrated with the main principal part of system to form one combined material for submission to the client for approval.

The sub-contractor shall comply ERTS-RS clause 16.6 to 16.13.

The work procedure for design submission to be followed is as below:



The sub-contractor shall submit three (03) hard copies and electronically (in PMIS) all documents and drawings in agreed format to CMRL/BEML & GC. The sub-contractor shall also submit knowledge sharing presentations / drawings / documents to BEML/CMRL & GC.

The documents shall be submitted in the following software unless otherwise stated, for the various electronic submissions required. Any formulae / micros / programmes used therein shall not be hidden / masked and must be visible and transparent without any compromise and shall be validated for the submissions. The following software compatible for use with Intel-Windows based computers shall be used, unless otherwise stated, for the various electronic submissions required:

Document Type	Electronic Document Format
Text Documents	MS Office (latest) Professional version
Spread Sheets	
Data Base Files	
Presentation Files	
Programmes Version 2.0a	Primavera for Windows or any latest better tools
AutoCAD Graphics	AutoCAD 2019 (latest)
Photographic	Adobe Photoshop, Ver.4.0 or latest version
Desktop Publishing	Page Maker 6.5,5
CADD Drawings	AutoCAD 2019 (latest)

7.4.3. Design Review

1) The Design reviews will be conducted to evaluate the progress and technical adequacy of the design and compatibility with the performance requirements as per technical provision of ERTS-RS 16.13. The sub-contractor shall ensure that the submissions are as per ERTS-RS.

2) The design reviews shall take place in three (3) phases as detailed below as per ERTS:

a. The Preliminary Design Review (PDR)

b. The Pre-Final Design Review (Pre-FDR)

c. The Final Design Review (FDR)

3) Sub-contractor shall ensure that relevant subject experts shall participate in both the physical and virtual design reviews and interface meetings.

4) Details of 3-D files shall be of the following but not limited to,

a. Visualization of BOM (Bill of Materials) of equipment up to the level of LRU & SRU

b. Views of all Components covering all the Recommended preventive as well as corrective maintenance of the OEMs.

7.5. Design Deliverables

1. For System, sub-system and components, the sub-contractor shall submit documents and drawings describing function description, product description, interface requirement description, RAM requirement description, Life cycle calculations, Type & routine test specifications, list and details of spares, related calculations etc.
2. Sub-contractor shall supply exhaustive documentation on complete Dual Mode Detrainment Door System, its sub systems and components, Door electronics (hardware), project software details, explanation and functionality at component and system level. It shall also include trouble shooting and diagnostic details. explaining clearly the logics etc.
3. The sub-contractor shall provide BEML with all necessary drawings, reports, calculations, technical specifications, technical data and similar documents of design, system assurance, quality assurance, manufacturing and testing with respect to PTS according to the time schedule approved by BEML.
4. These drawings and documents shall be delivered in English with the data format of, respectively, latest AutoCAD (2015) release. (Document - MS Word, spread sheet - MS excel, data base files - MS Access, Presentation file - MS Power Point).
5. The drawings shall contain minimum of three (3) views (for example, front view, top view and left side view). The sub-contractor shall provide STEP/IGES (Neutral format) file or CATIA file of 3D model of all Door system components & 2D drawings to BEML for preparing engineering mockup.
6. As-built drawings shall be updated on a regular basis based on the performance of trains up to first 2 years of DLP and shall be submitted along with final design document delivery as per ERTS-RS.
7. In the event that a statutory body (e.g., Government of India Ministry of Railways, RDSO, Commissioner of Metro Railway Safety, etc.) requires design information in a particular format, it shall be incumbent upon the supplier to provide the same, as directed by the BEML. The sub-contractor shall also comply with ERTS-RS 16.12.

8. The sub-contractor shall submit the design deliverable submission schedule for acceptance within following requested due date, and resubmit it whenever updated.
9. The sub-contractor shall submit BEML all necessary documents and deliverables such as the detailed drawings, specifications, assumptions, calculations, back-up data, plan, procedure, reports, co-ordination & interface information which possibly affects performance, fitting for approval according to the schedule accepted by BEML.
10. It is sub-contractor's responsibility to provide sufficient support and information for obtaining "Notice of No Objection (NONO)" for design document pertaining to sub-contractor in accordance with ERTS-RS.

The sub-contractor shall submit, but not limited to, the following design deliverables in accordance with the required schedule as per ERTS-RS Appendix H – Deliverables associated with Dual Mode Detrainment Door System and its interface:

Stage	**Document/Deliverable**	**Submission and approval**
Tender offer	Supporting documents for Qualification criteria as per Cl.4.	Along with tender technical offer
	Vendor approval documents including company profile with infrastructure facilities, product range, proposed manufacturing facility, supply credentials, Declaration etc., as per Cl.4	
	General Technical Description of proposed Dual Mode Detrainment Door system including door operation, sealing arrangements, Electrical, sound insulation & thermal insulation details and concept drawings.	
	Estimated weights of Dual Mode Detrainment Door System.	
	ERTS RS & PTS clause by Clause compliance	
	Project Management Plan	
	Spares technical offer including and recommended special tools, jigs and fixtures.	
	Bill of Materials (BOM)	
Preliminary Design Review (PDR)	General System Description of proposed Dual Mode Detrainment Door system.	

	Preliminary design Drawings (Dimensional Installation Drawings: Autocad or CATIA file)	Within 1 month of LOI/ contract award, submission and further updates including BEML/ CMRL approval
	Interfacing with carbody and other systems	
	Interfacing with TCMS & other electrical systems	
	List of standards and codes	
	RAMS documents	
	Fire safety plan	
	Noise and Vibration plan	
	Inspection, Testing and commissioning Plan	
Pre-Final Design Review (PFDR)	General Assembly, Installation and detail Component drawings of Dual Mode Detrainment Door system in a AutoCAD or CATIA file	Within 3 months of LOI/ contract award, submission and further updates including BEML/ CMRL approval
	Preliminary/Final 3D model of Dual Mode Detrainment Door system	
	Technical Description of proposed Dual Mode Detrainment Door System with functional description, detailed technical specification, data sheets, simulations etc., of the system and subsystems.	
	List of standards and codes	
	Fire safety Test Reports of the items including heat release rate for standard items common with other projects of the subcontractor	
	RAMS Deliverables	
	SIL 2 certificate as per 6.9.8	
	Preliminary test plan for Door systems & sub-systems	
	Preliminary outline of 6 types of manuals & Electronic manuals	
	Detailed Training proposal	
Final Design Review (FDR)	Final Design Drawings (Dimensional Sub-assembly drawings: Autocad or CATIA file)	Within 4 months of LOI/ contract award,

	Type Test Procedure (incl. record sheet) & Report	submission and further updates including BEML/ CMRL approval
	Routine Test Procedure (incl. record sheet) & Report	
	FAI Procedure & Report	
	Fire Safety Test Reports including heat release rates	
	Final List of Spares, Special Tools, Test Equipment	
	Draft and final of 6 types of manuals & Electronic manual	
	Training Manuals & Materials	
	Type test reports & FAI reports	
	All As-Built Drawings (Final drawings) of each part of Door system in Autocad, CATIA & Solid works.	
All stages	Design progress report	
	All PFDR & FDR design deliverable submission with updation based on type tests at unit level, car level, train level at subcontractor's place, BEML factory, depot and mainline, upto the satisfaction of CMRL.	
	Open items list	
	Master test plan and progress	
	Waiver request/Spec. Clarification items	
	Any other design data requested	
Note: Over and above mentioned documents, subcontractor shall submit any additional documents required by BEML/CMRL.		

11. BEML will review the submission of subcontractor's design submissions and will furnish review comments in writing or on marked up drawings and specifications to the subcontractor. Within one week of the receipt of comments, the subcontractor shall submit his proposals for implementation in the next submission. Once the design submission is acceptable to BEML, it will be submitted to CMRL for approval and it will be reviewed by them. Subcontractor shall re-submit the revised document incorporating CMRL comments issued during first review within one week. Sub-contractor shall submit requested documents/drawings during approval process within one week from each request.

12. Subcontractor shall establish the project schedule (including design completion schedule) by considering this review turnaround time.
13. In the event that the submission is rejected, the Subcontractor shall improve the design to the acceptable completion level and resubmit it for review within one week. Any adjustments in design activities to recover the lost time due to the re-submission shall be the full responsibility of the Subcontractor and shall submit the catch-up plan for no schedule impact.
14. **The Subcontractor shall be responsible for meeting the requirement of constructional details, material, and workmanship. All materials and workmanship shall be in every respect in accordance with the proven up-to-date best practice. The requirements for material and workmanship of Detrainment Door systems shall be met, to the requirements of ERTS RS Chapter-19, as a minimum**.
15. The subcontractor should take whole responsibility for occurring Liquidated Damage due to delays with regard to design data submission, production, supply, design error and so on.
16. The design, hardware & interfaces proposed/agreed during design will be subjected to review and updating /rectification/modification etc. based on the operational, maintenance reliability or safety requirements and generally in accordance with the subcontractor's proposals. In specific cases, the Project Manager may issue specific instructions in writing for undertaking the modifications to meet the above requirements. In such cases, the Project Manager instructions shall be implemented as instructed. The contractor shall abide by the Engineer’s instructions without any additional cost.

7.6. Test Program

7.6.1. General

1) The sub-contractor shall be responsible for performance tests of the components under scope of supply as per ERTS-RS Section 17 and submit the compliance. BEML and/or CMRL/representative have the right to witness any of these tests at any stage of test progress.
2) As per ERTS-RS, all the tests shall be carried out at the sub-contractor’s cost, wherever performed, in the presence of and to the satisfaction of BEML/CMRL, who reserves the right to witness any or all of the tests and to require submission of any or all test specifications and reports. In the event of failure to meet the requirements of ERTS-RS Section 17 Technical Provisions in any test, the sub-contractor shall make necessary corrections to the equipment and re-test at his own expense.
3) All test plans, procedures, and reports shall meet the requirements of ERTS-RS clause 17.2 and 17.3 and are subject to review and approval by CMRL.

4) In case of any change in the place of manufacturing then related type tests shall be repeated.
5) The individual equipments, sub-systems and systems, shall be type and routine tested in accordance with the test specifications and test procedures drawn by the sub-contractor and approved by CMRL. The test specifications shall be based on the requirements specified in respective IEC Standard or any other equivalent International Standards. After successful completion of the tests, sub-contractor has to submit the test reports for review and acceptance by CMRL.
6) In addition to 'mandatory' tests as prescribed in IECs, the sub-contractor shall have to perform any additional test as requested by the Statutory Authority for obtaining the sanction of Rolling Stock for passenger service.
7) The sub-contractor shall carry out the routine test of equipment and assembly and also submit the type test reports carried out for same components.
8) Wherever any equipment, system or sub-system is not specifically covered by an internationally recognized specification or test procedure, or where the type and routine tests prescribed by IEC or other international standard do not adequately cover the requirement, tests which are acceptable both to the sub-contractor and to the CMRL/BEML, shall be devised.
9) If any of the required tests have been previously performed by the sub-contractor, under conditions similar to those defined in ERTS-RS, a copy of the test procedure and report may be submitted for CMRL's evaluation. Upon review of such submittals, CMRL may waive the actual performance of the test and accept the test results as being adequate to demonstrate compliance with the requirements of ERTS. CMRL will make every reasonable effort to accommodate and accept previously performed tests similar to ERTS-RS requirements. If Submitted data is not be acceptable to CMRL, the sub-contractor shall complete the tests as specified, with no increase in contract cost or extension to the delivery schedule.
10) Approval may be given to waive tests required by the Technical Provisions if compliance with the requirements can be demonstrated adequately by analysis. A formal waiver request shall be made for each instance of such, and approval will be at CMRL's discretion.
11) All defects and shortfalls in the sub-contractor's system, discovered during all tests, shall be rectified and re-tested to the satisfaction of BEML/CMRL.
12) The sub-contractor shall provide full instrumentation to conduct all tests and carry out

modifications as required.

13) All test procedures, reports including all maintenance activities and check lists shall be submitted and approved by BEML/CMRL.
14) The results of all tests shall be submitted to BEML/CMRL, who will record his conclusions as to whether or not the equipment being tested has passed satisfactorily.
15) The sub-contractor shall produce a test report, in three copies, and in an approved format, within and defined period following the test, for acceptance by BEML/CMRL.
16) To carry out the routine test of Dual Mode Detrainment Door System at a train level (after dynamic commissioning of first trainset) the sub-contractor shall provide 2 set of the necessary hardware /software tools required for carrying out the routine test.

7.6.2. Inspection

1) The sub-contractor shall assure inspection and verification of compliance at all its facilities. Further inspections shall take place at the sub-contractor's, BEML's and CMRL's facilities to identify any components, systems, or equipment damaged during shipment or during any stage of the project.
2) All the materials, fittings, equipment, manufacturing processes and assembly workmanship shall be subject to inspection by BEML/CMRL, wherever carried out in accordance with the requirements specified in ERTS-RS clause 18.9. The sub-contractor shall submit the compliance to the ERTS-RS 18.9.
3) The sub-contractor shall perform First Article Inspection (FAI) of all the components. The test reports of all the FAI shall be submitted to the BEML/CMRL for review as per ERTS-RS18.9.7.
4) BEML/CMRL shall have free access to the sub-contractor's premises and to any other places where tests are proposed to be carried out, throughout the Contract, for the purpose of reviewing and inspecting the designs and manufacturing processes, and mock-ups. The sub-contractor shall provide the BEML/CMRL full opportunity to inspect, examine, measure, and test any of the Works on site, or wherever carried out.

7.6.3. Test Procedure and Reports

1) Test and inspection procedures shall be carried out in accordance with IEC 61133 (2006) or latest unless otherwise specified within the requirements of this Performance Specification as per ERTS-RS 17.3.
2) For each test, the sub-contractor shall submit a detailed test procedure for each of equipment/subsystem for CMRL approval. Any such test procedures shall be prepared

by the manufacturer of the system or component to be tested. The sub-contractor shall thoroughly review any test procedure before submittal to CMRL to ensure that testing also verifies system integration parameters.

3) Following points shall be complied as a minimum:
    a) All test equipments and measurement tools shall carry an appropriate and valid calibration label and certificate.
    b) The sub-contractor shall sign all reports of Tests.
    c) Test procedures shall be amended, as required by the employer throughout the duration of the contract, to reflect changes in system design or the identification of additional testing requirements.
    d) All costs including labor, supervision of testing, provision of specialized equipment and materials, and the cost of hiring consultants and the services of other specialized personnel or independent assessors etc. shall be borne by the sub-contractor. The sub-contractor shall also bear any expenses incurred due to re-testing caused by defects or failure of equipment or any other account to meet the requirements of the contract.

7.6.4. Test Classification

1) The tests to be performed as per ERTS-RS 17.4 on equipment's, sub-system, cars and trainset are categorized as follows:
    a) Design Conformance Tests
    b) Production Conformance Tests
    c) Train Acceptance Tests

7.6.5. Equipment Type Test & Routine Test

The Dual Mode Detrainment Door System shall be type and routine tested in accordance with relevant standard and specifications at subcontractor's works.

The subcontractor shall carryout the following type tests and routine tests, as a minimum and shall submit the reports.

Test	Type Test	Routine Test
1. Load and Evacuation test	O	—
2. Endurance Test	O	—
3. Shock & Vibration Test	O	—
4. Noise Test	O	—
5. Fire Safety Test	O	—
6. Operation(Function) Tests	O	O
7. Weight Checking	O	O
8. Water Tightness Test	O	O

Test	Type Test	Routine Test
9. Door leaf exterior cover & Windscreen glass	O	—
10. Visual Inspection	O	O
11. Dimensional Inspection	O	O
12.SIL testing	O	—

7.6.5.1. Load and Evacuation test (ERTS 6.9.12)

The ramp shall withstand load 500kg/m^2 or more and it shall not excessively sag or have permanent deformation >1mm after loading during evacuation process.

7.6.5.2. Endurance Test (ERTS 6.9.17 & 17.5.3.6.1)

Detrainment door: The detrainment ramp shall be tested with an uniformly distributed load of 750kg. The loading and unloading shall be repeated for 500 cycles. The detrainment ramp shall not deform after the test.

The subcontractor shall propose a suitable type test procedure to demonstrate compliance with all requirements. Separately, an endurance test shall also be performed to demonstrate 200 open/close cycles of operation.

7.6.5.3. Shock & Vibration Tests

Shock & Vibration test shall be carried out as defined in IEC 61373 and shall comply with the requirements for Category 1 class A.

7.6.5.4. Noise test

Sound reduction index Rw of the door panel assembly measured as per ISO 10140-2 shall be equal to or greater than 32 dBA.

7.6.5.5. Detrainment door functional operational testing(ERTS 17.5.4.8.20):

Detrainment door functionality during the passenger detrainment shall be tested for conformance according to Chapter 5, Chapter 6, Chapter 13 & Chapter 14.

7.6.5.6. Fire Safety Test

All non-metallic components in the Dual Mode Detrainment Door system shall meet fire safety requirements as per category HL-3 of EN 45545. Fire safety test reports shall be

submitted.

7.6.5.7. Functional Tests

The subcontractor shall carry out the functional tests to demonstrate the proper functioning of the Dual Mode Detrainment Door system. Also, emergency operation mode complete deployment shall not take more than 1 minute and also the stowing shall not take more than **3 minute**. However, deployment and stowage timings will be reviewed by the Engineer.

7.6.5.8. Water Tightness test (ERTS 6.9.27)

There shall be no draught, dirt or water entering through the detrainment door and it shall not generate any noise while the Train is in motion. The arrangement shall comply with BS EN 60529 IP65 or EN 14752(The water tightness test shall be carried out as per clause 4.10.2 of EN 14752 with continuous water spraying for a duration of 15 minutes).

7.6.5.9. Door leaf exterior cover & Windscreen glass.

The requirements for these items shall comply with the testing requirements for cab mask and side windscreen glass of carbody.

Windows Qualification Testing (ERTS 17.5.2.8)

Windshield and detrainment door glazing shall be impact tested according to EN 15152. Body side windows, cab windows and passenger door windows shall be impact tested according to DIN 52306 and fulfill bending according to EN 1288. One (1) sample of each type of window, selected at random by CMRL, shall be tested. Structural requirements for rail vehicle structures shall be tested and conform with GM/RT2100, UIC 566, EN 12663-1, UIC 651, EN 15152.

7.6.5.10. Visual inspection

Visual inspection shall be done for 100% of the supplies. There shall be no cracks, damages or any other defects.

7.6.5.11. Dimensional inspection

The dimensional inspection shall be carried out for 100% of the supplies and test reports shall be submitted.

7.6.6. First Article Inspection (FAI)

1. The subcontractor shall offer the first set of Door assembly for First Article Inspection by BEML/ CMRL in accordance with the Engineer approved FAI plan prior to serial production in order to confirm that the item produced fully complies with the technical

specifications, System design and manufacturing process.

2. The Subcontractor shall ensure that the produced equipment is compliant to all requirements prior to inviting for testing and FAI. The pre-test result prior to official testing/FAI shall be submitted with the invitation letter to request Engineer's witness.
3. At the FAI, the subcontractor shall make available all pertinent design and manufacturing process documentation, test records, material certifications, etc.
4. During FAI, if any inspections or tests indicate that specific hardware or documentation does not meet the specified requirements, the appropriate items shall be repaired, replaced, upgraded, or added by the Subcontractor at their own cost, as necessary to correct the noted deficiencies. After correction of deficiency, all tests necessary to verify the effectiveness of the corrective action shall be repeated.
5. If FAI has to be repeated due to non-compliances/ deficiencies noticed, the cost towards the same and the cost towards BEML/CMRL visit to subcontractor's place for witness of re-FAI shall be to subcontractor's responsibility.
6. Upon acceptance of the FAI by End User, the subcontractor is then free to proceed to manufacture all pertinent hardware. The hardware must meet or exceed the quality standards set at the FAI, and must incorporate any comments made by End User at the FAI.
7. Subcontractor shall note that the Engineer FAI clearance will not relieve the subcontractor's responsibility towards design, production, quality, reliability, availability, maintainability and safety of the systems and sub-systems during the revenue service.

7.6.7. Installation and Commissioning

1. After the Doors are delivered, the subcontractor shall depute his Engineer for the installation and commissioning of the Door System on the First Train set.
2. Modifications/ corrections, if any, shall be carried out by the subcontractor at his own cost.

7.6.1. BEML Factory Tests

7.6.1.1. Type Test, Completed car, unit and train tests

The individual cars and complete trains will be type tested by BEML under subcontractor's responsibility for Dual Mode Detrainment Door System with IEC 61133. The subcontractor shall participate in this testing to ensure that the Dual Mode Detrainment Door System meet the performance requirements specified in the contract and do not introduce any adverse effects into the train. The subcontractor shall be responsible for correcting any interfacing defects The subcontractor shall carryout hardware modifications, if required, at his own cost.

7.6.1.2. Routine Test, Completed Car, unit and train tests

1. The individual cars and complete trains shall be routine tested by BEML under subcontractor's responsibility for Dual Mode Detrainment Door System test in accordance with IEC 61133. The subcontractor shall be responsible for correcting any interfacing defects.
2. These tests will be a subset of those tests performed at Type Test, complete vehicle to demonstrate that the principal features of the door system are compliant with the ERTS RS. This test shall include but not be limited to a test of all safety system.

7.6.2. Testing and Commissioning of cars/trains in Depot

7.6.2.1. Type Commissioning Tests

1. On the first train or trains delivered, BEML will undertake Type Test for Dual Mode Detrainment Door System of commissioning tests at the depot to adequately demonstrate that the requirements of ERTS RS have been satisfied, under the subcontractor's responsibility.
2. The subcontractor's design engineer shall also participate in this testing to ensure that the Dual Mode Detrainment Door System meet the performance requirements specified in the contract and do not introduce any adverse effects into the railway and its environment. This testing shall demonstrate compatibility between Dual Mode Detrainment Door System and the interfacing system. The subcontractor shall be responsible for correcting any interfacing defects.

7.6.2.2. Routine Commissioning Tests

1. Following delivery of the trains to the depot, train will be commissioned by BEML and at an appropriate time the Engineer will witness certain of these tests to satisfy himself that the Dual Mode Detrainment Door System are acceptable for operating in passenger service.
2. This test for Dual Mode Detrainment Door System shall be performed by BEML under subcontractor's responsibility. The subcontractor shall be responsible for correcting any interfacing defects.
3. These tests will be a subset of those tests performed at type commissioning test to demonstrate that the principal features of the door system are compliant with the ERTS-RS.

7.6.3. Testing and Commissioning of cars/trains in Mainline

7.6.3.1. Noise Test

1. BEML will undertake Type Tests on the trains to demonstrate that the Noise levels of the car interiors are within the specified limits of the requirements of ERTS RS. The mainline tests will be carried out.
2. The subcontractor's design engineer shall also participate in this testing to ensure that the Dual Mode Detrainment Door System meet the performance requirements specified in the contract. Modifications, if any, required to the door system sealing, to meet the train level contract requirements, shall be carried out by the subcontractor, at his own cost.

7.7. Submissions for Statutory Approvals

1) The sub-contractor shall be responsible for all necessary submissions required to obtain all statutory approval(s) necessary to permit the fleet to enter revenue operation as per ERTS-RS 17.11.
2) The sub-contractor shall comply with all the Statutory requirements and guidelines related with Research Designs and Standards Organization (RDSO), Ministry of Railways (MoR), Commissioner of Metro Railway Safety (CMRS), Ministry of Housing and Urban Affairs (MoHUA) or any other bodies related to the sanction and operation of metro rolling stock.
3) The sub-contractor shall also ensure that all the requirements are covered in their documents pertaining to the Dual Mode Detrainment Door System which are stated in Enclosure 6 “Procedure for Safety Certification and Technical Clearance of Metro Systems” of this PTS.
4) The sub-contractor shall be responsible for submission of any additional data for design clearance and certification by the Commissioner for Metro Railway Safety (CMRS). All interface data interchange is described in Appendix C, Interfaces of ERTS-RS.
5) In the event that a statutory body (e.g., Government of India Ministry of Railways, RDSO, Commissioner of Metro Railway Safety, etc.) requires design information in a particular format, it shall be incumbent upon the sub-contractor to provide the same, as directed by the BEML.
6) OEM shall also support during the RDSO trials and Commissioner of Metro Railway Safety (CMRS) inspection along with the necessary instrumentation for the testing, if required. All the test data shall be recorded and report shall be submitted.

7.8. Operating Rule Book

The sub-contractor shall provide technical input associated with the Works to the BEML/CMRL for incorporation into the "Operating Rule Book" as per ERTS-RS 15.7.

7.9. Operating Procedure Manuals

The sub-contractor shall provide technical input associated with the Works to the BEML/CMRL for incorporation into the "Operating Procedures Manuals" as per ERTS-RS 15.8.

7.10. Operation and Maintenance Manuals (O&M Manual)

1. The subcontractor shall provide Operation and Maintenance (O&M) manuals, for use by supervisory, operating and technical staff of BEML/CMRL, conforming to ERTS-RS 15.9.
2. The O&M manual must provide all the essential operating and maintenance information to a level of detail that enables CMRL staff to operate, test, maintain, overhaul and repair the equipment to meet the specified performance requirements. The information contained within the manual shall comprise text, tables, technical illustrations and diagrams structured. It is the responsibility of the subcontractor to provide the required level of information for all sub-systems and equipment within its scope of supply. The subcontractor shall supply the following types of manuals as a minimum.

   Volume I : Technical Manual

   Volume II : Operation Manual

   Volume III : Maintenance Manual

   Volume IV : Faults Diagnostics Manual

   Volume V : Spare Parts Manual

   Volume VI : Special Tools and Test Equipment Manual

3. All the details specified in chapter-15 of ERTS-RS shall be covered in detail in the above volumes.

7.10.1. Operation manuals & technical description

The sub-contractor shall provide operating manuals and technical descriptions as per ERTS-RS 15.10.

7.10.2. Maintenance manuals

The sub-contractor shall provide the maintenance manuals for all equipment supplied as part of the Works as per ERTS-RS 15.11. The sub-contractor shall provide maintenance manuals explaining the components description, maintenance requirements, failure rectification and trouble-shooting, trouble-shooting, over-hauling maintenance details of the Dual Mode Detrainment Door System together with its component subsidiary systems and individual item of equipment

7.10.3. Storage, Packing, Crating and Marking

The sub-contractor shall be fully responsible for the provision and maintenance of acceptable storage facilities for the Plant and any materials or equipment he intends to use for the carrying out of the Works as per ERTS-RS 18.15.

7.11. Training

1. The sub-contractor shall provide comprehensive training to the CMRL / BEML / Employer's staff in operation, maintenance, engineering, etc.., of the Dual Mode Detrainment Door System in accordance with the training activities and works as per ERTS-RS Clause 15.4, 15.5, 15.12, 15.13, 15.14, 15.15, 15.16 & ERTS-CMC as a minimum.
2. The supplier shall provide according to requirement of BEML and CMRL training schedule, time, method and site etc.
3. The subcontractor shall provide a training proposal, one original and five colour copies and electronics copies of the training manual for use by CMRL / BEML for conducting in-house training.

4. Milestone Number	Milestone Activity	No of Days
RS-H4	Provision of Contractor's Driving Instructors for Training of Employer's operating personnel in India.	5 Man Days
RS-H5	Provision of Contractor's Instructors and OEM's Experts for on job Training and supervision of Employer's maintenance personnel in the metro train depot of CMRL in India.	42 Man Days

Table 1: Tentative Training Plan

1. The technical offer for training shall be submitted along with the technical offer

8. DNP / DLP / Warranty

1. Refer GCC, SCC, ERTS-RS & ERTS-CMC and related clauses of the tender.
2. Sub-contractor shall ensure minimum spare parts that he intends to make available during the installation, erection, commissioning and DNP/DLP/Warranty period.

3. The sub-contractor shall keep on site, throughout the installation, erection, commissioning and warranty period, stocks of spare parts, to enable rapid replacement of any item found to be defective or in any way in non-conformance with the specification.

9. Comprehensive Maintenance Contract

1. The sub-contractor shall support at all times throughout the Comprehensive Maintenance Contract (CMC) period, maintain Dual Mode Detrainment Door System of Rolling Stock in accordance with the provisions of the Contract, Applicable Laws, Applicable Permits and Good Industry Practices.
2. "Spares" and “Tools” shall include all types of Spares and Consumables, Special Tools, Jigs, Fixtures, Gauges, Testing and Diagnostic Equipment, Mechanical & Electrical Measuring and Testing Equipment, Mechanical, Pneumatic and Electric Tools, test benches and any other items required for all types of maintenance activities carried out on Rolling Stock for Dual Mode Detrainment Door System as per ERTS-CMC Part-2: Section VI C.

   Spares requirement shall be as per Annexure-A of the document.

10. List of Annexures and Enclosures

10.1. Annexures

Annexure No.	Document Description	Remarks
1	Submittals Check Sheet	-
2	Door Interface Drawing GR-5682	-
A	Spares as per Annexure-A	

10.2. Enclosures

Enclosure No.	Document Description
1	Section VI A: Employer’s Requirements Technical Specification (ERTS) – Rolling Stock (RS)
2	Section VI C: Employer’s Requirements Technical Specification (ERTS) – Comprehensive Maintenance Contract (CMC) of Rolling Stock and Depot Machinery & Plant.
3	Format for Submission of Vendor/Subcontractor/Suppliers Credentials: Rolling Stock
4	Form Sys-3: Subcontractors/Manufacturers
5	Form MAN: Manufacturer's Authorization
6	Procedure for Safety Certification and Technical Clearance of Metro Systems by RDSO

11. PTS & ERTS Compliance

1. The subcontractor shall offer a valid and fully compliant proposal for the Dual Mode Detrainment Door System as detailed in ERTS-RS, ERTS-CMC and PTS.
2. The subcontractor shall submit a detailed clause by compliance report for all the clauses of ERTS-RS, ERTS-CMC and PTS with regard to Door System.
3. The supplier must ensure that no separate offers or cost implications of whatsoever type due to any reasons are mentioned in the proposed offer in CBC. Such offers or claims shall be summarily rejected without giving any further opportunity.
4. Any clause of ERTS-RS, ERTS-CMC, PTS for which no comments have been provided in CBC by the supplier shall be construed as favorable to BEML.
5. It is suggested that supplier shall list out all deliverables or supply elements mentioned in this PTS and submit offer/ proposal for the same. Any queries can be addressed to BEML before submission of offer. Once the offer is submitted to BEML, it is deemed to be understood as inclusive of all deliverables, irrespective of whether it has been specifically asked or not.
6. The sub-contractor shall submit, along with the technical offer, the Clause-by-Clause Compliance for the ERTS-RS, ERTS-CMC and this PTS as follows:
    a. **Complied:** “Complied” shall be indicated by the sub-contractor where the sub-contractor is able to comply fully with the clause.
    b. **Noted & Complied to Door System scope of supply:** Where a clause merely provides information and no other comment is necessary, “Noted & Complied to Door System scope of supply” will suffice.
    c. “Noted” and/ or “any comments” shall be regarded as non-compliance from the subcontractor for his Scope of supply/ work.
7. **Offers with Non-compliance and deviations to any of the** ERTS-RS, ERTS-CMC and PTS **clauses with regard to Door System, are liable for rejection.**

12. Project Management

1. The sub-contractor shall assist BEML to smoothly carry out Project management, Co-ordination with designated and other contractors, Design submission, etc. according to the requirements specified in ERTS-RS Chapter 16 “Management Program”.
2. The subcontractor shall comply with the detailed requirements to be specified later by BEML/ CMRL if any.
3. Along with the technical offer, the sub-contractor shall submit a Project Management Plan which shall provide a clear over-view of the Contractor's organization, the management system and methods to be used for completion of the works.
4. The Project Management Plan in line with ERTS-RS Clause 16.3 and shall provide the following information:
    a. An organization chart which clearly identifies all staff expected to be allocated to the Works; indicating reporting lines to the Key Staff or any additional departmental managers proposed.

b. Resumes for each Key Staff member.

c. A job scope clarifying of the duties and responsibilities of each departmental manager / Key Staff member.

d. A resource plan for the project from NTP through the end of the CMC Period, showing the levels of staffing to be provided at each phase for each discipline and functional area.

e. A description of the methodology to be used to track and control program progress against the program schedule.

f. Master Program Schedule as described in ERTS-RS Clause 16.6.

13. Submittals with Technical Offer

The sub-contractor shall submit all the document as per Annexure 1 - Submittals Check Sheet.

-End-of-Section-