



BANGALORE METRO RAIL CORPORATION LIMITED

BID No. 5RS-DM

**DESIGN, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING
OF 318 NOS. OF STANDARD GAUGE METRO CARS AND TRAINING OF PERSONNEL
INCLUDING COMPREHENSIVE MAINTENANCE UPTO FIFTEEN (15) YEARS UNDER
BANGALORE METRO RAIL PROJECT PHASE-2, 2A AND 2B**

PART- 2

SECTION-VI A: EMPLOYER'S REQUIREMENTS – GENERAL SPECIFICATIONS

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EMPLOYER'S REQUIREMENTS: GENERAL SPECIFICATION

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1. SCOPE OF THE GENERAL SPECIFICATION

1.1. General

1.1.1. ~~This Specification covers the general aspects of the bid viz., description of the Works, Project Management, Design submission requirement, Inspection testing and commissioning requirements, Warranty requirements, Operation & maintenance manual, Software management and control plan, Supply of spares, packing requirement, Training requirement, Site Management, Draughting and CAD Standards, Maintenance Requirements of Train sets, Depot Machinery & Plant, Driving Simulator including provision of mechanical & Electrical Measuring and testing equipment, Mechanical, Pneumatic and electric tools, special tools, jigs & fixtures and any other items etc. This General Specification shall be read in conjunction with the General Conditions (GC), Particular Conditions (PC), Technical Specification, and Instructions to Bidders (ITB). The abbreviations used in this General Specifications are given in Appendix 7 to this Specification.~~

Addendum-1 dated 05.12.2022, Sl. No. 32

This Specification covers the general aspects of the bid viz., description of the Works, Project Management, Design submission requirement, Inspection testing and commissioning requirements, Operation & maintenance manual, Software management and control plan, Supply of spares, packing requirement, Training requirement, Site Management, Draughting and CAD Standards, Maintenance Requirements of Train sets, Depot Machinery & Plant, Driving Simulator including provision of mechanical & Electrical Measuring and testing equipment, Mechanical, Pneumatic and electric tools, special tools, jigs & fixtures and any other items etc. This General Specification shall be read in conjunction with the General Conditions (GC), Particular Conditions (PC), Technical Specification, and Instructions to Bidders (ITB). The abbreviations used in this General Specifications are given in Appendix 7 to this Specification.

1.1.2. General Description of the Works

The Tables-1A below shows route length of those corridors that are relevant to Bid 5RS-DM. These corridors are on Standard Gauge. Table-1A shows the length of the corridor.

TABLE – 1A: LINE R6 for Phase-2, Phase-2A and Phase-2B			
Sl. No.	Name of the Corridor	Approx. Total Length (Elevated/ Underground) in KM	Number of 6-car trainset required
1	Phase-2- New Line R6		
i	Kalena Agrahara to Nagavara (R6)	21.5 Elevated :8 KM, UG: 13.5 KM	16
2	Phase-2A		
i	Silk Board Junction to KR. Puram	19.8 (Elevated)	16

3	Phase-2B	
i	KR. Puram to KIA Terminal	38.4 (Elevated) 21
Total (1+2+3)		79.7 53 (318 cars)

The above corridors may be modified by not more than 5% increase on account of new stations / relocation of stations / rationalisation of curves & gradients during final layout design. The Contractor shall be advised of such modifications, as appropriate and shall keep sufficient margins to ensure compliance to the specifications.

Kothanur depot is the associated depot for Line R6 respectively. Presently, Baiyappanahalli depot is the associated depot for East-West corridor. On completion of Phase-2A (Silk Board Junction to KR. Puram), Baiyappanahalli depot will be associated with this line and in place of that a new depot at Whitefield will be constructed which will be associated with East-West Corridor. For Phase-2B (KR. Puram to Kempe Gowda International Airport Terminal), a new depot at Airport will be associated.

- 1.1.3. All the lines shall be Elevated except in Line-6, Underground section is for 13.5 km between Dairy Circle to Nagavara.
- 1.1.4. Commercial / revenue operations in different sections relevant to 5RS-DM Bid shall be implemented progressively from June 2024 and completed before June 2025. Rolling Stock supply target shall be governed as per the specified key dates pertaining to these three lines. Key dates for the Train Sets to be procured under variation shall be mutually discussed and finalized before issuing Letter of Acceptance (LOA) for these Train Sets.
- 1.1.5. Scope of the supply: -

The Scope of the supply under this contract covers design, manufacture, delivery, testing and commissioning including integrated testing of light weight fully furnished modern passenger cars including the training of Operation & Maintenance personnel for BMRCL. The Scope also covers Design, Supply, Installation, Testing and Commissioning of Depot Machinery & Plant, Driving Simulator and 15 years Comprehensive maintenance of Rolling Stock, Depot Machinery & Plant, Driving Simulator for line R6, Phase-2A and Phase-2B including provision of mechanical & Electrical Measuring and testing equipment, Mechanical, Pneumatic and electric tools, special tools, jigs & fixtures and any other items required for the comprehensive maintenance of cars. The cars required for the corridors shall be of modern design, lightweight made of stainless steel with 3 phase AC drive having V.V.V.F control, regenerative braking, suitable for CATC (Continuous Automatic Train Control System) based ATP, ATO and UTO, etc. provided by other designated contractors and shall be suitable for Grade of Automation– 'GoA2' and 'GoA4' as specified in IEC62290-1:2006. The cars shall operate on 750V DC Third Rail Traction system with bottom current collection for Underground, Elevated and At-grade section. The detailed performance requirements and design criteria of the cars and equipment are covered in Employer's Requirements -Technical Specification.

- 1.1.6. For the corridors mentioned, the Rolling Stock requirements is mentioned in Table 1A above.

1.2. Localisation

Maximum number of 6-car trainsets that can be manufactured in the off-shore factory outside India is 13 trainset of 6-car each i.e., 78 cars. Balance cars shall be manufactured in India. For this, an essential condition for complying with the bid is that the Contractor shall either establish independent manufacturing facility in India or partner or associate with a suitable Indian reputed manufacturer for local manufacturing of coaches in India.

In case local manufacture is undertaken in the facilities of the local partner, Quality control (total) and testing at Works shall be the responsibility of the member/s of consortium based on whose credentials the bidder has qualified for this bid. The bidder shall submit detailed proposal indicating details of the Indian Partner (if any), the place of manufacture in India, Work schedule etc in the bid. However, if not finalized at Pre-bid stage, the Contractor shall submit all these details within 06 (six) months of the Effective Date for approval by the Employer.

Total number of coaches, trainsets units (including configuration) required to be supplied along with Key Dates for delivery & commissioning are indicated in the 'Attachment of Appendix LB-1 to the Letter of Bid'.

- 1.3.** In order to facilitate ease in maintenance and easy availability of spares, BMRCL is keen in standardisation and expects Contractor to make efforts to source maximum number of equipment and materials from India.

The items given in Table 1C of Employer's Requirements-General Specifications shall be indigenized and sourced from India to meet the required performance requirements and quality standards.

Contractor and the selected and approved OEMs shall either choose their partner in India or open a wholly owned subsidiary in India for manufacture of all such items that are listed in Table 1C. The Contractor as well as the OEMs (as the case may be) shall arrange granting of unqualified licenses to their chosen Indian partners to manufacture and sell such indigenised items for other than 5RS-DM Contract requirements also. The Bidder shall certify in its Bid that the 'Local Content' (LC) shall meet the requirement for 'Class-II Local Supplier' as defined in the Order No. P-45021/2/2017-PP (BE-II) of Ministry of Commerce and Industry, Department for Promotion of Industry and Internal Trade, Government of India, dated 16th September 2020 as amended up to date of Bid submission for the items listed in Table 1C.

BMRCL also expects that efforts will be made by the Contractor to indigenise items given in Table 1D.

During vendor approval stage, the Contractor shall also submit a commitment from the approved vendors that in case of any future procurement action by BMRCL, they shall quote for the procurement directly to BMRCL.

Contractor shall submit comprehensive proposal indicating details of the Indian Partner(s)/vendor(s), the place of manufacture in India, work schedule etc. for the above identified items for indigenization within 6 (six) months of the Effective Date for approval by the Employer. An approved comprehensive proposal for indigenisation of items indicated in 'Table-1C' shall be a pre-requisite for finalisation of Final Design. Maintaining quality standards, ensuring performance requirements and timely delivery shall be the sole responsibility of the Contractor. Contractor shall ensure that

indigenisation content in the train sets is progressively increased. BMRCL expects that for all 318 cars (equivalent items for 53 trainsets of 6-car each), the items given in Table 1C of Employer's Requirements-General Specifications shall be sourced from India.

In case of any deviation on above, the Employer at his sole discretion on representation by the Contractor giving detailed reasons for not achieving indigenisation as per above may accord approval for waiver subject to the condition that in case of non or partial accomplishment of indigenisation of any item(s) listed in Table 1C (except Consumables) for specified number of cars noted above, the Contractor shall supply 20% of shortfall items (non-indigenised) as spares free of cost (including taxes and duties) to BMRCL. For consumables the Contractor shall remit cost of equivalent spares to BMRCL.

Table 1C: Mandatory items for Localisation

Sl. No.	Description of Items
1.	Current Collection Device (CCD)
2.	Auxiliary Power supply
3.	Battery Box
4.	Ni-Cd Battery
5.	Heating, Ventilation and Air Conditioner (HVAC)
6.	Driver Desk Panel (FRP)
7.	Luminaries
8.	LED Head Light & Saloon Light
9.	All types of Glasses (i.e., glasses of Door, Window & Windshield)
10.	Axle Box with Earth return brush
11.	Gear Drive
12.	Bogie Frame
13.	Air Duct
14.	Stainless Steel/ FRP Passenger Seats
15.	Axle Bearing
16.	Axle Brake System
17.	Pneumatic Piping - Stainless steel
18.	Air Reservoir for Secondary Suspension
19.	FRP Panel
20.	Semi-permanent couplers/ Electric Coupler
21.	Stainless Steel sheets
22.	Wheel Flange Lubricator

Table 1D: Recommended items for further Localisation

Sl. No.	Description of Items
1.	Floor cover
2.	Floor Board
3.	Dampers
4.	Brake Electronics

5.	Bearings (other than Axle Bearings)
6.	Wipers
7.	Secondary springs
8.	PCBs used in different equipment.
9.	Public Address (P/A) / Public Information System (PIS)
10.	CCTV

2. PROJECT MANAGEMENT BY THE CONTRACTOR

2.1. Contractor's Management plans

- 2.1.1. In order to ensure satisfactory execution of the Contract, completion of Works within specified targets, and quality in design, manufacturing and execution of Work, a series of Management Plans shall be developed.
- 2.1.2. The plans and documents shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities to meet the requirements of the Employer's Requirements - Technical Specification in respect of the subjects listed.
- 2.1.3. The respective Plans shall be submitted for the Project Manager review and approval as per the submission schedule furnished in the following table 2-A.

Table 2-A: Submission of Plans

Sl. No.	Plan	To be submitted within
1	Project Management Plan	21 days from Effective Date
2	Interface Management Plan	60 days of notification from Project Manager of the identity of each Designated Contractor
3	Work Management Plan (Works Programme and Design Submission Programme)	45 days from Effective Date
4	Quality Assurance Management Plan	60 days from Effective Date
5	EMC Management Plan	60 days from Effective Date
6	System Safety Assurance Management Plan	60 days from Effective Date
7	Reliability, Availability and Maintainability Assurance Management Plan	90 days from Effective Date
8	Site Safety Management Plan	150 days from Effective Date
9	Software Quality Assurance Management Plan	75 days from Effective Date
10	Environmental Management Plan	60 days from Effective Date
11	Inspection, Test and Commissioning Management Plan	150 days from Effective Date
12	DLP Management Plan Addendum-1 dated 05.12.2022, Sl. No. 33 Defect Liability Maintenance Period (DLMP) Management Plan	150 days from Effective Date
13	Maintenance Plan	150 days from Effective Date

2.2. Project Management Plan

- 2.2.1. The Bidder shall submit an Outline Project Management Plan as a part of the Bid, which shall provide a clear over-view of the Bidder's organisation, the management system and methods to be used for completion of the Works. The organisation resources for

the design, procurement, manufacture, installation, testing and commissioning, and setting to Work, shall be clearly defined.

2.2.2. The Contractor shall submit the Project Management Plan for the Project Manager review as per schedule of Table 2-A. The Project Manager will review the Contractor's Project Management Plan and will have the right to require the Contractor to make amendments as deemed necessary by the Project Manager. The Contractor shall submit a detailed revised plan within 14 days of the review of the Project Manager. It shall include:

- (i) A diagram showing the organisational structure for the management of the Contract, with locations, names and position titles of staff and their line and staff relationship. The diagram shall include associate organisations and sub-contractors and show clearly the individuals and lines of responsibility linking the various groups. It shall also identify the persons designated as contacts with the Project Manager.
- (ii) The names, qualifications, positions and current resumes of key executive, supervisory and engineering staff to be employed full-time for the Works, separately for principals and sub-contractors.
- (iii) ~~The bidder must demonstrate that it has the personnel for the key positions that meet the following requirements:~~

Table 2-B: Employer's requirements for personnel in key positions

Sl. No.	Position	Total Work Experience (in years)	Experience in Similar Works (in years)
1.	Contractor's representative (CR) - To be posted at Bangalore from Effective Date till the issue of performance certificate	15	10
2.	Contract Manager (to be posted at Bangalore site) from Effective Date till the issue of performance certificate	10	5
3.	Project Engineer (to be posted at Bangalore site from receipt of prototype train till the expiry of warranty)	10	5
4.	Interface Manager (to be posted at Bangalore site, starting from preliminary design stage to the expiry of warranty period)	10	5
5.	Procurement Manager (to be posted at Production site)	10	5
6.	Construction Manager (to be posted at Bangalore site at least 2 months before receipt of prototype train and up to the expiry of warranty period)	10	5
7.	Testing and Commissioning Engineer In-charge (to be posted at Bangalore site at least 2 months before receipt of prototype train and up to six months after commissioning of last car)	10	5
8.	Maintenance Engineer (to be posted at each depot at Bangalore site at least 2 months before receipt of prototype train and up to the expiry of warranty period)	5	3

Sl. No.	Position	Total Work Experience (in years)	Experience in Similar Works (in years)
9.	Safety Manager (to be posted at Bangalore site at least 2 months before receipt of prototype train and up to the expiry of warranty period)	10	5
10.	Quality Assurance Manager (to be posted at production site as well as Bangalore site)	10	5

The Bidder shall submit relevant CVs for Sl. No. 1, 2, 3, 4, 5, 6, 9 and 10 of the proposed Management Team for the Bidder/Joint Venture/Consortium in the format provided in "Appendix LB-25" of "Part-I, Section-4, Bidding Forms."

Addendum-1 dated 05.12.2022, Sl. No. 34

(iii) The bidder must demonstrate that it has the personnel for the key positions that meet the following requirements:

Table 2-B: Employer's requirements for personnel in key positions (REVISED)

Sl. No.	Position	Total Work Experience (in years)	Experience in Similar Works (in years)
1.	Contractor's representative (CR) - To be posted at Bangalore from Effective Date till the issue of performance certificate	15	10
2.	Contract Manager (to be posted at Bangalore site) from Effective Date till the issue of performance certificate	10	5
3.	Project Engineer (to be posted at Bangalore site from receipt of prototype train <u>up to start of DLMP of last Trainset</u>)	10	5
4.	Interface Manager (to be posted at Bangalore site, starting from preliminary design stage <u>up to completion of commissioning of last Trainset in GoA4</u>)	10	5
5.	Procurement Manager (to be posted at Production site)	10	5
6.	Construction Manager (to be posted at Bangalore site at least 2 months before receipt of prototype train and <u>up to start of DLMP of last Trainset</u>)	10	5
7.	Testing and Commissioning Engineer In-charge (to be posted at Bangalore site at least 2 months before receipt of prototype train and <u>up to completion of commissioning of last Trainset in GoA4</u>)	10	5
8.	Maintenance Engineer (to be posted at each depot at Bangalore site at least 2 months before receipt of prototype train and <u>up to start of DLMP of last Trainset</u>).	5	3

Sl. No.	Position	Total Work Experience (in years)	Experience in Similar Works (in years)
9.	Safety Manager (to be posted at Bangalore site at least 2 months before receipt of prototype train and up to completion of commissioning of last Trainset in GoA4)	10	5
10.	Quality Assurance Manager (to be posted at production site as well as Bangalore site)	10	5

The Bidder shall submit relevant CVs for Sl. No. 1 of the proposed Management Team for the Bidder/Joint Venture/Consortium in the format provided in “Appendix LB-25” of “Part-I, Section-4, Bidding Forms and CVs for Sl. No 2, 3, 4, 5, 6, 9 & 10 shall be provided during submission of Project Management plan as specified in ERGS clause 2.1.3, Table 2-A.

- (iv) A narrative describing the sequence, nature and inter-relationship of the main Contract activities including timing for exchange of information.
- (v) The Contractor shall nominate an English speaking engineer in accordance with requirements specified in Table 2-B to be Contractor's Representative. The nominee shall be subject to acceptance of the Project Manager, who shall have the right to demand his replacement at any time after the Work commences, should the Project Manager consider this to be in the best interest of the Project.
- (vi) The Contractor's Representative shall be continuously on site in Bangalore and devote himself full-time to the Project, from the Effective Date and shall continue up to the issue of performance certificate. Contractor shall also nominate a Contract Manager in accordance with the requirements specified in Table 2-B to be posted at Bangalore site. The Contract Manager shall assist the Contractor's Representative and ensure that Contract delivery schedules are met.
- (vii) The Contractor shall also nominate a Project Engineer in accordance with the requirements specified in Table 2-B to co-ordinate activities of the design offices and manufacturing works. The Project Engineer shall be responsible to the Contractor's Representative for all works executed outside India and in India for ensuring that effective co-ordination is maintained with the various design engineers and manufacturing units of the Contractor and Sub-Contractors.
- (viii) To fulfil the Contractor's obligations during the Testing and Commissioning and to ensure the maintenance of the train before the commencement of commercial / revenue service i.e. before start DLMP, the Contractor shall nominate experienced maintenance engineers in accordance with the requirements specified in Table 2-B and organise deployment after obtaining the Project Manager's approval before undertaking testing and commissioning in depots. Separate maintenance engineer shall be positioned in each depot and they shall be supported by a dedicated team of testing / commissioning and maintenance personnel. The Contractor shall deploy dedicated team of testing, commissioning and maintenance personnel with adequate number in each depot and the dedicated team shall comprise minimum four engineers for each depot from propulsion supplier and three engineers from brake supplier side and minimum one engineer from PA/PIS supplier apart from

the maintenance engineer being deployed. The deployed maintenance engineer of the Contractor and supporting maintenance team in each depot shall continue up to the start of DLMP. They shall be responsible for all works arising in the supplied rolling stock based in the respective depot.

- (ix) The work of the maintenance engineers of all the depots shall be coordinated by Contractor's Construction Manager who shall be nominated at least 90 days before, and shall be positioned (after obtaining approval of the Project Manager) at least 30 days before the start of testing and commissioning of the prototype train-set. The Contractor shall nominate a Construction Manager in accordance with requirements specified in Table 2-B for approval of the Project Manager
- (x) The Construction Manager and maintenance engineers shall coordinate with the Program Manager's nominated representative in each depot and provide guidance as may be required to carry out the scheduled and un-scheduled maintenance activities from time to time before start of DLMP. The work shall include, but not limited to, finalisation of detailed maintenance plans covering maintenance work instructions, requirements and specifications of tools, plants and test benches, test check sheets, etc.
- (xi) Suitable replacement after obtaining approval of the Project Manager shall be provided by the Contractor in case of absence of the Construction Manager and maintenance engineers from the site for a continuous period exceeding 15 calendar days, for whatever reason. In case of cumulative absence of Construction Manager and / or maintenance engineers for 30 days in a calendar year, the Project Manager may at his sole discretion recover a reasonable amount from the due payments to the Contractor.
- (xii) Timely deployment of the Construction Manager and maintenance engineers shall be a prerequisite for accomplishing the relevant key dates of testing and commissioning of the first train sets in the respective depots.
- (xiii) A Procurement Manager shall be nominated and posted by the Contractor in accordance with the requirements specified in Table 2-B who shall be responsible for procurement, sub-contracts, warehousing, inventory and transportation necessary to support the activities of the various project groups.

2.2.3. The Contractor shall provide details of their current management organization as the applicant or, if a Joint Venture/Consortium, of each constituent member and also a proposed management organization for the Contract.

2.3. Interface Management Plan

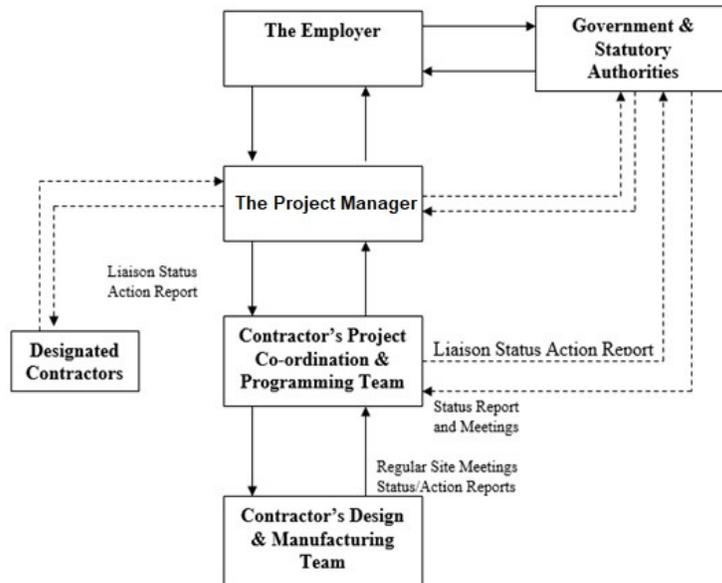
2.3.1. The Contractor shall interface and liaise with Designated and other Contractors in accordance with the requirements of Appendix D of the Employer's Requirements - Technical Specification and as per clause 2.18 of Employer's Requirements: General Specifications.

2.3.2. The Contractor shall develop and submit to the Project Manager as per schedule of Table 2-A, an Interface Management Plan, which is mutually acceptable to both the Contractors and the Designated Contractors. The Contractor shall appoint an experienced engineer in accordance with requirements specified in Table 2-B as Interface Manager after approval of the Project Manager. The Interface Manager shall be positioned at Bangalore site starting from not later than three months from Effective

Date and atleast till commissioning of all trains and satisfactory resolution of all interface issues. Non mobilization of the Interface Manager within the stipulated three months would attract penalty (to be solely finalized by the Project Manager) for delay of each month or part thereof. The CV of the proposed Interface Manager shall be submitted to the Project Manager for approval not later than the one (01) month from the Effective Date. The proposed Interface Manager should have minimum five (05) years of metro rolling stock project experience and should have worked on metro rolling stock project as a member of interface design and testing team involving design, supply & commissioning of trains.

The Interface Management Plan shall include:

- (i) Identify the sub-systems as well as the civil works and facilities with interfacing requirements.
- (ii) Define the authority and responsibility of the Contractor's and Designated Contractors' (and any relevant sub-contractors') staff involved in interface management and development.
- (iii) Identify the information to be exchanged, precise division of responsibility between the Contractor and Designated Contractors and integrated tests to be performed at each phase of the Contractor's and Designated Contractors' works.
- (iv) Address the works program of the Contract to meet the key dates of each Contractor and highlight any program risks requiring management's attention
- (v) After the review of Interface Management Plan with no objections by the Project Manager, the Contractor shall execute the works in accordance with the Plan



ORGANISATION CHART (PROPOSED INTERFACING)

2.4. Work Management Plan

- i) The Bidder shall submit a Work Management Plan as a part of the Bid which shall contain the following:
 - Proposed Works Programme.

- Proposed Design Submission Programme.

- ii) The Bidder's proposed Works Programme shall indicate how the bidder intends to organise and carry out the Works and achieve stages and complete the whole of the Works by the appropriate Key Dates. The Works Programme shall be prepared in terms of weeks from the Effective Date.
- iii) The Bidder's Design Submission Programme shall cover the Design phase and include a schedule identifying, describing, cross-referencing and explaining the Design Packages and submissions, which he intends to submit.
- iv) The Design Submission Programme should take due account of the design co-ordination interface periods with other Designated Contractors and be consistent with the Works Programme.
- v) The Bidder's proposed works program shall indicate how the bidder intends to organize and carry out the works and achieve stages and complete whole of the works with appropriate key dates in the current Pandemic situations prevailing in the world in general and in India in particular. The bidder shall submit the required justification in Appendix LB-20 - Requirements for Proposed Works Programme and proposed Design Submission Programme of Section IV: Bidding Forms as a separate Annexure.

2.4.1 Works Programme Submission Requirements

- i) The Works Programme submission requirements are organised into two parts: -
 - Part One is a requirement for all Bidders and shall be submitted as part of their Bid.
 - Part Two describes a series of reports to be submitted by the Contractor during the execution of the Contract.
- ii) In compiling its Works Programme, and in all subsequent up-dating and reporting, the Contractor shall make provision for the time required for co-ordinating and completing the design, testing, commissioning, and integrated testing of the Works, including *inter alia*, design co-ordination periods, during which the Contractor shall co-ordinate its design with those of Designated Contractors, the review procedures determining and complying with the requirements of Government Departments and all others whose consent, permission, authority or licence is required prior to the execution of any work. The Works Programme shall take full account of the Design Submission Programme.
- iii) All programme submissions shall, conform to the format and level of detail specified in Appendix 1.

2.4.2 Part One-Submission by Bidders

2.4.2.1. The Bidder shall clearly demonstrate in his Bid submission the following:

- i) The scheduling approach to the design, manufacture, testing and commissioning, integrated tests, and instrumentation tests, oscillation trials and any other required tests for the prototype rake, and service trials and their inter-relationships in the form of technically logical activity networks and also in bar chart format. These shall contain sufficient detail to assure the feasibility of the Bidder's approach to meeting

the contractual obligations. The programme shall be developed as a critical path network.

- ii) The Bidder's capability to manage the Execution of the Works to meet the specified Key Dates. Details are given in Appendix 3.
 - iii) A means to show the dates and periods relating to the Interfaces and Works of Designated Contractors. An Assumption Report accompanying the network should clearly indicate key dates, specific activities of other contracts, if any, which precede the commencement of activities listed in the Bid Submission.
 - iv) Show submission for review and review period for all major documentation required by the Contract.
 - v) Clearly identify the critical path in the programme and fully described in the accompanying narrative.
- 2.4.2.2. The Works Program in the Bid shall be accompanied by a narrative statement that shall describe Program activities, assumptions and logic, and highlight the Bidder's perception of the major constraints and critical areas of concern in the design, organization, manufacture, supply, testing, commissioning and completion of the Works. This narrative statement shall also indicate which elements of the Works the Bidder intends to carry out off-shore and/or in India, with details of the proposed locations of where any such work is to be carried out, the facilities available and any third party undertaking the Bidder may have in this regard. In particular the Bidder must state the assumptions made in respect of the interfaces with the Employer, Project Manager, other contractors and third parties both in detail and time, and any requirements for information on matters, which would affect his works.

2.4.3 Part Two-Submission by Contractor

i) Work Programme Plan

The Contractor shall prepare a plan, illustrated by sample schedules, charts, tables, etc., detailing his proposals for staff and their responsibilities to support the programming functions, for submission of works programmes for the Execution of the Works, for the design, manufacture, supply, testing and commissioning, in accordance with the key dates for co-ordinating his programmes with those of the System-wide and Civil Contractors, for measuring, monitoring and reporting progress, for revisions to the programmes to ensure completion of the Works within the specified times.

The Contractor shall submit the works programme plan as per the Employer's requirement for review of Project Manager. Based on the review, the Contractor shall promptly make all amendments as required by the Project Manager for his acceptance of the plan.

ii) Preliminary Programme

The Contractor shall make a preliminary Works Programme submission in accordance with the principles set out in his accepted plan. Such submissions may make use of the Bid submissions, suitably amended, to the requirements of the Project Manager. The submission shall be made in accordance with the respective plans as indicated in Table 2-A.

The Contractor shall note that at the time of submission of his preliminary networks and bar charts, it may be that such Programmes have yet to be co-ordinated with the System-wide and Civil Contractors. These shall not prevent the Contractor from submission of detailed preliminary programmes using approximate dates for work of the System-wide and Civil Contractors (where such dates are not available), which has impact on the Contractor's programmes. Such programmes shall be amended subsequently to take into account the actual schedules of the System-wide and Civil Contractors. It is the Contractor's responsibility to ensure timely co-ordination with the System-wide and Civil Contractors to finalise his preliminary programmes so as not to affect the progress of the Works or those of the System-wide and Civil Contractors.

iii) Baseline Programme

Following the Contractor's preliminary programme, submissions, no later than 90 days from the Effective Date, the Contractor shall make re-submissions of these programmes suitably amended to take into account the programmes of the System-wide and Civil Contractors. It is the Contractor's responsibility to ensure timely co-ordination with the System-wide and Civil Contractors to review, revise and finalise his preliminary programmes so as not to affect the progress of the Works and those of the System-wide and Civil Contractors.

The resubmitted programmes when accepted by the Project Manager shall form the Baseline Programme against which actual progress of the Works is measured.

As the Works progresses, it may be necessary for the Contractor to update the Baseline Programme but such updating shall only be carried out with the prior approval of the Project Manager or when directed by the Employer.

iv) Precedence Diagramming Method Logic Network

The Contractor shall submit Precedence Diagramming Method logic network when requested by the Project Manager from time to time to assist him in the analysis of the Contractor's Programmes.

v) Baseline Schedule Report

- a. The Contractor shall submit a Baseline Schedule Report in accordance with the approved format, which will quantitatively document the Baseline network and bar charts submitted. The activities in the report shall be grouped into the various phases e.g. design, manufacturing, delivery, commissioning etc.
- b. Also required with the submission of the Baseline Schedule Report is a narrative sufficient to explain the basis of the Contractor's determination of duration and to describe the Contractor's approach to meeting specified key dates. The reasons for the main logic links and outline method statements shall be provided.
- c. The Baseline Schedule Report and narrative shall be submitted together with the preliminary programme.
- d. Notwithstanding the above, the Project Manager may at any time during the course of the Contract require the Contractor to reproduce the computer-generated Baseline Schedule Report to reflect actual activity dates and generate schedules based upon "what if" statements.

2.5. Quality Assurance Management Plan

2.5.1. ~~The supplying Contract shall be executed within the framework of an efficient quality system. The international standards ISO 9001 / 2000, EN ISO 10007 are the standards of reference for the QA requirements applicable to the Contractor's (or sub-Contractor's) activities:~~

- ~~(i) design,~~
- ~~(ii) manufacturing,~~
- ~~(iii) on site activities.~~

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The supplying Contract shall be executed within the framework of an efficient quality system. The international standards ISO 9001 / 2000, EN ISO 10007 are the standards of reference for the QA requirements applicable to the Contractor's (or sub-Contractor's) activities:

- (i) design,
- (ii) manufacturing,
- (iii) on site activities.

However, Sub-Contractor shall provide necessary compliance documents in this regard during the type test of their subsystems.

2.5.2. The Bidder shall submit an Outline Quality Assurance Management plan, illustrating the intended means of compliance the Employer's and setting out in summary form an adequate basis for the development of the more detailed document. The outline Quality Plan shall contain sufficient information to demonstrate clearly the proposed method of achieving the Bidder's quality objectives with regard to the requirements of the Contract.

2.5.3. The Quality Assurance Management Plan submitted for the Project Manager review as per schedule of table 2-A shall contain sufficient information to demonstrate clearly the proposed method of achieving the Quality objectives with regard to the requirements of the Contract.

2.5.4. The Quality Assurance Management Plan shall indicate the approach and structure that the detailed plan will take and shall include the following:

- (i) a summary of the Project requirements including all proposed quality activities;
- (ii) all quality assurance and quality control procedures proposed by the Contractor for his use in the execution of the Works;
- (iii) a list of all the Codes of Practice, Standards and Specifications that the Contractor proposes to apply to his work;
- (iv) the Contractor's proposals for internal and sub-contractor quality assurance audits;
- (v) a statement detailing the records that the Contractor proposes to keep, the time during which they will be prepared and the subsequent period and manner in which they will be stored;
- (vi) Quality Control Points and Quality Hold Points during verification, surveillance, tests, trial and commissioning activities.

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- (vii) procedures for maintenance of records of inspection/tests.
- 2.5.5. The Quality Assurance System shall be applied without prejudice to, or without in any way limiting, any Quality Assurance System that the Contractor already maintains.
- 2.5.6. The Contractor shall maintain the QA plan up-dated during the course of the execution of the Contract. All amendments to the original and approved QA plan shall be notified to the Project Manager. The quality plan shall comprise:
- (i) A Management Quality Plan for control of management related activities;
 - (ii) A Design Quality Plan for control of design related activities; and
 - (iii) A Manufacturing (including Inspection and Testing) Quality Plan for the control of related activities.
 - (iv) Testing and Commissioning (including Integrated Testing and Commissioning) Quality Plan.
- 2.5.7. The Contractor shall submit a detailed organisation chart identifying the responsibilities, authority and inter-relation of all personnel who manage, perform and verify work involving quality in respect of all Quality Plans. The organisation chart shall be specific to this Contract. The Contractor shall nominate and post a Quality Assurance Manager in accordance with the requirements specified in Table 2-B who shall act as the quality co-ordinator for the Contractor in all dealings with the Project Manager and shall be responsible to the Contractor's representative in establishing the project quality systems as well as measurement of the Contractor's compliance with the international standards, contractual requirements, facilities and workmanship.
- 2.5.8. The Contractor shall audit all the activities in each Quality Plan at quarterly intervals or at other such intervals as the Project Manager may require to ensure continuing suitability and effectiveness of the quality management system. The Contractor shall make available upon request any document, which relates to his recent internal audits.
- 2.5.9. The Project Manager may require compliance audits of the Contractor's quality system to be conducted. Not less than two week's notice will be given by the Project Manager. During audits, the Contractor shall provide suitably qualified staff to accompany the auditor.

2.6. System Safety Assurance Management Plan

- 2.6.1. The Bidder shall submit, as part of its Bid, an Outline Safety Assurance Management Plan, which shall contain sufficient information to demonstrate clearly the Bidder's proposals for achieving effective and efficient safety procedures in the design, manufacture, testing and commissioning of the Rolling Stock. The Outline Safety Plan should include an outline of the safety procedures and regulations to be developed and the mechanisms by which they will be implemented for ensuring safety including Hazard Analysis, Fire control, EMC/EMI control, RAM (Reliability, Availability and Maintainability) requirements, site safety, transportation of rolling stock etc. The Contractor shall nominate and post a Safety Manager in accordance with the requirements specified in Table 2-B who shall be responsible to the Contractor representative in establishing the safety assurance systems and ensuring the Contractor's compliance with the international safety standards and Employer's safety requirements.

- 2.6.2. The Outline Safety Plan shall be headed with a formal statement of policy in relation to safety and shall be sufficiently informative to define the Bidder's Safety Plan and set out in summary an adequate basis for the development of the site safety and safety in transport.
- 2.6.3. The Contractor shall submit for review by the Project Manager, a System Safety Assurance Management Plan for the Project Manager review as per schedule of table 2-A. The Safety Assurance Management Plan shall contain sufficient information to demonstrate clearly the Contractor proposals for achieving effective and efficient safety procedures and solutions in the design, manufacture, testing and commissioning of the Rolling Stock. It shall include but not limited to:
- (i) The Hazard Analysis report in accordance with the requirements of Chapter 19 of the Employer's Requirements - Technical Specification shall evaluate and ensure that all the hazards are identified and satisfactorily resolved.
 - (ii) The Fire Safety analysis report in accordance with the requirements of Chapter 19 of the Employer's Requirements - Technical Specification shall evaluate and ensure inter alia that the fire loadings of material proposed to be used, and the fire withstand ratings etc. are as per the requirements specified in the Employer's Requirements - Technical Specification and also are compatible with currently accepted international practices.
 - (iii) The EMC/EMI Control Plan shall evaluate and ensure that the requirements for electromagnetic compatibility and interference as specified in the Employer's Requirements - Technical Specification for all elements of the system are met.

2.7. Reliability, Availability and Maintainability Assurance Management Plan

- 2.7.1. The Contractor shall submit for review by Project Manager, a Reliability, Availability and Maintainability Assurance Management Plan and maintenance programs (inspections service checks and maintenance activities) for the Project Manager review as per schedule of table 2-A in accordance with the requirements of Chapter 19 of the Employer's Requirements - Technical Specification.
- 2.7.2. The Contractor shall describe procedures required to perform the specific tasks necessary to achieve RAM requirements in the Reliability, Availability and Maintainability Plan.

2.8. Site Safety Management Plan

- 2.8.1. The Contractor shall also submit Site Safety Plan for the Project Manager review as per schedule of table 2-A and a plan for safe transport of rolling stock to the depot as per requirements of Chapters 11 of this Employer's Requirements - General Specification.

2.9. Software Quality Assurance Management Plan

- 2.9.1. The Contractor shall submit a Software Quality Assurance Plan for the Project Manager review as per schedule of table 2-A in accordance with the requirements of Chapter 7 of this Employer's Requirements - General Specification.

2.10. Environmental Management Plan

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- 2.10.1. The Bidder shall submit as part of this bid an Outline Environmental Plan illustrating the intended means of compliance with the Employer's Environmental Quality Management Manual. Outline Environmental Plan shall also contain sufficient information to demonstrate clearly the proposed method of achieving the Environmental objectives with particular reference to Noise, Vibration, EMC/EMI etc. to meet the stipulations of Chapter-3 of Employer's Requirements - Technical Specification.
- 2.10.2. The Contractor shall submit as part of this bid an Outline Environmental Plan for the Project Manager review as per schedule of Table 2-A illustrating the intended means of compliance with the Employer's Environmental Quality Management requirements. The Environmental Management Plan shall contain sufficient information to demonstrate clearly the proposed method of achieving the Environmental objectives with particular reference to Noise, Vibration (Noise and vibration analysis report), EMC/EMI (EMC/EMI analysis report) etc. to meet the requirements of Chapter-3 of Employer's Requirements -Technical Specification.

2.11. Inspection, Test and Commissioning Management plan

- 2.11.1. The Contractor shall submit a Testing and Commissioning Management Plan as per schedule of Table 2-A for the Project Manager review as required in Chapter-20 of the Employer's Requirements – Technical Specification. The Contractor shall also nominate and post a Testing and Commissioning Engineer In-Charge in accordance with the criteria specified in Table 2-B who shall be responsible to the Contractor representative in establishing the testing and commissioning systems as well as ensuring the Contractor's compliance to the testing and commissioning management plan and the standards specified for testing and commissioning.

2.12. Review Periods for Contractor's Submissions

- 2.12.1. The Project Manager shall review those Contractor's plan and programme submissions which require his acceptance and shall signify his acceptance or otherwise within 30 days. The Contractor shall, when required by the Project Manager, re-submit his programmes within 14 days of receipt of the Project Manager's comments.

The Project Manager will endeavour to review and respond to the Contractor on the adequacy and acceptability of the Contractor's submissions and re-submissions as soon as reasonably possible but the Contractor should always allow for a 30 days review period.

The Contractor shall allow in his programme a 30-day review period for all submissions to the Project Manager.

2.13. Failure to Make Submissions

- 2.13.1. Failure of the Contractor to submit any plan and program, or any required revisions thereto within the time limits stated shall be sufficient reason for certification that the Contractor is not performing the work required in a timely manner. The Project Manager may certify retention of payment under the Milestone-related Schedule of Payments proposed for the Contractor, until his plans and programmes are accepted by the Project Manager, and may also cause imposition of Liquidated Damages.

2.13.2. In case the Contractor submits documentation clearly generated for other project with the intention of avoiding penalties, the submission will be considered as not carried out and all consequences for missing submission will be applied.

2.14. Plans and Programme Revision

2.14.1. The Contractor shall revise his plans and programmes whenever necessary, with the consent of, or as required by the Project Manager to ensure completion of the Works within the times for completion prescribed in the Contract

2.15 Planning and Programming Staff

2.15.1. The Contractor shall employ sufficient number of planning and programming staff competent in the use of the programming software and with a good knowledge of the type of work required to be performed by the Contractor under the Contract.

The Project Manager shall have the discretion to require the Contractor to replace his planning and programming staff if the Project Manager considers that they do not have the training or skill required for this very specialised nature of work.

2.16 Project Calendar

2.16.1. Project Weeks shall commence on a Monday. A day shall be deemed to commence at 0001 hours on the morning of the day in question. Where reference is made to the completion of an activity or Milestone by a particular week, this shall mean by midnight on the Sunday of that week. Further details are specified in Appendix-10

2.17 Progress Reports

2.17.1 Progress reports, as detailed in Appendix 2, shall be regularly submitted by the Contractor, on a monthly basis, within first 10 days of each month.

2.18 Co-ordination and interface with Designated and other Contractors

2.18.1 The Contractor is responsible for detailed co-ordination of his design and manufacturing activities with those of the System-wide Contractors, Civil Contractors, Consultants and other Contractors whether or not specifically mentioned in the Contract, who may be working on or adjacent to the site for the purpose of the Project.

2.18.2 All of the above parties are referred to as Designated Contractors. A list of some of the main Designated Contractors, and some of the identified major interfaces are given in Appendix-D of the Employer's Requirements – Technical Specification. The Contractor shall note that there are other contractors, consultants, agencies etc. which the Project Manager may engage from time to time, and with whom the Contractor shall have to similarly co-ordinate. Such co-ordination responsibilities of the Contractor shall include the following, but need not be limited to:

- i) To provide all information reasonably required by the Designated Contractors in a timely and professional manner to allow them to proceed with their Design, Manufacturing, Construction activities, and to meet their milestones and key dates.
- ii) To ensure that the Contractor's requirements are provided to all other Designated Contractors, in a timely and reasonable manner.
- iii) To obtain from the Designated Contractors information reasonably required, to enable the Contractor to meet his own design submission dates.

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- iv) To ensure very close co-ordination with Signalling & Communication Contractor, in respect of provision of Signal and Communication equipment in the cars, and finalising the interface between the Rolling Stock and Signalling & Communication equipment.
 - v) Where the execution of the work of the Designated Contractors depends upon the site management or information to be given by the Contractor, the Contractor shall provide to such Designated Contractors the services, or the correct and accurate information required, to enable them to meet their own program or construct their own works.
 - vi) To ensure that there is no interference with the works of Designated Contractors.
 - vii) To attend regular co-ordination meetings convened by the Designated Contractors and the Project Manager. The Contractor shall conduct separate meetings with the Designated Contractors as necessary to clarify particular aspects of the Designated requirements of the Works. A record of the decisions taken in each such meeting shall be furnished to the Project Manager. The party who convenes the meeting shall prepare minutes recording all matters discussed and agreed at the meeting.
 - viii) To ensure that all correspondence, drawings, meeting minutes, programs, etc. relating to the Contractor's co-ordination with the Designated Contractors are issued to all concerned parties and four copies issued to the Project Manager no later than seven calendar days from the date of such correspondence and meetings.
- 2.18.3 The Contractor shall in carrying out his co-ordination responsibilities raise in good time and provide sufficient information for the Project Manager to decide on any disagreement between the Contractor and the Designated Contractors as to the extent of services or information required to pass between them.
- 2.18.4 If such disagreement cannot be resolved by the Contractor despite having made all reasonable efforts, then the decision of the Project Manager shall be final and binding on the Contractor.
- 2.18.5 Where a Designated Contract is yet to be awarded, the Contractor shall proceed with the co-ordination activities with the Project Manager until such time as the Designated Contractor is available. The Contractor shall provide the Designated Contractor with all information necessary to enable the Designated Contractor to follow-on and proceed with their co-ordination.
- 2.18.6 Any claim of additional costs by the Designated Contractors as a result of the Contractor's failure to keep to specified dates shall be borne by the Contractor. The Contractor shall note that the information exchange is an iterative process requiring the exchange and updating of information at the earliest opportunity and shall be carried out on a regular and progressive basis in order for the process to be completed for each design stage by the specified dates. Project Manager shall have full right to impose liquidity damages on the Contractor should there be an impact of these delays in achieving the key dates. Decision of Project Manager shall be final and binding.
- 2.18.7 The Contractor shall establish a dedicated co-ordination team, led by a Co-ordinator reporting to the Contractor's Contractor representatives. The primary function of the team is to provide a vital link between the Contractor's design and manufacturing teams

and the Designated Contractors. The Project Manager shall have the right to require the replacement of the Coordinator if in his opinion the Coordinator is unable to meet the co-ordination requirements of the Contract. The Contractor's attention is drawn to the need for the Coordinator to establish effective dialogues and communication links with the Designated Contractors. The Contractor's co-ordination team shall comprise a mix of personnel with experience in both design and manufacture of rolling stock necessary for effective co-ordination.

- 2.18.8 The Coordinator shall assess the progress of co-ordination with Designated Contractors by establishing lines of communications and promoting regular exchange and updating of information so as to maintain the Contractor's program.
- 2.18.9 The complexity of the project and the importance of ensuring that work is executed within time limitations require detailed programming and monitoring of progress so that early program adjustments can be made in order to minimise the effects of potential delays.
- 2.18.10 The Coordinator in conjunction with the Designated Contractors shall identify necessary provisions in the Works for plant, equipment and facilities of the Designated Contractors. These provisions shall be allowed by the Contractor in his design of the Works.
- 2.18.11 During the course of the Contract, information will be obtained in a number of ways, including direct inspection, regular site meetings, the obtaining of progress reports and the use of turn round documents to obtain design and program data. Turn round documents shall be issued to the Designated Contractors to be returned giving the current positions on their program.

3. DESIGN SUBMISSION REQUIREMENT

3.1 General

- 3.1.1. 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 Project Manager.
- 3.1.2. The design submissions include Design Calculations, Design Reports and Design Drawings.
- 3.1.3. In the event that a statutory body (e.g. Government of India - Ministry of Railways or Ministry of Urban Development, RDSO, Commissioner of Metro Railway Safety etc.) requires design information in a particular format, it shall be incumbent upon the Contractor to provide the same, as directed by the Project Manager.

3.2 Review of Data

- 3.2.1. As soon as practicable after Contract Award, the Contractor shall review all applicable data, criteria, standards, directives and information provided to him as the basis for design. Any apparent inconsistencies or erroneous information shall be brought to the attention of the Project Manager. Such information shall not alleviate the Contractor from his responsibilities under the Contract.

3.3 Format of Deliverables

- 3.3.1. Drawings and CAD data shall comply with the requirements of Appendix 4 of this General Specification: Drawing and CAD Standards. Reports, calculations, specifications, technical data and similar documents shall be provided in A4 format, and one of the copies shall be ring bound to facilitate photocopying. A3 size drawings included in documents shall be folded to A4 size.

- 3.3.2. Drawing and CAD Data Format:

Within 30 days of Effective Date, the Contractor shall have prepared and submitted the drawing and CAD procedures together with sample drawings and corresponding CAD data to demonstrate his understanding and compliance with Appendix 4 of this General Specification: Draughting and CAD Standards.

3.4 Number of Copies

- 3.4.1. The following quantities of drawings and other documents shall be submitted to the Project Manager, including preliminary, pre-final, and final design submissions, the final contract document, and all other submissions. These drawings and documents are in addition to those required for the exchange of information between Designated Contractors and other submissions to statutory, governmental and local authorities.

The submissions shall be in A0, A1, A3 or A4 size, as appropriate except as may otherwise be agreed by the Project Manager. In addition, the submissions shall also be made in electronic format in a medium acceptable to the Project Manager.

A. Hard copies

- i. Full-size sets of paper drawings (folded and collated): one copy for each Depot plus two copies (total four copies).

- ii. FDD (Final Design Documents): one copy for each Depot plus two copies (total four copies)
- iii. 3 sets of design documents and calculations.
- iv. 2 copies of Design Status Report and Design Statement. 2 sets of all other submissions.
- v. 3 sets of all other submissions.

B. Soft Copy

Contractor shall handover and maintain at Employer's office 3 nos. of external hard disks of sufficient storage capacity for Employer's office as directed by the Project Manager, duly fed with all the details and documents specified at para-A (i) to (v) above, including Presentations made by Contractor and other related agencies. The stored information shall be updated on daily basis during working hours by the Contractor till issuance of Performance Certificate by the Employer as per Contract conditions.

All the above-mentioned submissions shall be in editable format (except catalogues and test certificates) as well as in PDF format.

3.5 Design Submission Programme

3.5.1. The Contractor shall prepare the Design Submission Programme, which is to set out fully the Contractor's anticipated programme for the preparation, submission and review of the Design Packages, the Final Design Submission and the Installation and Manufacturing Drawing Submissions and for the Issue of Notices in relation thereto.

3.5.2. The Design Submission Programme shall:

- i. be consistent with and its principal features integrated into the Works Programme, and show all relevant Milestones and Key Dates;
- ii. identify dates and subjects by which the Project Manager's decisions should be made;
- iii. make adequate allowance for periods of time for review by the Project Manager and other review bodies;
- iv. indicate the Design Interface and Coordination periods for each Designated Contractor.
- v. include list of requisite design details for each and every component or equipment of all sub-systems and systems.
- vi. Submission of design documentation shall be suitably staggered.
- vii. The Contractor shall update the Design Submission Programme suitably if Project Manager observes any deviation.

3.5.3. For System, sub-system and components the 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. The Design Submission Programme shall also include listing of various Plans, processes and other submissions.

3.5.4. The Contractor shall submit the Design Submission Programme to the Project Manager as indicated in Chapter-2 of this Employer's Requirements - General Specification, and thereafter up-dated versions thereof at intervals of not more than one month throughout the Design Phase.

3.6 Design Process

3.6.1. The Contractor shall deploy Design staff having sufficient experience in Bangalore within 3 months from the Effective Date and the team shall be present up to pre-final design stage at all times to maintain liaison with the Project Manager. The principal requirement of the Design Phase is to undertake the design during this phase in three stages:

- i) the preparation of the Preliminary Design;
- ii) the preparation of the Pre-final Design;
- iii) the preparation of the Final Design

In the contract document, wherever the various details/documents are being asked to submit at Design stage, it shall mean the Pre-Final Design Stage unless otherwise specified

3.7 Preliminary Design

3.7.1 The purposes of the Preliminary Design submission are as follows:

- i) State the design criteria;
- ii) Design the overall system, and propose the system configuration;
- iii) Identify the functions of each system, sub-system, equipment or other element within the overall design, and specify the relationships and interfaces between elements of the system;
- iv) Identify the functions of each system, sub-system, equipment or other element within the overall design, and identify the relationships and interfaces between elements of the Contractor's system and those of other Designated Contractors;
- v) Verify the Bid designs and calculations: In case of simulations, the inputs, relevant formulae, principles, assumptions, algorithm and logic followed shall be submitted with a sample calculation for each case. It shall be obligatory on the Contractor to submit any further details as required by the Project Manager to approve the results. Any spreadsheet if submitted shall be supported with the linked formulae and calculations.
- vi) Incorporate the Project Manager's suggestions and changes based on the Technical Specification and/or operational requirements

3.8 Pre-Final Design

3.8.1. In the Pre-final Design stage, the conceptual designs (including interfaces with those of Designated Contractors of the Employer, and of the Contractor's vendors) are required to be fully developed. In this stage, each element of the system will be considered and preliminary specifications with supporting calculations developed. Preliminary electrical and control schematics shall be developed to illustrate how various operational and functional requirements are achieved. Software design and development shall also be carried out at this stage.

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- 3.8.2. Manufacturing units will be allowed to commence production only after receiving 'no objection' advice from the Project Manager. This submission shall include sufficient detail from prospective suppliers to demonstrate that they have adequate understanding of the requirements. It will include either evidence of or proposals for design verification. Interfaces with other Designated Contractors shall be finalised by this stage.
- 3.8.3. The Contractor shall submit clause by clause compliance of the applicable clauses of this General Specifications and Technical Specifications from the Original Equipment Manufacturer (OEM) of the sub- systems. The Contractor shall also submit detailed Bill of Material including the make, model, type number, ratings, MDBC/ MTBF, proposed quantity per box / car, replacement schedule, country of origin / manufacturing of the proposed sub-assemblies, as well as drawings of sub-assemblies, etc as relevant to the sub-system. Submission of the above information is pre-requisite for completion and issuance of No Objection Certificate for Pre-final Design stage. The submitted information as approved by Project Manager and actual Part number as supplied in the Project shall be included in the O&M Manuals as per provisions of ERGS Chapter 12.”

3.9 Final Design

- 3.9.1. The purpose of the Final Design submission is to agree with the Project Manager that the equipment is satisfactory, compliant with the specification, fit for purpose and safe. The Final Design shall be the level of design developed to the stage where all manufacturing drawings (including those received from Designated Contractors of the Employer, and vendors of the Contractor) are fully defined and specified and in particular:
- i) calculations and analyses are complete;
 - ii) all main and other significant elements are delineated;
 - iii) all other work, including studies, investigations and reports are complete

3.10 Design Submission and Review Procedure

- 3.10.1. All design submissions from the Contractor shall be made under a Design Review Certificate Application (DRCA) notice. The following DRCA numbering system shall be used to identify all submissions:
- <Contract No.>/<Subject Code>/<Stage Code>/<Sequence No.>/<Revision No.>
- 3.10.2. The contract number shall be limited to not more than five digits and reflect the contract number only.
- 3.10.3. The stage code and subject codes should be developed in conjunction with the Project Manager to help identify particular types of submissions, e.g., type of service or equipment. A schedule of subject codes for each contract should be submitted to the Project Manager for acceptance.
- 3.10.4. The Contractor shall ensure that all submissions are correctly numbered in accordance with the schedule. The sequence code shall be a unique sequential number for each submission for each particular subject. Revision numbers shall be used when a re-submission is required, i.e. a DRCA was awarded "Not Accepted". For the initial submission the revision code of DRCA number shall be left blank.

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- 3.10.5. Upon receipt of design submissions from the Contractor, a copy of the DRCA will be signed, dated and returned by the Project Manager.
- 3.10.6. The Project Manager shall issue Design Certificate Consent (DCC) Sheet properly dated and numbered to Contractor for each of the DRCA. The DCC will carry status as Notices of "No Objection", "Notices of No Objection, subject to...." and decisions made by the Project Manager in response to a Design Review Certificate Application made by the Contractor. The Design Certificate Consent (DCC) Sheet properly dated and numbered shall be sent to the Contractor. The consent sheet number shall be the same as the Design Review Certificate Application number except that the letters "DRCA" are replaced by "DCC".
- 3.10.7. When significant comments are noted by the Project Manager on the design submission, the "DRCA" shall be returned "Not Accepted", and signed by the Project Manager. One copy of the "DRCA" shall be returned to the Contractor together with the comments on why the submission was rejected.
- 3.10.8. When minor comments are noted by the Project Manager on the design submission and it is "No Objection, but Subject to Comments" the "DRCA" will have the appropriate decision indicated upon it and be signed by the Project Manager. One copy of the DCC, together with comments, will be returned to the Contractor.
- 3.10.9. A submission will be rejected automatically if not signed by the Contractor's Authorised Design Representative.
- 3.10.10. Upon receipt of a decision sheet from the Project Manager, the "DCC" will be signed, dated by the Contractor, and returned to the Project Manager.

3.11 Project Manager's Review

- 3.11.1. The Project Manager will complete his review of the submission within 21 calendar days), after which the review comments in writing or on marked up drawings and specifications will be furnished to the Contractor. The Contractor shall then meet with the Project Manager to discuss the review comments. Within two weeks of the receipt of the Project Manager's comments the Contractor shall submit his proposals for implementation in the next submission. Where the comments are minor, such proposals may be clarified by calculations, part prints, etc. acceptable to the Project Manager and included in the Contractor's next submission. Should the Project Manager deem the submission to be unacceptable, the Contractor shall revise and re-submit the entire submission within two weeks, unless otherwise agreed with the Project Manager.
- 3.11.2. After Project Manager's review of the design submissions, the Contractor shall update the documentation incorporating Project Manager's observations and also other design requirements. For all subsequent submissions, the Contractor shall demonstrate that all the previous comments by Project Manager has been incorporated. The Comments previously issued by Project Manager shall also become part of the submission. All re-submissions by the Contractor to the Project Manager shall invariably include an item-wise 'Reply sheet' to Project Manager's comments on previous submissions/ Minutes of Meetings.
- 3.11.3. It is Employer's understanding that the Contractor will need to depute a team of its design engineers for interaction with Employer's experts at Bangalore. Employer at his discretion may also consider deputing a team of engineers (around six) to Contractor's design office or at Sub vendor's office for requisite duration with a view to expedite

finalization of designs. In such case, Contractor shall provide office facilities and bear full expenditure towards out of pocket allowance, travel expense (as per entitlement), boarding, lodging etc. Such visit(s) as described above shall not be considered as part of inspection activity.

3.12 Final Design Document Delivery

3.12.1. To achieve agreement with the Project Manager on the completion of the design and to allow the formal submission of the Final Design, the Contractor shall submit a list of all accepted Design Submissions to the Project Manager for review along with self-adhesive stickers signed by the Contractor's Representative (CR). If there is no objection by the Project Manager, he shall then sign and return the self-adhesive stickers to the Contractor for affixing to the amended Final Design Drawings (original) prior to their submission under the Final Design Document Delivery.

3.12.2. Based on the Project Manager's review of the Final Design Submission, the Contractor shall then re-submit the entire Final Design Submission together with the following documents:

- i) joint statements of completed design interface with the Designated Contractors of the Employer;
- ii) a signed statement confirming that he has incorporated all comments of the Project Manager.
- iii) a Design Certificate duly endorsed, as shown in Appendix 5.

This above jointly will be known as "Final Design Document Delivery"

3.13 As-Built Drawings and Documents

~~3.13.1. As-built drawings are intended to show the works exactly as constructed. These are prepared by amending the manufacturing drawings to take into account changes necessitated by manufacturing methodology. These drawings shall be completed on a regular basis as the works progress, and not left until the completion of the Defect Liability Period.~~

[Addendum-1 dated 05.12.2022, Sl. No. 36](#)

As-built drawings are intended to show the works exactly as constructed. These are prepared by amending the manufacturing drawings to **consider** changes necessitated by manufacturing methodology. **These drawings shall be updated on a regular basis based on the performance of trains up to first 2 years of DLMP and shall be submitted along with final design document delivery.**

3.13.2. At least 1 months but not more than 3 months prior to the anticipated date of delivery of the prototype rake, the Contractor shall compile and submit to the Project Manager for recording purposes all those documents and drawings which in the opinion of the Contractor, constitute the complete record of the design and manufacture of the Works.

~~3.13.3. The updated compilation of the complete record of the design and manufacture of the Works shall be submitted at the end of the Defect Liability Period.~~

[Addendum-1 dated 05.12.2022, Sl. No. 37](#)

The updated compilation of the complete record of the design and manufacture of the Works shall be submitted **along with the final design document delivery.**

3.14 Manufacturing Drawings

3.14.1. Detailed manufacturing drawings will not normally be required for acceptance but shall be submitted for comment if the Project Manager so requires.

3.15 Post Acceptance Changes

3.15.1. Changes to accepted drawings, whether they are initiated by the Contractor or the Project Manager, shall be submitted through the DRCA system. The same process of submission, review and acceptance as described above shall be adopted. Upon acceptance of the post acceptance change, the Project Manager shall issue a DCC to this effect. Submission as a result of a post acceptance change shall use a new DRCA number, i.e. not a previously used one.

3.15.2. The Contractor may propose a alternative procedure for implementing post acceptance changes (hardware and software) for review of the Project Manager.

3.15.3. For requesting any change to the accepted design the Contractor shall submit the relevant design details for review of Project Manager. The Contractor shall not implement any change without receiving 'No objection' from the Project Manager.

4. INSPECTION, TESTING AND COMMISSIONING

4.1 General

4.1.1. The Contractor shall submit Inspection, Testing and Commissioning Management Plan for Project Manager's review as per schedule furnished in table 2-A. The purpose of the inspection, testing and commissioning Management Plan is:

- (i) To provide evidence as to how the Contractor will plan and program his tests and inspection and test activities.
- (ii) To allow the Contractor to indicate his "Witness and Quality hold points" for selected operations.

4.1.2. The Inspection, Testing and Commissioning Management Plan shall be prepared in accordance with the requirements of Chapter-20 of the Employer's Requirements – Technical Specification. This plan shall also include Integrated Testing and Commissioning of Trains in the Section and Service Trials before introduction in Commercial / revenue Service. The Plan shall contain, but not limited to, the following topics:

- i) the Contractor's methodology for inspection, testing and commissioning;
- ii) all Inspections and Quality Hold Points;
- iii) Inspection, testing and acceptance operations performed on the parts during and after fabrication,
- iv) Inspection, testing and acceptance operations performed on sub-assemblies composed of these parts, if any,
- v) Inspection or test operations performed during on site activities.
- vi) Tests, Inspections and examinations performed on systems assembled in shop and site.
- vii) the interdependency and inter-relationship with Designated Contractors and their commissioning programme;
- viii) the objectives of each test and criteria for successful tests;
- ix) organisation chart and CV of key personnel in the Testing and Commissioning team;
- x) documentation for conducting tests and submission of Testing and Commissioning procedures.

4.1.3. Inspection Hold Points

- i) The Contractor shall, propose a set of inspection hold points in the Inspection, Testing and Commissioning Plan. The hold points shall be structured so that a formal hold point is allowed for each significant element of the car's manufacturing process. At each hold point the Inspecting Officer appointed by the employer shall hold a formal inspection, or advice that the inspection has been waived.
- ii) The manufacturer of each car or part thereof shall not proceed until the inspection by the Inspecting Officer has been completed or waived.
- iii) The Employer and the Project Manager shall be afforded the opportunity of inspecting all cars, trains and mock-up to be delivered under the Contract before they leave the Contractor's premises. No car shall be considered ready for delivery without Project Manager's endorsement in writing.

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- iv) The Contractor shall advise the Project Manager no fewer than 21 days in advance of a car or train being available for inspection, and shall notify him of the tests proposed to be carried out. In case, inspection is not carried out at the time agreed upon as a result of the Project Manager not being available, the Contractor shall notify the Project Manager immediately and he will deploy an Inspecting Officer within one week. In case the Inspecting Officer fails to turn up within this period, the Contractor may proceed with the work and the Inspection Certificate issued by the Manufacturer will be expected by the Project Manager”.
 - v) Once the Inspection and any required remedial actions are completed to the satisfaction of the Project Manager, he shall give consent for the cars' or trains' shipment and/or dispatch.
- 4.1.4. Basically, the Contractor or his Sub-Contractor is responsible for the execution and recording of all inspections and tests which are to be found on the test and commissioning plan. All the technical conditions of the material manufacturing and testing have to be included in the material and part acceptance certificates.
- 4.1.5. For manufacturing and on-site activity surveillance, the Contractor will develop and implement a test and commissioning plan, which includes acceptance tests. EN 50215 can be used as a guideline for test after completion and before entry in the service.
- 4.1.6. The Project Manager will then check the plans to see whether, it meets the requirements. The Project Manager shall inform the Contractor in writing within a reasonable period after receipt of the above information;
- i) that the Contractor's proposed methods of inspection, testing and commissioning (including Integrated Testing and Commissioning) have the consent of the Project Manager; or
 - ii) in what respects, in the opinion of the Project Manager the Contractor's proposed methods etc.
 - iii) fail to comply with the Employer's Requirements and/or the Final Design Document;
 - iv) would be detrimental to the Works and/or to the other works comprising the Project;
 - v) do not comply with the other requirements of the Contract; or
 - vi) as to the further documents or information which are required to enable the Project Manager to properly assess the proposed methods of inspections, etc.
- 4.1.7. In the event that the Project Manager does not give his consent, the Contractor shall take such steps or make such changes in the said methods or supply such further documents or information as may be necessary to meet the Project Manager's requirements and to obtain his consent. The Contractor shall not change the methods of inspection, testing and commissioning (including Integrated Testing and Commissioning) which have received the Project Manager's consent without further review and consent in writing of the Project Manager.
- 4.1.8. Notwithstanding the foregoing provisions of this Chapter, or that certain of the Contractor's proposed methods of inspection etc. may be the subject of the consent of the Project Manager, the Contractor shall not be relieved of any liability or obligation under the Contract.

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- 4.1.9. The Project Manager shall have the facility to monitor all tests and have access to all test records. Ample time shall be allowed within the testing programme for necessary alterations to equipment, systems and designs to be undertaken, together with re-testing prior to final commissioning.
- 4.1.10. Unless agreed in writing by the Project Manager, personnel engaged on testing shall be independent of those directly engaged in the design or installation of that equipment.
- 4.1.11. All test equipment shall carry an appropriate and valid calibration label and / or certificate.
- 4.1.12. For each of the identified tests, the Contractor shall produce a test report, in three copies, and in an approved format, within an agreed period following the test, for acceptance by the Project Manager. The Contractor including sub-contractor shall sign all reports of Tests. The Project Manager reserves the right to reasonably call for additional tests if considered necessary.

4.2 Non-Conformity and deviation disposition

- 4.2.1 The Non-Conformity and Deviation detected/observed during manufacturing, testing and Commissioning shall be grouped into essentially three types and shall be dealt as under:

- i) Type 1: Non-Conformity not in violation with the Contractual Technical Specifications or design documents originated by the Contract and approved by the Project Manager.
- ii) Type 2: Non-conformity with the Contractual Technical Specification or Design Technical Specifications or Documents issued by the Contractor and approved by the Project Manager but which can be reconciled with the applicable Specification.
- iii) Type 3: Non-conformity with the Contractual Technical Specification or Design Technical Specifications or Documents issued by Sub-Contractors and approved by the Project Manager which cannot be reconciled with the applicable Specification. Some examples of this group of non-conformity but not limited to are:
 - equipment, component or system unable to meet functional on performance requirements;
 - critical dimensions (involved in the stress analysis report of interface dimensions) out of tolerance;
 - inspection or control not carded out and being impossible to be repeated;
 - component without appropriate identification to ensure its recording.

- 4.2.2 These types of non-conformity shall be recorded in a Non-Conformity Report (NCR) and reported by the Contractor to the Project Manager for processing and disposition. The Contractor shall propose the final solution and submit to the Project Manager for approval during a meeting before implementation.

4.3 Project Manager's Stop Work Order (SWO)

- 4.3.1 The Project Manager or his representative will have the general responsibility to verify that the manufacturing and its associated control or test operations are performed in accordance with the contractual documents and technical specification.

4.3.2 A stop work order is issued when significant situations adverse to quality are noted and immediate action is required.

4.3.3 The stop work order shall be issued under the following conditions:

- (i) equipment procured by the Contractor is not able to meet the specified quality level,
- (ii) Use of non-approved drawings or documents during the manufacturing of items or equipment by the Contractor (or his Sub-Contractor),
- (iii) repetitive non-conformity without appropriate corrective action by the Contractor (or his Sub-Contractor),
- (iv) Contractor (or his Sub-Contractor) frequently ignores the Project Manager's observations regarding inspections,
- (v) or when a significant non compliance of the QA Plan is detected,

4.4 Employer's / Project Manager's Corrective Action Requests (CAR)

4.4.1 During the course of performing audit or factory inspection, depot testing, mainline testing and during commercial / revenue operation under DLMP, the Project Manager or Employer's Representative may identify situations which are contrary to product quality or may lead to products of indeterminate quality or are not in accordance to the Employer's Requirement as specified in the Contract and in such situation the Project Manager or Employer's Representative shall issue a CAR (Corrective Action Request) in the form of "BMRCL Note" with serial number giving the details of defects/deviations observed.

4.4.2 On receipt of CAR (BMRCL), the Contractor shall take Corrective Action and shall submit the compliance and return the CAR to the Project Manager or The Employer in the prescribed form. Such corrective action to be implemented in all Trainsets/cars. In this regard, the Employer's Representative or Project Manager's decision shall be final.

4.4.3 To finalize the Corrective Action Request (CAR), if necessary, a joint meeting shall be held with the Contractor or Contractor along with its OEM and Minutes of the Meeting (MoM) shall be jointly signed by the Contractor's Representative and Project Manager or Employer's Representative. Compliance of the MoM shall be submitted along with CAR.

4.5 Test Groups

4.5.1. The tests are organised into two broad groups:

- i) Design qualification testing or type test which includes verification of the design to the performance specification and demonstration testing on single articles of equipment.
- ii) Acceptance testing or routine tests which verifies that the equipment is conforming to, selected specification requirements at various stages of production and commissioning.

4.5.2. The tests also can be detail grouped as follows:

- i) Routine and type tests of components, equipments and sub-systems in accordance with relevant standards and specifications in Contractor/Sub-contractor's factories.

- ii) Factory acceptance Tests as a type test for the first train (prototype) at location of car body assembly (function test of vehicle) in accordance with IEC 61133.
- iii) Type test of the first metro train (prototype) at test centre if any (traction and braking performance, door system).
- iv) Type test of the first metro (prototype) train in Bangalore including instrumentation and oscillation trials in accordance with IEC 61133.
- v) Factory acceptance Tests as routine test of all the metro trains at location of car body assembly (function test of the vehicle) in accordance with IEC 61133.
- vi) Acceptance / Integration Tests for all the metro trains in Bangalore in conjunction with works of all designated Contractors in accordance with IEC 61133.
- vii) Service Trials.

5. DEFECT LIABILITY PERIOD (WARRANTY BEFORE DLMP)

- ~~5.1.1 The period from Commercial Operation Date (COD) of the first train to the period of Commercial Operation Date of the last train shall be treated as Defect Liability Period (DLP). For M&P's the DLP shall start from the date of commissioning of the respective M&P's and continue upto 24 months from the date of commissioning or start of the DLMP, whichever is earlier. DLP shall not be applicable for M&Ps commissioned during the DLMP. It shall be the responsibility of the Rolling Stock Contractor to carry out scheduled maintenance and unscheduled maintenance of trains & M&P's during the DLP.~~
- ~~5.1.2 Defect Liability and Maintenance Period (DLMP) shall start from the date of commencement of commercial / revenue service of the last train.~~
- ~~5.1.3 The Contractor shall also ensure that the technical support from Sub-Contractors/Vendors of following major equipment/subsystems shall be made available through permanent positioning of Sub-Contractor's/Vendor's staff at Depots for meeting DLP obligations:~~
- ~~i) Propulsion system (including Traction Inverter, Traction motors, etc.)~~
 - ~~ii) Auxiliary Power Supply system~~
 - ~~iii) Brake and Pneumatic system~~
 - ~~iv) Door~~
 - ~~v) HVAC~~
 - ~~vi) Bogies~~
 - ~~vii) Communication System~~
 - ~~viii) Depot M&Ps~~
 - ~~ix) Any other system as advised by Project Manager.~~
- ~~5.1.4 Deleted~~
- ~~5.1.5 "After sale" service organisation set up by the Contractor during all the DLP including any extension shall be described in term of permanent resident staff, with requisite qualification and experience. During the DLP, the Contractor shall be responsible free of charge for the detection and repair of defects and components replacements where the metro train or M&P does not conform to the Functional specification and performance requirements. Normal wears and tears are excluded from these defects.~~
- ~~5.1.6 The repair and or replacement of failed components and equipment and installation of repaired/replaced components/equipment shall be undertaken by the Contractor free of charge at Site. The Contractor shall bear custom duty, freight charges and all other expenses involved in collection of defective components and equipment from the Site, and transportation to the manufacturer's works in India or abroad for repairs / update / modification etc. as the case maybe and its return to site after making it good for use. Further, should any design modification be required to any component or equipment as a consequence of failure analysis, such modification shall be done free of charge. In such case, the minimum period of Defect Liability Period (DLP). i.e. 24 months shall recommence from the date when the modified part is commissioned into service and continue upto end of the 24 months period or commencement of DLMP, whichever is earlier. In all such cases, Defect Liability Period (DLP) will be applicable on complete sub-assembly, even when only component has been modified/replaced/repared due to design change.~~

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- ~~5.1.7 All replacement and repairs under the Defect Liability Period (DLP) shall be carried out by the Contractor promptly and to the complete satisfaction of the Project Manager on notification of the defect by the Project Manager or his/her authorised representatives to avoid delay in commercial / revenue service operation.~~
- ~~5.1.8 The Employer and the Contractor shall discuss jointly and finalise the procedure monitoring of performance of trains and M&Ps during DLP period before start of commercial / revenue service of first train.~~
- ~~5.1.9 Bidder shall submit a list of the spares (including Unit Exchange Spares) and consumables which shall be stocked by him during Commissioning and DLP as part of the Bid. This list along with schedule of supply shall be finalized during design stage in consultation with Project Manager.~~
- ~~5.1.10 All schedule maintenance and unscheduled maintenance of trains and M&Ps during DLP period shall be done by the Contractor. However, regular payment shall be made to the Contractor for DLMP only as specified in Milestone specified under Cost Centre-F.~~
- ~~5.1.11 The chapters 14 to 18 of Employer's Requirement General Specifications shall be applicable after start of DLMP.~~

~~5.2 Taking over~~

- ~~5.2.1. Each train set after completion of Integrated Testing and Commissioning, shall be subjected to intensive service trials on their nominated line as stipulated in Chapter 20 of Employer's Requirement: Technical Specifications. Any defects, deficiencies detected during these Service Trials shall be made good promptly by the Contractor. The Project Manager shall thereafter consider issue of Taking Over Certificate for respective train set before introduction into commercial service.~~
- ~~5.2.2. After completion of service trials of the individual train and attending the defects noticed during service trials, the Contractor shall issue notice to Project Manager in terms of GC clause 24.4 for a Taking-Over-Certificate not earlier than 14 days before the works or section (as the case may be) will, in the Contractor's opinion, be complete and ready for taking over. The Project Manager shall, within 28 days after the receipt of the Contractor's application:~~
- ~~(a) issue the Taking Over Certificate to the Contractor, stating the date on which the Works or Section were completed, including the Tests on Completion and Integrated Testing and Commissioning where ever applicable in accordance with the Contract, if defects and/or outstanding works are minor that does not affect the use and safety of the Works or Section for their intended purposes. The list of such works along with the target date of completion for each work shall be enclosed with the taking over certificate and completion of all these works/rectification of defects within the stipulated time shall be the responsibility of the Contractor and any failure in it may be considered a reason by the Project Manager to cancel the taking over certificate issued earlier; or~~
 - ~~(b) reject the application, giving his reasons and specifying the work required to be done by the Contractor to enable the Taking Over Certificate to be issued. The Contractor shall then complete such work before issuing a further notice under this Sub-Clause.~~

5.2.3. Taking over of Parts of the works

- ~~i) The Project Manager may, at the sole discretion of the Employer issue a Taking Over Certificate for any part of the Permanent Works.~~
- ~~If the Employer uses any part of the Works in terms of GC clause 25.4 for commercial / revenue service before the Taking Over Certificate is issued:~~
- ~~a) the part which is used shall be deemed to have been taken over at the date on which it is used, subject to the Contractor completing the works which remain outstanding in the opinion of the Employer;~~
- ~~b) the Project Manager shall, when requested by the Contractor, issue a Taking Over Certificate after the Contractor has completed the outstanding Works and has carried out Tests on Completion, including Integrated Testing; and~~
- ~~e) the Contractor shall cease to be liable for the care of such part from such date, when responsibility shall pass to the Employer.~~
- ~~ii) If the minor outstanding works as incorporated in the taking over certificate are not attended by the Contractor within the specified time frame, the following shall apply:~~
- ~~a) The warranty of the sub-system for which outstanding works are to be completed by the Contractor shall start only after completion of minor outstanding works.~~
- ~~b) Unless, outstanding works as indicated in para (a) above are completed, no amount of Performance Security due to the Contractor shall be released.~~
- ~~e) If in the opinion of Project Manager minor outstanding works will affect the performance of sub-system/components/equipment during service period, the pending works shall be carried out at the risk and cost of the Contractor.~~

Addendum-1 dated 05.12.2022, Sl. No. 38

5. DEFECT LIABILITY AND MAINTENANCE PERIOD (DLMP)

5.1.1

- i) Defect Liability and Maintenance Period (DLMP) shall start after commencement of revenue service of the first train set in GoA2 and shall end 15 years after the start of revenue service of last train set in GoA2.
- ii) For M&P's including Mechanical & Electrical Measuring and Testing Equipment, Mechanical, Pneumatic and Electric Tools, Special Tools, Jigs & Fixtures, Testing & Diagnostic Equipment and Driving Simulator, the DLMP shall start from the date of installation and commissioning of the respective M&P's and shall end 15 years after the start of revenue service of the last train set in GoA2.
- iii) The details of maintenance requirement during DLMP are described in Chapter 14 to 18 of Section VIA - Employer's Requirements: General Specifications. The Contractor shall submit the Defect Liability Maintenance Period (DLMP) Management Plan as per ERGS Clause 2.1.3, Table 2-A.
- iv) The price for DLMP for (SI (i) and (ii)) above shall be quoted by the Bidder as per Part 1, Section IV – Bidding Forms: Price Schedule, Annexure PD-2 COST CENTRE- F

5.1.2 Deleted

5.1.3 Deleted

5.1.4 Deleted

5.1.5 Deleted

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5.1.7 Deleted

5.1.8 Deleted.

5.1.9 Deleted

5.1.10 Deleted

5.2 Taking over

5.2.1. Each train set after completion of Integrated Testing and Commissioning, shall be subjected to intensive service trials on their nominated line as stipulated in Chapter 20 of Employer's Requirement: Technical Specifications. Any defects, deficiencies detected during these Service Trials shall be made good promptly by the Contractor. The Project Manager shall thereafter consider issue of Taking Over Certificate for respective train set before introduction into commercial service.

5.2.2. After completion of service trials of the individual train and attending the defects noticed during service trials, the Contractor shall issue notice to Project Manager in terms of GC clause 24.4 for a Taking-Over-Certificate not earlier than 14 days before the works or section (as the case may be) will, in the Contractor's opinion, be complete and ready for taking over. The Project Manager shall, within 28 days after the receipt of the Contractor's application:

- (a) issue the Taking Over Certificate to the Contractor, stating the date on which the Works or Section were completed, including the Tests on Completion and Integrated Testing and Commissioning where ever applicable in accordance with the Contract, if defects and/or outstanding works are minor that does not affect the use and safety of the Works or Section for their intended purposes. The list of such works along with the target date of completion for each work shall be enclosed with the taking over certificate and completion of all these works/rectification of defects within the stipulated time shall be the responsibility of the Contractor and any failure in it may be considered a reason by the Project Manager to cancel the taking over certificate issued earlier; or
- (b) reject the application, giving his reasons and specifying the work required to be done by the Contractor to enable the Taking Over Certificate to be issued. The Contractor shall then complete such work before issuing a further notice under this Sub-Clause.

5.2.3. Taking over of Parts of the works

- i) The Project Manager may, at the sole discretion of the Employer issue a Taking Over Certificate for any part of the Permanent Works.

If the Employer uses any part of the Works in terms of GC clause 25.4 for commercial / revenue service before the Taking Over Certificate is issued:

- a) the part which is used shall be deemed to have been taken over at the date on which it is used, subject to the Contractor completing the works which remain outstanding in the opinion of the Employer;
 - b) the Project Manager shall, when requested by the Contractor, issue a Taking Over Certificate after the Contractor has completed the outstanding Works and has carried out Tests on Completion, including Integrated Testing; and
 - c) the Contractor shall cease to be liable for the care of such part from such date, when responsibility shall pass to the Employer.
- ii) If the minor outstanding works as incorporated in the taking over certificate are not attended by the Contractor within the specified time frame, the following shall apply:
- a) Deleted
 - b) Unless, outstanding works are completed, full amount of Performance Security (excluding Cost Centre-F) due to the Contractor shall not be released.
 - c) Deleted.

6. OPERATION AND MAINTENANCE MANUAL

6.1. General

- 6.1.1. The Contractor shall provide Operation and Maintenance manuals, for use by supervisory, operating and technical staff of BMRCL, in English.
- 6.1.2. Thirty days before the date of commencement of test running of the first Metro train, the Contractor shall deliver the originals and 6 coloured copies each of the final Operation and Maintenance manuals. These manuals shall have been submitted for proof reading and training purposes prior to delivery. It is accepted that further amendments may subsequently be required.
- 6.1.3. Each and every manual shall be divided into indexed sections explaining the subject matter in logical steps. Most manuals shall consist of A4-size printed sheets bound in stiff-cover wear-resistant binders clearly and uniformly marked with the subject matter and reference number. Where alternative sizes are proposed, (e.g. A5/A6 pocket books of schematic wiring diagrams) these shall be for review and acceptance. The binding shall allow for all subsequent changes and additions to be readily affected.
- 6.1.4. Information shall be provided in pictorial form wherever whenever possible and shall include step-by-step instructions and views of the particular equipment including exploded views. Programmable equipment shall be supplied with sufficient flow charts and fully documented programmes to enable faults to be quickly identified and system modification to be undertaken at any time.
- 6.1.5. The Contractor shall provide clarifications and amendments to the Operation and Maintenance manuals as necessary during the execution of Contract. Updates shall be provided for the originals and all copies.
- 6.1.6. Bidder shall include the price in Cost Centre-H of Annexure PD-2, Section IV: Bidding Forms.

6.2. Operation Manuals

- 6.2.1. The Contractor shall provide operation manuals explaining the purpose and operation of the complete system together with its component subsidiary systems and individual item of equipment. The characteristics, ratings and any necessary operating limits of the Equipment and Sub-systems shall be provided.

6.3. Maintenance Manuals

- 6.3.1. The Contractor shall provide maintenance manuals showing details of all the various systems and sub-systems from a maintenance and fault-finding standpoint, with particulars of operating parameters, tools for dismantling and testing, methods of assembly and disassembly, tolerances, repair techniques and all other information necessary to set up a repair and servicing programme.
- 6.3.2. ~~The Contractor shall provide documentation for all hardware and software for computer systems and other associated electronic equipment to meet the following requirements. Contractor shall ensure the any hardware(s)/software(s) required for the purpose as covered in the maintenance manuals are supplied free of cost. Such documents shall include but not be limited to:~~
 - ~~(i) manufacturers' documentation supplied as standard with the equipment;~~

- ~~(ii) hardware configuration with details of expansion capabilities and options;~~
- ~~(iii) programme loading instructions, including runtime environment configuration;~~
- ~~(iv) programme listing including comprehensive 'comment statements' in hard copy and soft format for source code, compilers and development tools necessary to modify and recompile software;~~
- ~~(v) flow charts, data flow diagrams and state diagrams as appropriate;~~
- ~~(vi) description of software modules including purpose, linkage with other modules, error routines and any special considerations;~~
- ~~(vii) memory maps for both internal and peripheral memory showing description of all programmes, data files, overlay areas, memory available for expansion and the like;~~
- ~~(viii) loading and operating instructions for diagnostic programmes and specifically developed debugging tools; and~~
- ~~(ix) programming manuals relevant to operating systems, languages, development tools, etc.~~

~~With respect to the requirement specified in (iv) to (ix) above, the Contractor shall provide details, documentation, parameterization of software so as to enable the Employer to use, maintain, repair, overhaul trains for maintenance purpose.~~

~~The source code and other information specified in clause (iv) and (ix) above shall be deposited in to "Escrow account" after DLMP period and shall be readily available with the respective supplier for implementing any changes in future.~~

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The Contractor shall provide documentation for all hardware and software for computer systems and other associated electronic equipment to meet the following requirements. Contractor shall ensure the any hardware(s)/software(s) required for the purpose as covered in the maintenance manuals are supplied free of cost. Such documents shall include but not be limited to:

- (i) manufacturers' documentation supplied as standard with the equipment;
- (ii) hardware configuration with details of expansion capabilities and options;
- (iii) programme loading instructions, including runtime environment configuration;
- (iv) programme listing including comprehensive 'comment statements' in hard copy and soft format for source code, compilers and development tools necessary to modify and recompile software;
- (v) flow charts, data flow diagrams and state diagrams as appropriate;
- (vi) description of software modules including purpose, linkage with other modules, error routines and any special considerations;
- (vii) memory maps for both internal and peripheral memory showing description of all programmes, data files, overlay areas, memory available for expansion and the like;
- (viii) loading and operating instructions for diagnostic programmes and specifically developed debugging tools; and
- (ix) programming manuals relevant to operating systems, languages, development tools, etc.

With respect to the requirement specified in (iv) to (ix) above, the Contractor shall provide details, documentation, parameterization of software so as to enable the Employer to use, maintain, repair, overhaul trains for maintenance purpose.

The source code and other information specified in clause (iv) and (ix) above shall be deposited in to "Escrow account" **or shall be deposited by the Contractor as per their company policy** after DLMP period and **same** shall be readily available with the respective supplier for implementing any changes in future.

- 6.3.3. The documentation of software may be supplied after the expiry of the DLMP period, under terms and conditions to be mutually agreed at Contract pre-award stage. The manual shall also include inspection/overhaul procedure and periodicity of various inspection/overhaul schedules in detail including the tools, special tools/plants, and facilities required. The manual shall be subject to review by the Project Manager.
- 6.3.4. A preliminary maintenance schedule specifying the frequency of inspections and the scope of work during such inspections, including facilities, manpower and down-time required shall be included within the Bid.
- 6.3.5. The maintenance manual shall also include an illustrated parts catalogue of all plant supplied and shall contain sufficient information to identify and requisition the appropriate part by maintenance staff. The catalogue shall comprise 3 sub-sections. The first sub-section shall be an alphanumeric parts list, which shall include the following information:
- i) Part number
 - ii) Description
 - iii) Name of manufacturer
 - iv) Quantity and Unit
 - v) Part number of next higher assembly (usually a line replaceable unit).
 - vi) Cross-reference to figure number.
 - vii) Category: e.g. consumable, line replaceable unit, repairable.
 - viii) Life-expected life, Mean time between failure or mean distance between failure where available.
 - ix) General or specific purpose
 - x) Purchase and technical specification

The second sub-section is a series of illustrations to indicate the location of each replaceable item, which shall be clear and progressive with exploded views to enable parts to be identified easily by cross-reference with the alpha-numeric list.

And the third sub-section, an indicative price list which shall list in alpha-numeric sequences the part number with the price, lead time and vendor.

6.4. Electronic Manuals

- 6.4.1. The Contractor shall provide manuals in electronic format. This is in addition to the submission of manuals in hard-copies.

- 6.4.2. The format of the electronic copies shall be proven in at least two other applications and shall allow for links between parts catalogue and maintenance instructions.

The Documents Management System (DMS) shall be PC based, menu driven and user friendly with extensive linkages between OEM's documents, spare parts catalogues, test certificates, HECs, SECPs etc. The DMS to be used shall be demonstrated and approval of the Project Manager obtained. After Taking Over Certificate, one copy of the DMS, fully functional shall be handed over. The Contractor shall however keep another set updated & handover the second set to BMRCL one month before the expiry of DLMP. Language used shall be subject to Project Manager's review.

7. SOFTWARE MANAGEMENT AND CONTROL

7.1. Prescriptive Framework

- 7.1.1. The Contractor shall, within 30 days of Effective Date, submit a Software Assurance Plan for review by the Project Manager.
- 7.1.2. All software to be developed or modified (re-engineered software) shall follow the standardisation requirements of EN 50128 (Railway Applications: Software of Railway Control and Protection Systems). The Contractor shall define within the Software Quality Assurance Plan what techniques and measures are to be applied for software development.
- 7.1.3. The Plan shall require the Contractor to provide all changes, bug fixes, up-dates, modifications, amendments and new versions of the programs, as required by the Project Manager. The Project Manager may also direct to provide the copy of previous version of software till such time the new version of software is proven.
- 7.1.4. The Contractor shall provide all tools, Laptop computers or any special device to upload / download the software, TMS data, equipment, manuals and training necessary for the Project Manager to maintain and re-configure all software provided under this Contract. The documentation of software may be supplied after the expiry of the DLMP, under terms and conditions to be mutually agreed at Contract pre-award stage.
- 7.1.5. When a fault is discovered in delivered software, or an error in the associated documentation, the Contractor shall take the necessary steps to rectify such faults and errors at the earliest opportunity. The Contractor shall supply to the Project Manager, full details, in writing, as to the nature of the corrective action proposed or taken. These changes shall be documented in the form of Software Engineering Change Proposal (SECP), which shall be got approved from the Project Manager. The documentation of software may be supplied after the expiry of the DLMP period, under terms and conditions to be mutually agreed at Contract pre-award stage.
- 7.1.6. It will be incumbent upon the Contractor to take responsibility for any changes required to software.

7.2. Software Framework

- 7.2.1. As defined in EN 50128, all software produced or supplied for the Project shall be subject to a defined quality framework. EN ISO 9000-3 shall be considered appropriate for low criticality software (safety integrity level 0 or 1) whilst the application of a more stringent framework shall be required for higher criticality software (safety integrity level 2 or above). The quality framework requirements for safety integrity level 2 and above are supplementary to the requirements of EN 50128.
- 7.2.2. SIL level of all softwares used in different sub systems shall be defined and certified.

7.3. Software Management Control

- 7.3.1. The Contractor shall ensure a full time Software Project Manager and Software Quality Manager are appointed for software development, if software development or modifications are required under the Contract.

7.4. Auditing

7.4.1. The Project Manager may carry out an audit of the Software. Further external independent audits may also be arranged at the Project Manager discretion.

7.5. Software Acceptance

7.5.1. The Contractor also shall submit an Operational Safety Report (Software) for software acceptance by the Project Manager.

7.5.2. The Operational Safety Report (Software) shall include, as a minimum

i) OSR(S) – Introduction.

Shall describe the nature of software sufficiently to ensure that the Project Manager is given a comprehensive overview of primary characteristics such as structure, functions, criticality, volume and language.

ii) OSR(S) - Evidence of Quality Management.

Shall provide evidence to demonstrate that the software development has been subject to acceptable quality assurance.

iii) OSR(S) - Evidence of Safety Management.

Shall provide evidence to demonstrate that the software development has been subject to acceptable safety management.

iv) OSR(S) - Technical Report.

Shall describe how software integrity has been achieved.

v) OSR(S) - Operation and Maintenance Report.

Shall describe the Software operation and maintenance characteristics.

vi) OSR(S) - Restrictions for Use.

Shall define what restrictions are applied to the use of the software.

7.6. Application Software and Development Tools

7.6.1. With the exception of commercial, "Off the Shelf", the Project Manager shall be provided with full access to application software(s) and any other software/ hardware tools which may be specifically required for the Intended purpose specified in this specification. For commercial software, the Contractor shall provide all available documentation for the application and maintenance of that software. In case any commercially available software has been modified for being used in the train, the same shall be supplied to all depots. Also, in such case, the modification done shall ensure that the developed software shall work in the intended manner without any limitation whatsoever with the updated software versions and full backward integration shall be available.

Complete documentation along with the software to be supplied by the Contractor shall comprise of signal flow diagram, flow charts, functional blocks, details of signals, interpretations so as to enable Employer's Personnel or Contractor's Maintenance Personnel during DLMP to debug and implement vehicle/ train level modifications based on BMRCL's experience operational and maintenance requirement. Full access to the application software shall be provided for this purpose.

It shall be possible for the Employer to modify/change various parameters/logics used in the software and implement the changes on trains. Full facilities including any software/hardware tools, simulation/test bench which are essential for this purpose shall be supplied. The Employer may depute their Employer's Personnel or Contractor's Maintenance Personnel during the TCMS software development. They shall be fully exposed and given hands-on experience of software modification, simulation and implementation. Details shall be finalized during design. Complete set of parameters along with necessary changes that may be required to be made in the supplied software, shall be furnished so that different makes of equipments if need be, can be integrated. It shall also be possible for Employer's Personnel or Contractor's Maintenance Personnel to connect/interface additional peripheral equipment as required by the Employer with vehicle/train software or TCMS, as the case may be, and implement system integration for the same. Contractor shall demonstrate to entire satisfaction of the Project Manager that BMRCL will be able to integrate peripheral equipments of makes other than that have been used by Contractor in the train. Any hardware/software tool required for this purpose shall also be supplied.

Employer's Personnel or Contractor's Maintenance Personnel shall be fully trained to the entire satisfaction of Project Manager and made conversant with the software and other related issues as found necessary during the contract execution. The documentation of software shall be supplied at the time of testing and commissioning of prototype trainset and this shall be considered as a pre-requisite for accomplishment of Key Date '9'. The final document including all changes that may be done during the currency of the Contract shall be supplied after the expiry of the DLMP period and this shall be considered as a pre-requisite for issue of Performance Certificate.

7.6.2. After loading, and the satisfactory functioning of the software, the Contractor shall supply two back-up copies of the software, including any new versions adopted. The documentation of the software shall be supplied at the time of testing and commissioning of prototype trainset. The final documentation of software including all changes that may be done during the currency of the Contract shall be supplied after the expiry of the DLMP period and this shall be considered as a pre-requisite for issue of Performance Certificate.

7.6.3. ~~All software(s), irrespective of Contractor's own software or of sub-suppliers, shall be compatible with latest version of Windows Operating software and shall also have upward compatibility. In case, the compatibility of installed software(s) with latest version of Windows is not available, the Contractor shall replace the installed software(s) that are compatible with latest version of Windows O.S. without downgrading the train performance. Contractor shall commit to support and supply free of cost any special hardware/software required for ensuring compatibility with new version of Windows for atleast a period of 5 years beyond DLP of the last train.~~

~~Beyond this period, in case of obsolescence suitable alternatives solutions shall be implemented (at mutually agreed terms and conditions) and full support shall be provided by the Contractor so as to ensure that train performance is not affected adversely.~~

~~Diagnostic tools to be provided under DLMP by the Contractor and shall be included in Annexure-EDLMP and shall include all hardware/software required for the purpose of:~~

- ~~i) Uploading/downloading of all softwares used in the train/system/sub-systems.~~
- ~~ii) Downloading of faults and any other information required for trouble shooting and diagnostic purpose.~~
- ~~iii) Data analysis and investigation tools of real-time downloads on central computer.~~

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All software(s), irrespective of Contractor's own software or of sub-suppliers, shall be compatible with latest version of Windows Operating software and shall also have upward compatibility. In case, the compatibility of installed software(s) with latest version of Windows is not available, the Contractor shall replace the installed software(s) that are compatible with latest version of Windows O.S. without downgrading the train performance. Contractor shall commit to support and supply free of cost any special hardware/software required for ensuring compatibility with new version of Windows for at least a period of 5 years beyond **DLMP** of the last train. Beyond this period, in case of obsolescence suitable alternatives solutions shall be implemented (at mutually agreed terms and conditions) and full support shall be provided by the Contractor so as to ensure that train performance is not affected adversely.

Diagnostic tools to be provided under DLMP by the Contractor and shall be included in Annexure-EDLMP and shall include all hardware/software required for the purpose of:

- i) Uploading/downloading of all softwares used in the train/system/sub-systems.
- ii) Downloading of faults and any other information required for trouble shooting and diagnostic purpose.
- iii) Data analysis and investigation tools of real-time downloads on central computer.

7.7. Re-Use of Existing Software

7.7.1. Where existing software (defined to module level) is to be re-used without modification, the Contractor shall provide acceptable evidence to the Project Manager, as to why that software is suitable for use in the proposed application. This evidence may be historical (certified evidence of previous satisfactory use in a similar environment and application), or it may be sought as cross acceptance from another railway authority or statutory body. Software re-use shall not be acceptable, without detailed review, where the proposed application is of the same or lower safety integrity level than the current application.

7.8. Re-Engineered Software

7.8.1. Re-engineered software may be used for applications at all safety integrity levels where the proposed application is of the same or lower safety integrity level than the current application. However, this shall be subject to quality assurance testing as defined above.

7.9. Test Software

7.9.1. All test software, with the exclusion of built-in test software, shall be produced in accordance with a quality system controlled under the requirements of accepted international standards. Test software shall be developed and documented using structured techniques and shall be designed to be maintainable throughout the

duration of the Contract. All test software shall be documented to be supportive of maintenance. Any test software, which is to be delivered to the Project Manager (for long term testing use), shall be fully documented including source code listings to allow the Project Manager to maintain the software for the life of the supported system.

7.10. Software Rights

7.10.1. The Contractor shall ensure that the Employer is granted all necessary rights to use Software embodied in the equipment and there are no restrictions attached to the use of any information supplied by the Contractor which might later prevent or hinder the Employer from modifying or adopting or extending the system. The Contractor shall indemnify the Employer against claim of any party, sub- contractor for the unauthorised possession or use of the software supplied.

7.11. Final Version of Software

7.11.1. After DLMP, Contractor shall submit final version of the software for individual sub-systems updating all the changes up to the end of DLMP.

8. SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF DEPOT MACHINERY & PLANT INCLUDING PROVISION OF MECHANICAL & ELECTRICAL MEASURING AND TESTING EQUIPMENT, MECHANICAL, PNEUMATIC AND ELECTRIC TOOLS, SPECIAL TOOLS AND JIGS & FIXTURES AND ANY OTHER ITEMS REQUIRED FOR MAINTENANCE.

- 8.1. The Contractor shall supply, install and commission the Depot M&P, Mechanical & Electrical Measuring and testing equipment Mechanical, pneumatic and electric tools, special tools, Special jigs & fixtures activities and any other items required for maintenance for Kothanur and Airport Depot as detailed in Appendix-11 of ERGS for which price shall be included under Cost Centre-E1, Annexure PD-2, Price Schedule of Section IV: Bidding Forms. The list of M&P's item required in each Depot are provided in Appendix-11 of ERGS along with Technical specification of major Six (6) M&P's item. These specifications are minimum requirement and can be improved upon by the Contractor. For remaining items of M&P's required, it shall be responsibility of the Contractor to procure the same based on standard specification and past performance.
- 8.2. Depot facilities (M&P items) at Baiyappanahalli have already been installed and commissioned for the maintenance of DTG train sets of East-West corridor. This depot is to be upgraded for maintenance of CBTC train sets for Phase-2A and Phase-2B corridors. The Rolling Stock contractor shall examine the available facilities at Baiyappanahalli depot and propose the addition/alteration/modification of the existing M&P facilities (items/equipment) for maintenance of CBTC trains, for which cost shall be included under Cost Centre E-1, Annexure PD-2, Price Schedule of Section IV: Bidding Forms. The details of the major M&P's items installed and commissioned at Baiyappanahalli Depot has been furnished in Appendix-11 of ERGS.
- 8.3. All items of Special Jigs, Fixtures and Gauges supplied by the Contractor, shall be accompanied by drawings, manuals and full operating instructions to enable them to be used by suitably skilled (but not necessarily specially trained) personnel in a non-hazardous manner and to achieve the desired result in terms of accuracy and quality. Each set of these equipments will be provided along with individual set of these drawings, manuals and full operating instructions.
- 8.4. The Contractor shall provide the means and instructions which describe the parameters of each item of Special Jigs, Fixtures and Gauges that are critical to their proper methods of use and which enable the staff using the equipment to achieve the proper performance and operation. Such means and instruction shall include, but not be limited to any routine checking or re-calibration, needs for the tool or test equipment itself.
- 8.5. ~~The warranty period of above items shall be as per Chapter 5 of ERGS.~~
[Addendum-1 dated 05.12.2022, Sl. No. 41](#)
~~Deleted.~~
- 8.6. It shall be responsibility of the Contractor to undertake schedule and un-schedule maintenance, overhauling schedule, repairs etc. during DLMP as per Chapter-14 of ERGS for which price shall be included under Cost Centre-F, Annexure PD-2, Price Schedule of Section IV: Bidding Forms.
- 8.7. The costs indicated in this Cost Centre-E1 of Annexure PD-2, Price Schedule of

Section IV: Bidding Forms for all the Milestones 'E1.1' to 'E1.5' shall be the ACTUAL COSTS and not the apportioned cost.

8.8. Simulator

The Contractor shall supply Train driving Simulators as detailed Appendix -9 of ERGS for which price shall be included in Cost Centre-E2 of Annexure PD-2, Price Schedule of Section IV: Bidding Forms for all Milestone 'E2.1' to 'E2.2' shall be the ACTUAL COSTS and not the apportioned cost.

9. STORAGE, PACKING, CRATING AND MARKING

9.1 General

9.1.1 The 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.

9.1.2 The Contractor shall prepare, protect and store in a manner to be accepted by the Project Manager, all equipment and materials so as to safeguard them against loss or damage from repeated handling, from climatic influences and from all other hazards arising during shipment or storage on or off the Site. Secure and covered storage shall be provided for all equipment and materials other than those accepted by the Project Manager as suitable for open storage.

9.1.3 The Contractor shall provide all packing, crating and markings. In so doing he shall comply with the following requirements:

- i) All packing procedures shall be subject to acceptance by the Project Manager.
- ii) Spare parts shall be tropicalized in their packing for prolonged storage in accordance with BS 1133 or equivalent and shall be suitably labelled to indicate:
 - Ownership (BMRCL)
 - Shelf life.
 - Type of storage.
 - Description of item and relevant part number.
 - Serial number, if applicable.
 - Inspection Certificate number and batch number, that is, the number allocated by the Contractor's Inspector at the time of manufacture or packing.
- iii) Protection requirements shall include but not be limited to:
 - a) Electrical and other delicate items or equipment shall be properly protected to the Project Manager acceptance.
 - b) Tube ends, cable ends, cable entry points into equipment and other similar terminations and openings shall be blanked off to prevent ingress of dirt, moisture, vermin or insects and to provide protection against damage.
 - c) Flanged ends shall be protected by adhesive tape or jointing material covered by a properly secured wooden blank not smaller than the flange itself. Plain tube ends shall be closed off with bungs or plugs or suitable materials firmly fixed in position.
 - d) Particular care shall be taken to prevent damage to or corrosion of shafts and journals where they rest on timber or other supports, which may contain moisture. At such points, wrappings impregnated with anti-rusting composition shall be used. Wrapping shall be of sufficient strength to resist chafing under the pressures and movements likely to occur in transit.
 - e) Spare ball and roller bearings and similarly protected items shall not be removed from the manufacturer's wrappings or packing.

- iv) Each case, crate or package shall be legibly and indelibly marked in large letters with the name (BMRCL), address, Contract Number, "right way up", opening points and other markings as necessary to permit materials and Plant to be readily identified and handled during transit and when received at Site.
 - v) Each case, crate or package shall contain a comprehensive packing list showing the number, mark, size weight and contents together with any relevant drawings. A second copy of the packing list shall be enclosed in a watertight enclosure on the outside of each case.
 - vi) All items heavier than 100 kg shall be marked on the outside of the case to show the gross and net weights, the points for slinging, and where the weight is bearing.
 - vii) Care shall be taken to prevent movement of equipment within cases, crates or packages by the provision of bracings, straps and securing bolts as necessary. Bags of loose items shall be packed in cases and shall be clearly identified by well-secured labels on which the quantity and name of the part and its index or catalogue number have been stamped.
 - viii) In order to reduce fire risk and prevent obstruction, all empty cases, crates, or packages whether or not returnable shall be removed from the Site as soon as possible. If this requirement is not complied with, after due notice, the Project Manager will instruct the Civil Contractor or others to remove them and the Project Manager will back-charge the Contractor the costs incurred together with handling charges.
- 9.1.4 If Sea transportation of trains from manufacturer's works to site at Bangalore is required, seaworthy packing/ treatment of Trains shall be carried out for the safe transportation of trains. It shall apply to sea transportation of spares and other materials also.

10. TRAINING

10.1. Training Requirements

10.1.1. The Bidder shall include and price in his Bid submission a comprehensive proposal to meet the complete training requirements for Operation and Maintenance of the Rolling stock. This shall comprise of, but not limited to, the following

- i. Training of Employer's operating personnel in India at Employer's Metro Rail office (50 Man months) in operation of Train (as per GoA2/GoA4).
- ii. Training of Employer's Driving Instructors and Train Operators at Sub-Contractor's / Contractors and MRTS works offshore (2 Man months).
- iii. Training of Employer's maintenance personnel at Employer's Metro Rail works / Training institute in India (10 Man Months).
- iv. Training of Employer's maintenance personnel at Sub-Contractor's / Contractors works offshore (5 Man months).
- v. Training Manuals

The price of 10.1.1(i) to (v) shall be included in Cost Centre-H of Annexure PD-2, Section IV: Bidding Forms.

10.1.2. The travel, boarding and lodging expenses for the Employer's trainees will be borne by the Employer. The Contractor shall submit the different training modules, their durations, periodicity and target group of persons at the time of design approval stage. The Project Manager in consultation with Contractor may at its absolute discretion alter or include new training schedules while finalizing the design"

10.1.3. Facilities such as classrooms, overhead projectors and video monitors will be made available for imparting training in Employer's depots in India free of cost to the Contractor. However, for training in the Contractor's works, such facilities shall be arranged by the Contractor's at his own cost. The Contractor is however, required to provide at his own cost all other necessary training aids such as written and printed notes, video programs, transparencies, slides, films, models and drawings, and other training aids etc.

10.1.4. The Employer's personnel required to undergo training will be qualified electrical, mechanical and electronics engineers, technicians, supervisors or instructors, with relevant practical experience. The training syllabus should therefore concentrate on familiarisation with particular systems and equipment of the cars and technologies outside of their experience.

10.1.5. Training Instructors provided by the Contractor shall be fully qualified and experienced electrical, mechanical and electronics engineers and experts in the relevant field with experience in training of engineering graduates and technicians to the level of competency essential for operation and maintenance of Metro trains of similar specifications. The Instructors shall be preferably English speaking. If any interpreter is required, it shall be arranged by the Contractor at his cost. The appointment of Instructors shall be confirmed only after his detailed curriculum vitae have been accepted by the Project Manager. In the event that an Instructor is subsequently deemed not to be competent, he shall be replaced forthwith.

10.1.6. The Contractor shall submit a detailed Training proposal in the Technical package to meet the above requirements duly taking into consideration that it shall be the sole responsibility of the Contractor to adequately train Employer's personnel so that they can effectively run/operate trains and can provide the desired output in terms of prescribed level of Reliability, Availability and Maintainability of rolling stock supplied by the Contractor.

10.2. Training Objectives: Train Operating Staff

10.2.1 The objective of training of train operating staff is that the batches of drivers and instructors who will operate the trains should be able to run the trains safely under all operating conditions. The training should also enable them to acquire full capability for identification and troubleshooting of the faults in the specified duration. In order to achieve the above objective, the Operating Staff and instructors should be trained in a similar transit railway or in the Contractor's Works off-shore and on a Test Track. It will be preferred that after classroom instructions, which include mock-ups of cab equipment, the staff are trained in actual operation of cars in a Mass Rapid Transit System or on a test track, having similar cars, to acquire the required confidence.

10.2.2 The Contractor's Instructors deployed for training of operating Staff in India shall provide training in classroom, as well as actual driving of trains during and after commissioning of trains in India under UTO mode. The instructors shall also train the operating staff in trouble shooting of the faults and emergency procedures.

10.3. Training Objectives: Maintenance Staff

10.3.1 The training should enable the Employer's engineers, inspectors and staff to achieve the following broad objectives:

- i) Full understanding of all aspects of the system design and functions of all the equipment including proprietary and third-party equipment, software etc.
- ii) Full understanding of all aspects of program maintenance and overhaul requirements of cars and equipment.
- iii) Procedures to be followed for unscheduled maintenance and repair of cars and equipment.
- iv) Identification of failed components and sub-systems in electronic equipment by use of special test equipment, as necessary.
- v) Modification in the software to extend or modify the control and monitoring functions.
- vi) Maintenance Management Information System and documentation.
- vii) Monitoring and scheduling trains in the Progress Planning and Investigation Organisation.
- viii) Stores inventory planning and control.

10.3.2 The training of Engineer's personnel off-shore shall include direct exposure to Employer's personnel, technicians, inspectors and staff in actual repair, maintenance and overhaul of similar cars in the Depots and Workshops of an operational Mass Rapid Transit System.

10.3.3 The Contractor's Instructors deputed to train Employer's personnel in India shall impart theoretical as well as practical training so as to enable them to develop skill and expertise necessary for satisfactory maintenance, repairs and overhaul of cars.

10.4. Training Methods

10.4.1. As a general guide, training shall be based upon a “two-stage” concept:

- i) Contractor shall depute a training manager for complete management of the training till the initial training requirements are completed. Contractor shall propose a comprehensive training program comprising of different modules and prospectus for approval. The program shall be reviewed by the Project Manager based on the operational and maintenance needs feedback of the completed training modules.
- ii) Stage one shall consist of training in the basic concepts and principles. These shall include system configuration and specification, operation and control of all equipments installed in the cars, preventive maintenance procedures, overhaul and repair concepts, fault diagnostic and trouble shooting and emergency procedures. The training shall consist of class room (theory) training; computer based interactive training and mock-up training.
- iii) Stage two shall consist of “hand-on” site-based practical training on preventive and corrective maintenance and operating procedures.
- iv) The Contractor shall also include the training of the staff in the correct procedures of maintenance and repair of different equipment based on the Training Manual supplied against the Contract.
- v) Contractor shall arrange the experts from the OEMs of the systems to impart the “hands on” training at site for the agreed durations during the Contract execution.
- vi) Training evaluation shall be carried out at regular intervals to monitor the progress and suitability of the training program, and of the trainees.
- vii) The performance of Contractor's Instructors shall also be evaluated by the Project Manager at regular intervals.

10.4.2. Contractor shall provide training for maintenance on models with CBT etc. and overhauling of the actual equipments, which shall cover, as a minimum of following work areas:

- i) ~~Depot Maintenance Management including Documentation. The software package used shall be in the name of BMRCL and shall remain fully functional under the BMRCL's control after the DLP.~~

Addendum-1 dated 05.12.2022, Sl. No. 42

- i) Depot Maintenance Management including Documentation.
- ii) Bogie, Brakes & pneumatics
- iii) Car body including furnishing
- iv) Doors and associated drives
- v) Lifting of car, assembly/disassembly of equipment
- vi) Traction Motors
- vii) Converter/Inverter and associated controls
- viii) Auxiliary Supply Equipments
- ix) TCMS / Control Electronics

- x) PA/PIS and CCTV system
- xi) Gangway and coupler
- xii) Software handling
- xiii) Air-conditioning
- xiv) Stores Management
- xv) Any other area requiring specialist service.

10.5. Training Manual

The Contractor shall provide one original and six coloured copies of the Training Manual for use by the Employer for conducting in-house training. The Manuals shall cover all requirements specified in this chapter. Bidder shall include the price in Cost Centre-H of Annexure PD-2, Section IV: Bidding Forms.

10.6. Transfer of Training Aids

10.6.1. After completion of the training, training aids and materials used shall become the property of Project Manager to enable and further training to take place.

10.7. Training Location and Facilities

10.7.1. Training shall be carried out at such locations as will provide the maximum benefit to the trainees. Such locations may be in India, or abroad, at places of manufacture, assembly or testing, or at other locations as may be necessary. All locations proposed for training shall be subject to the consent of the Project Manager. Details of the facilities proposed to be provided, shall be included within the detailed Training Proposal submitted by the Contractor.

10.8. Administration

10.8.1. The Contractor shall be responsible for the reception, office facilities etc. for the trainees, when in countries other than India.

10.8.2. The Contractor shall be responsible for the general welfare, health and safety of trainees under his control.

11. SITE AND SITE MANAGEMENT**11.1 Access to Site**

11.1.1 The Contractor will be given access to the Site in accordance with Clause 10.2 of the General Conditions of Contract.

11.2 Site Facilities

11.2.1 ~~The Contractor can be provided subject to availability approximately 400 sq. m of total space at nominated depots for the setting up of contractor's site offices and stores at their own cost. These site offices shall be built commensurate with the architecture of the surrounding buildings and after obtaining the approval of Project Manager for its broad design. The structure shall be handed over to Employer in good condition after the completion of the comprehensive maintenance period.~~

~~The built up space if provided to RS contractor for setting up of site office, shall be charged at the commercial rate prevailing in that area as on starting of the year of occupation of built up space by the Contractor and same shall be escalated at the rate 5% per annum.~~

~~[Addendum-1 dated 05.12.2022, Sl. No. 43](#)~~

~~Deleted.~~

11.2.2 The Contractor shall arrange its furnishing, security etc. Charges for the electricity consumption shall be payable by the Contractor at the prescribed rates.

11.2.3 ~~Offices shall be contained in one building and each office shall be accessible only from a corridor within the building. An external double door with reception area shall be provided to the corridor.~~

~~[Addendum-1 dated 05.12.2022, Sl. No. 44](#)~~

~~Deleted.~~

11.2.4 ~~Materials used for the construction of the offices shall be new and of good quality. Materials shall be chosen such that the buildings when erected shall give good temperature and sound insulation.~~

~~[Addendum-1 dated 05.12.2022, Sl. No. 45](#)~~

~~Deleted.~~

11.2.5 ~~Windows to each room shall be of an area not less than 10% of the floor area. All the rooms shall be adequately ventilated. All windows to ground floor offices shall be fitted with burglar bars firmly attached to the structure of the building.~~

~~[Addendum-1 dated 05.12.2022, Sl. No. 46](#)~~

~~Deleted.~~

11.2.6 The Contractor shall also arrange for the constant and hygienic disposal of all effluent, sewage and rubbish from the buildings.

11.2.7 All buildings shall be supplied with electricity 240V 50Hz that shall be distributed to each room in accordance with the Regulations. Lighting and electrical power points shall be provided to each room.

- 11.2.8 Firefighting equipment shall be provided in accordance with the recommendations of the Bangalore City Fire Brigade.
- 11.2.9 The Contractor shall provide, erect and maintain appropriate name boards as specified for each of the offices.
- 11.2.10 Traction power at 750 V D.C will be made available to Contractor free of charge for testing and commissioning. The Contractor shall liaise with Designated Contractors for availing of the power and assuring compliance of all safety procedures. The Contractor shall provide his own train drivers, who are competent and certified for Train Testing, Commissioning and Service Trials. A test track is installed in each of the depot. It will be available for the testing of first prototype train. The Contractor will be allowed use of the test track free of charge.
- 11.2.11 The Contractor shall provide his own lifting facilities for unloading of metro cars and any heavy equipment, at the port of arrival, transshipment point and depot. The Contractor shall however, be allowed to use any necessary Depot facilities free of charge for assembly, commissioning, inspection, repairs to metro cars and equipment, subject to availability. The Project Manager shall, however, not be responsible for adequacy, reliability and safety of the facilities provided to the Contractor.
- 11.2.12 Reasonably lit access to the areas and to rail sidings will be provided by others. If Lighting are not provided in the specific areas allocated to the Contractor, he should make his own arrangements. The Contractor shall be solely responsible for the security and housekeeping of the area, plant and possessions allocated to him. The Contractor shall provide and maintain all facilities required by him in the area allocated for his exclusive use and all other work required to allow the Contractor to fulfil his obligations under the Contract.
- 11.2.13 ~~The Contractor shall arrange at his own cost all Site services necessary and appropriate for the assembly, testing and commissioning of trains, which shall include, but not necessarily be limited to:~~
- ~~i) Electricity at site area (other than traction and inside the shed);~~
 - ~~ii) Compressed air other than the depot inspection shed;~~
 - ~~iii) Communication facilities; and~~
 - ~~iv) Instrumentation.~~

Addendum-1 dated 05.12.2022, Sl. No. 47

The Contractor shall arrange at his own cost all Site services necessary and appropriate for the assembly, testing and commissioning of trains **except traction power supply.**

- 11.2.14 The Contractor shall be responsible for making applications or requests to the concerned Authorities for availing of the above facilities. In the event that electricity or water supplies are arranged by another Designated Contractor in the Depot area, the Contractor may avail himself of those supplies from the Designated Contractor, either directly on agreed terms and conditions. The Contractor shall comply with all regulations of the utility companies and Government departments concerned.

11.2.15 The Contractor shall allocate at his Works, and those of his major sub-contractors, adequate office space, furniture and equipment for the use of the Employer's representative Inspection Engineers. Such accommodation shall include secure filing for Contractual and other sensitive documents, and secure telephone with internet connectivity, computer and printer/ facsimile facilities. Such facilities shall apply equally to the overseas and the local building phases of the Works.

11.3 Site Management

11.3.1 The particular use to which the Site is put shall be submitted to the Project Manager for review within 120 days of the Effective Date. The Contractor shall:

- i) confine his use of the areas of the Site to purposes having been reviewed without objection by the Project Manager who reserves the right to extend, amend or restrict the uses to which areas of the Site will be put;
- ii) where required under the Contract, provide and maintain fencing and lighting around and within the areas of the Site when or where necessary for the safety and convenience of the public or others or as directed;
- iii) refrain from depositing rubbish or causing nuisance or permitting nuisance to be caused and, except where reviewed without objection by the Project Manager, depositing earth on or removing earth from areas of the Site;
- iv) refrain from felling trees, other than those specifically identified in the Contract to be felled, and refrain from depositing earth around the trunks of trees and protect all trees remaining on Site to the satisfaction of the Project Manager
- v) except where otherwise provided, not permit any person to reside on the Site.
- vi) unless otherwise stated, pay all rates and charges of any nature whatsoever arising out of his use of the Site and all work areas provided therein under the Contract.
- vii) not use any part of the Site or Works for advertising purposes except with the acceptance of the Project Manager.

11.3.2 The site shall be maintained in a clean and tidy condition. Materials, including those required for Temporary Works, shall be stored in an orderly manner. The Contractor shall, throughout the period of the Contract, provide a central collection point on Site, as reviewed without objection by the Project Manager, for collecting all empty cans, drums, packing and other receptacles capable of holding water. The Contractor shall ensure the regular collection and removal of such debris from the Site. After every shift of works, all work areas shall be cleaned and made tidy to the satisfaction of the Project Manager

11.3.3 The Contractor shall ensure that gases, fuels, explosives and other dangerous goods are stored and handled in a safe manner and in accordance with the Statutory Regulations pertaining to their storage and handling. The Contractor shall be responsible for obtaining the requisite licences at his own cost.

11.3.4 The Contractor shall provide all necessary protective clothing, safety equipment, hand tools, ladders, trestles, power supply, and replacement equipment for the staff engaged on Site maintenance.

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- 11.3.5 Because of the multi-disciplinary nature of the Project, several different parties may require access to the same portion of the Site during the construction phase, for the installation, erection and testing of the Works.
- 11.3.6 To facilitate the organisation and co-ordination of access and occupation requirements, the Contractor shall maintain a close liaison with other Contractors.
- 11.3.7 As soon as any or all of the Contractor's installations are no longer required for the execution of the Works, the Contractor shall remove those facilities and ensure that the area is left free of debris, excess materials, and obstructions.
- 11.3.8 Deleted.
- 11.3.9 Contractor shall provide and maintain office stationery, one heavy duty photocopier cum colour printer etc. at the project office in Bangalore, throughout the Contract period.

11.4 Site Safety

- 11.4.1 The Project Manager will issue to the Contractor with the latest edition of the Employer's Project Safety Manual. The Contractor shall, as a minimum, comply with the Safety Manual. However, this shall not relieve the Contractor of any of his statutory duties, obligations or responsibilities under the Contract. The Project Manager reserves the right to order the immediate removal and replacement of any item of Contractor's equipment, which is deemed to be in an unsafe condition.
- 11.4.2 The Contractor shall submit, as part of his Safety Plan, a Site Safety Plan, and also designate a member of his staff as Safety Officer.
- 11.4.3 The Contractor shall establish and maintain and staff at all times when personnel are on site, a First Aid Post. Portable First Aid Boxes shall be maintained in a fully equipped state at each site work centre. The Contractor shall ensure that at least one employee on every working shift, is a trained First Aider, capable of administering First Aid competently until the arrival of professional help, in an accident situation.
- 11.4.4 The Contractor shall be fully responsible for the safety of the Works, his personnel, his sub-contractors' personnel, the public, and any persons directly or indirectly associated with the Works, or on or in the vicinity of the depot site. The Contractor shall treat safety measures as high priorities in all his activities throughout the execution of the work.
- 11.4.5 The Contractor shall submit to the Project Manager, regular Site Safety Reports, and shall notify immediately the occurrence of an accident involving his staff or that of his sub-Contractors, or to any person within the area of the depot for which the Contractor is responsible.

12. TRAFFIC, ROAD & APPURTENANCES**12.1. General**

12.1.1. The Contractor shall conform to the applicable requirements of the Motor Vehicle Act - 1988. The Contractor shall ensure compliance with the requirements regarding the licensing of drivers and the registration of vehicles. Vehicle size and load limitations shall be in accordance with all statutory requirements.

12.2. Transportation to Site

12.2.1. The Contractor shall make all arrangements and assume full responsibility for transportation to the site at nominated depots of the passenger rolling stock, and all plant, equipment, materials and supplies needed for the proper execution of the Works. Procedures for access to and from the Site shall be co-ordinated with the relevant Authorities.

12.2.2. Cars shall be transported to depot on trailer. A loading / unloading line shall be made available on each depot. Contractor shall make the arrangement of cranes with adequate capacity and manpower to unload these cars safely on the unloading lines. Prior to unloading, Contractor shall inspect the unloading lines and adjacent area and submit the report to the Project Manager for any infringement.

12.2.3. The Contractor shall use such routes and rights of entry to the Site as may be decided by the Project Manager from time to time. Routes for 'very large' or 'very heavy' loads shall be discussed with the Project Manager in advance and all arrangements thereafter shall be submitted to the Project Manager. In this context, the definition of the terms "very large" and "very heavy" refer to articles that cannot be transported by normal road vehicles or be handled by readily available methods. Where doubt exists, it shall be the responsibility of the Contractor to notify and discuss the nature of the load in question with the Project Manager for possible solutions.

12.2.4. The Contractor shall be responsible for obtaining permission from the Traffic Police and other relevant authorities to move "very large" and "very heavy" loads and for arranging police escorts if required. The Contractor shall ensure that all roads and pavements, etc. leading to and around the Site are kept free from obstructions and shall not cause inconvenience or hindrance to traffic or persons either by its vehicle or its workmen, scaffolding, plant, materials, equipment, etc. All Workmen working on the road shall wear approved reflective safety vests at all times.

12.2.5. The Contractor shall repair damage caused to existing roads, footpaths, steps, cables, sewers, drains, etc. and shall reinstate the same at his own expense to the satisfaction of the relevant authorities.

13. PUBLIC RELATIONS MATTERS AND PROGRESS PHOTOGRAPHS**13.1. General**

- 13.1.1. The Contractor shall, in conjunction with the Project Manager, liaise with Public Relations Officer, BMRCL on all press and public relations matters in connection with the Contract.
- 13.1.2. All press releases, press statements, articles or printed material prepared by the Contractor shall be submitted to BMRCL, in consultation with the Project Manager prior to publication or release to the news media.
- 13.1.3. All press queries relating to the Contract received by the Contractor must be referred to BMRCL for clearance, in consultation with the Project Manager. The Contractor is not allowed to be interviewed by the press or divulge any information freely to reporters without first seeking clearance from BMRCL.
- 13.1.4. Use of the BMRCL logo in the Contractor's publications shall be subject to approval of BMRCL.
- 13.1.5. The Contractor shall provide BMRCL and Project Manager with schedules relating to night works, traffic diversions, closure of road etc. that may cause inconvenience to the public.
- 13.1.6. The Contractor shall extend to BMRCL all the necessary assistance and co-operation with regard to requests for photo-taking, video-taking and visits to the Site by the BMRCL official photographer or appointed film-maker, in consultation with the Project Manager
- 13.1.7. The Contractor shall include a section on matter concerning Public Relation in his monthly report to the Project Manager.
- 13.1.8. All hoardings and signboards put up by the Contractor shall be maintained in good condition.
- 13.1.9. All public complaints should be thoroughly investigated and acted upon by the Contractor on an urgent basis.
- 13.1.10. The Contractor shall give full support to all functions and events e.g. community talks for residents, Site visits for the media etc. organised by the BMRCL during the period of the Contract.

13.2. Progress Photographs

- 13.2.1. After design, manufacturing and testing activities start, the Contractor shall furnish photographs showing the progress of the Works during the month. The actual number of photographs taken and the subjects photographed shall be as directed by the Project Manager.
- 13.2.2. Each photograph shall have forty millimetres by eighty millimetres title block in the lower right-hand corner, which shall show the following information:
 - a) BMRCL Contract No:
 - b) Contract Name:
 - c) Contractor:
 - d) Photograph No:

e) Date

f) Description:

13.2.3. Three colour prints of each photograph shall be submitted. Prints shall be standard commercial quality on single-weight glossy paper 200mm by 250mm in size inserted back-to-back in clear plastic envelopes made for the purpose. Diskettes capturing Office software shall be provided together with the colour prints.

13.2.4. Detailed photographs (date and time stamped) of each train on its arrival at the depot and before introducing for commercial / revenue operation shall be archived and copies handed over to the Project Manager. The photographs must include all such items that are incomplete / defective etc. Complete set (soft copy) shall be submitted every month to the Project Manager.

14. MAINTENANCE REQUIREMENTS OF TRAINSETS AND M&P'S**14.1. Maintenance Requirements of Trainsets and M&Ps**

14.1.1. The Contractor shall at all times, maintain the Trainsets in accordance with the provisions of the Contract, Applicable Laws, Applicable Permits and Good Industry Practices. In particular, the Contractor shall, at all times during the DLMP conform to the Maintenance Requirements including cleaning of Trainsets.

~~14.1.2. The Contractor shall also at all times maintain Depot Machinery & Plants including Mechanical & Electrical Measuring and Testing Equipment, Mechanical, Pneumatic and Electric Tools, Special Tools, Jigs & Fixtures, Testing & Diagnostic Equipment during the DLMP.~~

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The Contractor shall also at all times maintain Depot Machinery & Plants including Mechanical & Electrical Measuring and Testing Equipment, Mechanical, Pneumatic and Electric Tools, Special Tools, Jigs & Fixtures, Testing & Diagnostic Equipment during the DLMP.

EOT cranes shall be Installed & maintained by BMRCL. However, Operation of the EOT cranes shall be done by the contractor.

14.1.3. Contractor shall also at all times maintain Driving Simulator during the DLMP.

14.1.4. The Contractor shall repair or rectify any defect or deficiency set forth in clause 14.2 of this Chapter.

14.1.5. The payment for undertaking Maintenance Obligations of Rolling Stock, Depot Machinery & Plants including Mechanical & Electrical Measuring and Testing Equipment, Mechanical, Pneumatic and Electric Tools, Special Tools, Jigs & Fixtures, Testing & Diagnostic Equipment and Driving Simulator shall be made as per Attachment-5 of this Chapter-14.

14.2. Repair/rectification of defects and deficiencies

14.2.1. The obligations of the Contractor in respect of Maintenance Requirements of Trainsets shall include repair and rectification of the defects and deficiencies in Trainsets.

14.2.2. The obligations of the Contractor in respect of Maintenance Requirements of Depot Machinery & Plants including Mechanical & Electrical Measuring and Testing Equipment, Mechanical, Pneumatic and Electric Tools, Special Tools, Jigs & Fixtures, Testing & Diagnostic Equipment shall include repair and rectification of the defects and deficiencies.

14.2.3. The obligations of the Contractor in respect of Maintenance Requirements of Driving Simulator shall include repair and rectification of the defects and deficiencies.

14.3. Other defects and deficiencies

For defect or deficiency not specified in this document, BMRCL may, in conformity with Good Industry Practice, specify the permissible limit of deviation with reference to the Specifications and Standards. Any deviation beyond the permissible limit shall be repaired or rectified by the Contractor in accordance with Good Industry Practice.

14.4. Emergency repairs/restoration

Notwithstanding anything to the contrary contained in this Chapter, if any defect, deficiency or deterioration in the Trainsets poses a hazard to safety or risk of damage to property, the Contractor shall promptly take all reasonable measures for eliminating or minimizing such danger.

14.5. Spares and Consumables

~~14.5.1. During the Maintenance Period (DLMP), the Contractor shall, at its own cost and expense, maintain sufficient stock of all Spares and Consumables required to meet the comprehensive maintenance obligations at all times. This shall include but not be limited to the following:—~~

- ~~i) Unit exchange spares (refer to Clause 14.5.7)~~
- ~~ii) mandatory spares~~
- ~~iii) Consumable spares~~
- ~~iv) Recommended spares;~~
- ~~v) Overhauling spares;~~
- ~~vi) Testing and Diagnostic equipment;~~
- ~~vii) Any other items required for the maintenance.~~

~~The price for the above shall be deemed to be included in the price quoted in Cost Centre F of Annexure PD-2, Price Schedule of Section IV: Bidding Forms.~~

~~The above spares, tools and equipment shall be stored at the designated depots of Line 6 and Phase 2A & 2B.~~

~~Bidder shall submit a list of the above spares, consumables, special tools, special equipment and ordinary tools/equipment which shall be stocked by him during DLMP as part of the Bid. This list along with schedule of supply shall be finalized during design stage in consultation with Project Manager.~~

~~Any spare item, if required based on OEM's recommendations or otherwise, but not included in the above list shall be deemed to be included and shall be supplied as per the provisions of this Contract without any extra financial implication to the Employer. Contractor will furnish complete details during contract execution (detailed design stage) as noted below for the listed spares;~~

- ~~i) Names, addresses, telephone numbers and other particulars of manufacturers and their local representatives;~~
- ~~ii) Models and part numbers~~
- ~~iii) Full description of spares including a note whether it is sealed unit or an assembly or sub-assembly, which can be broken down into component parts;~~
- ~~iv) Quantity installed in the system;~~
- ~~v) Overall dimensions and weight including minimum packing (if any) for shelf space purposes;~~
- ~~vi) Designed and shelf life;~~
- ~~vii) Interchangeability or otherwise with similar parts;~~
- ~~viii) Normal manufacturing and shipment lead times;~~
- ~~ix) Purchase Technical Specification with relevant drawings~~

~~The information as above shall also be given for all other components/equipments etc. which may have to be changed/replaced during maintenance and overhauling based on the proposed maintenance practices of the contractor.~~

[Addendum-1 dated 05.12.2022, Sl. No. 49](#)

During the Maintenance Period (DLMP), the Contractor shall, at its own cost and expense, maintain sufficient stock of all Spares and Consumables required to meet the comprehensive maintenance obligations at all times. This shall include but not be limited to the following: -

- i) Unit exchange spares (refer to Clause 14.5.7)
- ii) mandatory spares
- iii) Consumable spares
- iv) Recommended spares;
- v) Overhauling spares;
- vi) Testing and Diagnostic equipment;
- vii) Any other items required for the maintenance.

The price for the above shall be deemed to be included in the price quoted in Cost Centre F of Annexure PD-2, Price Schedule of Section IV: Bidding Forms. The above spares, tools and equipment shall be stored at the designated depots of Line 6 and Phase 2A & 2B. Bidder shall submit a list of the above spares, consumables, special tools, special equipment and ordinary tools/equipment which shall be stocked by him during DLMP as part of the Bid. This list along with schedule of supply shall be finalized during design stage in consultation with Project Manager.

Contractor shall submit the following details during design stage for the above listed spares;

- i) Names, addresses, telephone numbers and other particulars of manufacturers and their local representatives;
- ii) Models and part numbers
- iii) Full description of spares including a note whether it is sealed unit or an assembly or sub-assembly, which can be broken down into component parts;
- iv) Quantity installed in the system;
- v) Overall dimensions and weight including minimum packing (if any) for shelf space purposes;
- vi) Designed and shelf life;
- vii) Interchangeability or otherwise with similar parts;
- viii) Normal manufacturing and shipment lead times;
- ix) Purchase Technical Specification with relevant drawings

The information as above shall also be given for all other components/equipments etc. which may have to be changed/replaced during maintenance and overhauling based on the proposed maintenance practices of the contractor.

14.5.2. The Contractor shall ensure replenishment of Consumables and replacement of worn-out items ('**Spares**') as per OEM's recommendations and wear-out of components beyond serviceable limits during normal course of operation of a Trainset. The Consumables/spares shall be replaced or installed, as the case may be, by the Contractor when a Trainset is brought to a Maintenance Depot in accordance with the provisions of this Contract.

14.5.3. The Contractor shall also keep sufficient spares, consumables for maintenance for Depot Machinery & Plants including Mechanical & Electrical Measuring and Testing Equipment, Mechanical, Pneumatic and Electric Tools, Special Tools, Jigs & Fixtures, Testing & Diagnostic Equipment and Driving Simulator during DLMP. Cost for these spares and consumables shall be deemed to be included under Cost Centre-F of

Annexure PD-2 in Price Schedule of Section IV: Bidding forms.

14.5.4. The Contractor shall, during the DLMP, be responsible for timely supply and installation of all other Spares and Consumables, parts, assemblies, sub-assemblies at its own cost and expense; provided, however, that if such supply and installation have arisen on account of negligence, solely and directly attributable to BMRCL, or on account of occurrence of a Force Majeure event, the obligations hereunder shall form part of Unscheduled Maintenance and the cost thereof shall be borne in accordance with the provisions of clause 14.8 of this chapter.

14.5.5. The Contractor shall be fully responsible to ensure sufficient inventory of Consumables and Spares in designated Depots during DLMP for timely repair and maintenance of the Project Assets in conformity with its Maintenance Obligations and to meet the laid down Reliability, Availability and Maintainability targets in Chapter-19 of ERTS.

14.5.6. Inventory Management: -

- i) The Contractor shall, during the Maintenance Period, maintain at its own cost, an inventory of Spares and Consumables required for scheduled and un-scheduled maintenance (as described in below clauses 14.6 and 14.7 respectively), under its own supervision and in its own custody.
- ii) The Employer shall build custody stores, as a part of the Depots and provide the same to the Contractor for his use during the Maintenance Period. The Contractor shall equip the same according to his needs, at his own cost.
- iii) The Contractor shall develop and implement an "Inventory Management System" according to Good Industry Practice. The Contractor shall provide all information for each spare part, special tool and special equipment such as identification, technical specification and store management.
- iv) Inventory management data shall be in sufficient detail to enable assessment of consumption trends and optimum stocking limits. It should be transparent and accessible to the Employer.

~~14.5.7. Unit Exchange Spares (UES)~~

- ~~i) The Contractor shall maintain a minimum Unit Exchange Spares at the designated Depots as per the list indicated in Attachment-4 during the Maintenance Period to meet any exigencies. This list can be revised during Contract subject to meeting the above minimum requirement.~~
- ~~ii) All the UES (Full quantity as specified in Attachment-4) shall be handed over by the Contractor to the Employer free of cost as part of Handover Requirements in accordance to Clause 17-Handover Requirements of ERGS.~~

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Unit Exchange Spares (UES)

- i) The Contractor shall maintain a minimum Unit Exchange Spares at the designated Depots as per the list indicated in Attachment-4 (**revised**) during the Maintenance Period to meet any exigencies **and price for the same shall be included under Cost Centre-F. Any additional requirement over and above the list indicated in Attachment-4 (revised) may be considered by the Bidder for which price shall also be included under Cost Centre F. No extra payment shall be made for such additional requirement beyond the list indicated in attachment-4 (revised) provided for Unit Exchange Spares during the DLMP.**
- ii) All the UES (Full quantity as specified in Attachment-4 (**revised**)) shall be handed

over by the Contractor to the Employer free of cost as part of Handover Requirements in accordance to Clause 17-Handover Requirements of ERGS.

14.5.8. Not used.

14.5.9. The Contractor shall also be responsible for initial provisioning as well as periodic replacement/replenishment of all the required tools and tackles to the maintenance manpower for the requisite repair, maintenance and overhauling activities during the Maintenance Period.

14.6. Scheduled Maintenance

14.6.1. Save and except as otherwise provided in this Contract, the Contractor shall perform its Maintenance Obligations at the periodic intervals notified in the Maintenance Program (the "**Scheduled Maintenance**") for the train sets, Depot Machinery & Plants including Mechanical & Electrical Measuring and Testing Equipment, Mechanical, Pneumatic and Electric Tools, Special Tools, Jigs & Fixtures, Testing & Diagnostic Equipment and Driving Simulator.

14.6.2. The Contractor shall, at least 15 (fifteen) days prior to the Commercial Operation Date (COD) of the first Trainset, mutually agree on a procedure in writing describing the procedure of recalling of Trainsets to the Depot for carrying out Scheduled Maintenance and tests thereafter ("Preventive Maintenance Program"). Further, while finalizing the Preventive Maintenance Program, the Contractor shall plan Scheduled Maintenance of the Trainsets in a manner such that the Required Availability of the Trainsets is maintained by it without compromising on the safety and reliability.

14.6.3. The Preventive Maintenance Program shall be daily reviewed and updated by the Contractor's personnel in Maintenance Depot in consultation with OCC. The Contractor shall prepare the individual scheduled trips of each Trainset in the Reference Train Operation Plan to optimally use the Available Trainsets without affecting the Scheduled Maintenance of the Trainsets. The Contractor shall agree and acknowledge with BMRCL's personnel and Contractor's personnel to collectively coordinate with each other with respect to the Scheduled Maintenance such that the Scheduled Maintenance of the Trainsets is carried out in tandem with the scheduled maintenance of the assets and infrastructure comprising the Maintenance Depot and Line.

14.6.4. The Contractor agrees and acknowledges that it shall be allowed to carry out Scheduled Maintenance of Trainsets in accordance with the procedure set out in the Preventive Maintenance Program or otherwise agreed in advance with the Contractor. For avoidance of doubt, it is clarified that days or time shall be decided such that during which BMRCL through its representatives is not undertaking any scheduled maintenance of the assets and infrastructure comprising the Depot Premises and Line.

14.6.5. The Contractor shall acknowledge that the maintenance activities on the Line shall be undertaken by BMRCL in a planned manner, except in case of any unsafe or emergency conditions which may result in an accident and/or damage to life or property. In the event that the Scheduled Maintenance to be carried out by the Contractor on the Trainsets is interrupted or delayed on account of such conditions and the Contractor is unable to meet the Required Availability of the Trainsets under such Scheduled Maintenance, then the Contractor shall not be liable for any Damages in accordance with Chapter-19 of Employer Requirement-Technical Specification.

14.6.6. Daily Preventive Maintenance Program shall be prepared and finalized for each day at

least 24 (twenty-four) hours in advance duly indicating the Trainsets demanded for Scheduled Maintenance, time required for maintenance activity and description of the maintenance activity (**Daily Preventive Maintenance Program**). The format for submission of Daily Preventive Maintenance Program shall be finalized jointly with BMRCL. The Daily Preventive Maintenance Program submitted by the Contractor shall be reviewed by BMRCL and Trainsets demanded shall be made available within the permitted maintenance tolerance limits decided jointly.

14.7. Unscheduled Maintenance

14.7.1. Any maintenance or repair of a Trainset including M&P and Driving Simulator, not being Scheduled Maintenance, and arising during the DLMP out of any reason including Fault, unsatisfactory performance, defects, deficiencies, accident, vandalism, natural calamity, fire, riots, arson or negligence, shall be undertaken by the Contractor as unscheduled maintenance (the "**Unscheduled Maintenance**"). The Contractor expressly agrees that any and all Unscheduled Maintenance shall be undertaken by them promptly to ensure efficient, safe and reliable operation of the Trainsets, M&P and Driving Simulator. The Contractor shall minimize the Unscheduled Maintenance requirements on the Trainsets as it may adversely affect the overall Train Operation Plan.

"Fault" means, in relation to a Trainset that such Trainset does not comply with the requirements of the Contract or is not fit to be operated for commercial / revenue Services, whether on account of, including but not limited to, a defect, faulty design, faulty materials, bad workmanship or negligence of, or for any other reason which is not solely and directly attributable to BMRCL or occurrence of a Force Majeure Event."

14.7.2. In the event any failure occurs which is solely and directly attributable to BMRCL or due to occurrence of a Force Majeure Event, then BMRCL shall at its sole discretion consider the operational suitability of such Trainset(s) and may operate/return such Trainset to the Contractor for undertaking Unscheduled Maintenance as required.

14.7.3. Any and all Unscheduled Maintenance shall form part of Maintenance Obligations and shall be undertaken by the Contractor. The cost and expense for such Unscheduled Maintenance shall be borne as follows:

- (a) Unscheduled Maintenance due to Fault(s): The Contractor shall bear the cost and expense towards undertaking any and all Unscheduled Maintenance arising on account of Fault(s).
- (b) ~~Unscheduled Maintenance solely and directly attributable to BMRCL; then Contractor shall determine the cost & time required of such repair work and share the same with BMRCL along with the basis of the assessment of the repair cost & time and BMRCL shall bear such costs in accordance with **Attachment-1** of this chapter and the Train Operation Plan shall be suitably revised to reflect the reduced number of Trainset(s) due to Unscheduled Maintenance for only such time period as may be necessary for such repair work. BMRCL can however ask Contractor to review its assessment of cost or repair time based on its own experience, good industry practices and or other inputs from third party suppliers/manufacturers. Contractor shall however be obliged to share its internal costing, pricing details in order to reach at a mutual agreement expeditiously.~~

~~The Contractor shall ensure that train becomes fit for service within least possible~~

~~down time which shall generally not be more than 48 hours.~~

~~Notwithstanding above, for unscheduled maintenance solely and directly attributable to BMRCL for items listed below, only the material cost of the defective items shall be payable to Contractor as per the last supply rate of the same item by the respective vendor substantiated with proof for the same. Contractor shall ensure that train shall become fit for service within 48 hours from reporting of item getting defective.~~

- ~~i) Current collecting Device due to breakage of CCD arm on mainline during revenue service.~~
- ~~ii) Obstruction Deflection & Derailment detection device (ODD),~~
- ~~iii) Breakage of glasses due to stone pelting.~~
- ~~iv) Potential Transformer~~
- ~~v) Current Transformer~~
- ~~vi) Surge Arrester~~

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Unscheduled Maintenance solely and directly attributable to BMRCL; then Contractor shall determine the cost & time required of such repair work and share the same with BMRCL along with the basis of the assessment of the repair cost & time and BMRCL shall bear such costs in accordance with *Attachment-1* of this chapter and the Train Operation Plan shall be suitably revised to reflect the reduced number of Trainset(s) due to Unscheduled Maintenance for only such time period as may be necessary for such repair work. BMRCL can however ask Contractor to review its assessment of cost or repair time based on its own experience, good industry practices and or other inputs from third party suppliers/manufacturers. Contractor shall however be obliged to share its internal costing, pricing details in order to reach at a mutual agreement expeditiously.

The Contractor shall ensure that train becomes fit for service within least possible down time which shall generally not be more than 48 hours.

Notwithstanding above, for unscheduled maintenance solely and directly attributable to BMRCL for items listed below, the material cost of the defective items shall be payable to Contractor as per the last supply rate of the same item by the respective vendor substantiated with **documentary** proof for the same. **Also, labour cost for replacement shall be paid to the Contractor based on actual man hours consumed for replacement of the same.** Contractor shall ensure that train shall become fit for service within 48 hours from reporting of item getting defective.

- i) Current collecting Device due to breakage of CCD arm on mainline during revenue service.
 - ii) Obstruction Deflection & Derailment detection device (ODD),
 - iii) Breakage of glasses due to stone pelting.
 - iv) **Deleted**
 - v) **Deleted**
 - vi) Surge Arrester
- (c) Unscheduled Maintenance due to occurrence of a Force Majeure: the cost shall be borne by the Parties in accordance with Clause 37 of the GC and the Train Operation Plan shall be suitably revised to reflect the reduced number of

Trainset(s) due to Unscheduled Maintenance for only such time period as may be decided by the BMRCL.

- 14.7.4. Notwithstanding anything to the contrary contained in this Contract, the Contractor shall, upon arrival of a Trainset at the Maintenance Depot for carrying out Unscheduled Maintenance, commence the repair thereof as soon as may be possible; provided that if the Trainset is determined to be fit for condemnation, as the case may be.
- 14.7.5. The Contractor shall, within 12 (twelve) hours of arrival of a Trainset, for any Unscheduled Maintenance, furnish to BMRCL in reasonable detail the particulars of defects, deficiencies or damages and the estimated time of repair thereof.
- 14.7.6. BMRCL at its sole discretion may at any time inspect the Trainset to verify the defect, deficiency or damages rectified by the Contractor in a Trainset during an Unscheduled Maintenance.
- 14.7.7. Refer Attachment 2 to this Chapter for details on the Condemnation of a Train or Car.
- 14.7.8. The Contractor shall be fully responsible to ensure availability of adequate competent manpower for carrying out all maintenance and overhauling activities during the Maintenance Period so as to meet the Reliability, Availability and Maintainability targets laid down in ERTS Chapter-19. The competence certificate to the contractor's personnel shall be issued by BMRCL. The Contractor shall provide the necessary supporting documents viz. training certificate etc. to BMRCL for issue of competency certificate. Only personnel's having requisite competency certificate issued by BMRCL shall be allowed to work in depot and undertake train maintenance.
- 14.7.9. BMRCL at its sole discretion may appoint its representative(s) for inspection of the trains, work carried out by the Contractor on train/depot, issuing of final train fitness certificate etc. as the case may be during the contract period.

14.8. Prompt Response and Emergency Breakdown

- 14.8.1. The Contractor shall engage trained personnel and constitute teams comprising of atleast 3 (three) personnel to provide a prompt response for Unscheduled Maintenance outside the Maintenance Depot including handling emergency breakdown through Emergency Breakdown Equipment (EBE) and for conforming with the Maintenance Requirements of Trainsets (the "**Prompt Response and Emergency Breakdown Teams**" or "**PREB Teams**"). The Contractor shall ensure that during DLMP, such PREB Team is available for operation on the line and that such PREB Team are able to leave for their destination, along with a suitable maintenance kit and/or the EBEs, within 30 (thirty) minutes of being notified of an event requiring Unscheduled Maintenance and handling emergency breakdown(s) hereunder. For avoidance of doubt, the Contractor may, with the consent of BMRCL, employ other forms of prompt response which can be demonstrated as equivalent to or better than the prompt response specified herein.
- 14.8.2. The PREB Team shall, to the extent possible, repair and rectify the defects and deficiencies, including those specified in the Maintenance Requirements of Trainsets, and notify BMRCL of further repairs, if any, required to be taken for safe and reliable operation of the Trainset. Upon receiving such report, the Parties agree to take action as may be necessary to procure safe and reliable operation of the Trainset.
- 14.8.3. The PREB shall provide emergency breakdown assistance at site for prompt

rectification of any failure which has caused the emergency breakdown of the Trainset(s).

- 14.8.4. The emergency response and breakdown procedures followed by BMRCL shall be provided after the award of the Contract. The Contractor shall adopt the same for handling the emergency response and breakdown. The Contractor shall provide the necessary support in handling of emergency and/or providing assistance to BMRCL, as the case maybe, in early redressal of the problem.

14.9. Epidemic Defect Warranty

- 14.9.1. The Contractor shall agree that if any identical defect or deficiency occurs on more than 10% (ten per cent) of the equipment or parts of the Trainsets in any rolling period of 36 (thirty six) months commencing from the second year of Supply, such defect or deficiency shall be deemed to be an epidemic defect (the "**Epidemic Defect**") and the Contractor shall promptly take corrective actions for such Epidemic Defect under an epidemic defect warranty to be maintained by the Contractor for the Maintenance Period (the "**Epidemic Defect Warranty**").

- 14.9.2. If during the Contract Period, BMRCL notifies the Contractor that an Epidemic Defect has occurred, the Contractor shall remedy such Epidemic Defect on all Trainsets and undertake such other work and measures as may be necessary for enabling the Trainsets to continue in operation in conformity with the Maintenance Obligations until such defects are rectified. Within 30 (thirty) days of having been notified of such Epidemic Defect by BMRCL, the Contractor shall submit to BMRCL a program for rectification of the Epidemic Defect as soon as practicable and the Contractor and BMRCL shall negotiate and agree to such program in good faith, within a period of 30 (thirty) days after receipt of such program.

14.10. Operations Management by BMRCL

- 14.10.1. BMRCL shall, at all times, operate the Trainsets in accordance with Operations & Maintenance Manual and Good Industry Practice. The Contractor through its Maintenance Personnel at the Depot shall closely liaison with the OCC for all the operational aspect of the Trainsets for example its induction, schedule/unscheduled withdrawal, Line Failures, Train Operators (TO) reports etc.
- 14.10.2. For guidance of the operating staff of BMRCL, the Contractor shall provide an Operations and Maintenance Manual to BMRCL.

14.11. Maintenance Report

No later than 7 (seven) days after a Scheduled Maintenance, Unscheduled Maintenance or any maintenance carried out by the Contractor, as the case may be, the Contractor shall prepare a report containing the particulars of maintenance carried out by the Contractor including:

- (a) an analysis of the defects and deficiencies affecting the performance or safe operation of each Trainset;
- (b) time of arrival of the Trainset in the Maintenance Depot or the arrival of the PREB Team at the site of the failure and/or emergency breakdown, as the case may be, and the time of departure of the Trainset from the Maintenance Depot or the time of rectification of malfunction by the PREB Team at the site of failure and/or emergency breakdown, as the case may be. The details can be verified by BMRCL and if required, shall also be used for the purpose of calculation of Availability of

- Trainsets and corresponding Damages; and
- (c) details of failure including date and time of such failure, counter signed by BMRCL Representative.

Refer **Attachment 3** to this Chapter for more details on Monitoring of the Maintenance by BMRCL

14.12. Warranties for defects and deficiencies

The Contractor warrants that:

- a) all equipment, supplies, plant and machinery at the Maintenance Depot as well as components, parts and systems forming part of a complete Train including the Spares and Consumables as provided by the Contractor shall be new and of utility-grade quality and in full conformity with the Specifications and Standards, Designs and Drawings, Applicable Permits, Applicable Laws and the other requirements of the Contract, of suitable quality and fit for the purpose for which they are intended and be free from defects, deficiencies and defective workmanship;
- b) all Trainsets shall be free from defects, shall comply with all Applicable Laws and Good Industry Practice and shall be capable of operating in the manner intended and contemplated in the Specifications and Standards, Designs and Drawings, Applicable Permits, Applicable Laws and the Contract;
- c) the manufacturing, assembly and supply of the Trainsets shall be performed in accordance with the standards of professional care, skill, diligence and competence generally accepted in the international independent manufacturing industry applicable to engineering and manufacturing and project management practices for manufacturing projects of similar size and type as the Project, when operated in accordance with Good Industry Practice;
- d) the supplied Trainsets shall be capable of performing and would continue to perform as per this Contract;

14.13. Access and audit

In order to verify performance of and compliance with this Contract, BMRCL shall be entitled, to inspect or witness on reasonable notice any aspect of the provision of the Maintenance Obligations and to inspect the Maintenance Reports and any of the records required to be kept by the Contractor. Where such inspection reasonably requires the attendance or participation by the Contractor and/or its sub-Contractor, the Contractor shall provide such attendance or participation by appropriately qualified individuals at its own cost. No such inspection shall however unreasonably disrupt the commercial and industrial operation of the Contractor.

ATTACHMENT 1 - OBLIGATIONS REGARDING RISK OF LOSS OR DAMAGE

1. The Contractor shall bear the risk of loss in relation to each Car arising from the performance of its obligations under this Contract throughout the Contract Period. If the Contractor claims that any damage in the Cars is attributable to BMRCL, then the Contractor shall at its own cost and expense engage an independent third party to conduct a root cause analysis of the damage. Such independent third party shall be engaged with prior consent of BMRCL. The decision of BMRCL regarding appointment of independent third party shall be communicated within a period not exceeding 30(thirty) days of receipt of written communication from Contractor. The Contractor shall submit such report by the third party to BMRCL. If the root cause analysis report identifies the damage attributable to solely any act or omission of BMRCL, then the difference in the amount recovered by the Contractor under the insurance and the amount claimed towards the loss shall be borne by BMRCL, upon submission of relevant documents in support of its claim by the Contractor to the satisfaction of BMRCL. However, any findings of the investigations conducted by the Railway Statutory Authority for analyzing the cause of the failure/Accident resulting into loss shall be binding on both the Parties.

ATTACHMENT 2 - CONDEMNATION OF TRAINSETS**1 Condemnation of Trainsets**

- 1.1 The Parties agree that in the event of the cost of repair of a Trainset or Car thereof, as the case may be, arising out of any reason or event not attributable to the Contractor, including gross negligence, Accident, natural calamities, vandalism, arson, riots or any event of a nature analogous to the foregoing, is more than 50% (fifty per cent) of its depreciated Book Value, the Contractor may, in its discretion, withdraw such Trainset or Car from the Fleet.

2 Termination of Maintenance Obligations

The Parties expressly agree that the obligations of the Parties with respect to a Trainset or Car thereof which is withdrawn or condemned, as the case may be, in accordance with the provisions of 1.1 above shall be deemed to be terminated and the obligations of the Parties including the obligations of Contractor to meet the Required Availability and BMRCL's obligation to make payment under Cost Centre for Maintenance, shall be reduced accordingly on pro-rata basis. Notwithstanding anything contained in this Contract including Force Majeure, no payment shall be made by BMRCL to the Contractor with respect to such condemned or withdrawn Trainsets or Cars thereof, under this clause.

ATTACHMENT 3 - MONITORING OF MAINTENANCE**1 Monthly status reports**

- 1.1 During the Maintenance Period, the Contractor shall, no later than 7 (seven) days after the end of each month, furnish to BMRCL a monthly report stating in reasonable detail the maintenance services performed by the Contractor on the Trainsets and the defects and deficiencies that require rectification in accordance with ERTS Chapter 19. The report submitted shall also include Key Performance Indicators achieved by the Trainsets and the compliance or otherwise with the Maintenance Requirements of Trainsets and Operations and Maintenance Manual. The Contractor shall promptly give such other relevant information as may be required by BMRCL.
- 1.2 Monthly report specified in this attachment shall also include a summary of the key operational hurdles and deliverables expected in the succeeding month along with strategies for addressing the same and for otherwise improving the Contractor's operational performance.

2 Reports of unusual occurrence

The Contractor shall, prior to the close of each day, send to BMRCL, by e-mail, a report stating the Faults, Accidents and unusual occurrences relating to the Trainsets. A weekly and monthly summary of such reports shall also be sent within 3 (three) days of the closing of each week and month, as the case may be. For the purposes of this attachment, unusual occurrences on a Trainsets shall include:

- (a) Fault of a Trainset;
- (b) Accidents involving a Trainset;
- (c) Trouble on a Trainset during operation; and
- (d) Unscheduled Maintenance performed on a Trainset.

3 Inspection

BMRCL shall be entitled to inspect the Trainsets after any Scheduled Maintenance or Unscheduled Maintenance, as the case may be, for evaluating the compliance of Trainsets with the Maintenance Obligations. It shall make a report of such inspection (the "**Maintenance Inspection Report**") stating in reasonable detail the defects or deficiencies, if any, with particular reference to the Maintenance Obligations and notify the Contractor of the same for taking remedial measures in accordance with the provisions of this attachment.

4 Tests

For determining that the maintenance of Trainsets conforms to the Maintenance Obligations, BMRCL may require the Contractor to carry out, or cause to be carried out, the Tests specified by it in accordance with Good Industry Practice. The Contractor shall, with due diligence, carry out or cause to be carried out all such tests in accordance with the instructions of BMRCL and furnish the results of such Tests to BMRCL within 15 (fifteen) days of such Tests being conducted.

5 Remedial measures

- 5.1 The Contractor shall repair or rectify the defects or deficiencies, if any, set forth in the Maintenance Inspection Report or in the Test results referred to in Clause 4 and furnish a report in respect thereof to BMRCL within 15 (fifteen) days of receiving the Maintenance Inspection Report or the test results, as the case may be.
- 5.2 BMRCL shall require the Contractor to carry out or cause to be carried out tests, at the cost of the Contractor, to determine whether the remedial measures have brought the Trainsets into compliance with the Maintenance Obligations and Safety Requirements, and the procedure set forth in this Clause 5 shall be repeated until the maintenance of Trainsets conforms to the Maintenance Obligations and Safety Requirements. In the event that remedial measures are not completed by the Contractor in conformity with the provisions of the Contract, BMRCL shall be entitled to recover Damages from the Contractor under and in accordance with the provisions of GCC. For avoidance of doubt, the remedial measures hereunder and the tests relating thereto shall be deemed as part of Unscheduled Maintenance, and the period for which the Trainset remains out of service on account thereof shall be included in Non-Available Hours.

6 Responsibility of the Contractor

- 6.1 It is expressly agreed between the Parties that any inspection carried out by BMRCL or the submission of any Maintenance Inspection Report by BMRCL as per the provisions of this Attachment 3 shall not relieve or absolve the Contractor of its obligations and liabilities hereunder in any manner whatsoever.
- 6.2 It is further agreed that the Contractor shall be solely responsible for adherence to the Key Performance Indicators specified in ERTS Chapter 19.

7 Technical Records

- 7.1 The Contractor shall maintain records of the maintenance and repairs it carries out using:
- a) Asset Management System or any such substitute system as the Contractor and BMRCL may agree; and
 - b) a hard copy, Train maintenance log.
- 7.2 The Contractor shall provide BMRCL, on request with such access it reasonably requires including inputs, outputs, downloads, print outs and analysis and any other information from the Asset Management System, TCMS or any other relevant management information system deployed by the Contractor for management of Project Assets.
- 7.3 The Contractor shall keep and maintain clear, adequate and accurate records and documentation on per Trainset basis to show to BMRCL's reasonable satisfaction that the Maintenance Obligations have been and are being carried out in accordance with the Maintenance Program, Maintenance Requirements of Trainsets, Safety Requirements, all Applicable Laws, Applicable Permits and Specifications and Standards, mileage information, the date of the next maintenance service due and the reasonable requirements of BMRCL. The Contractor will maintain records of the maintenance and repairs it carries out in accordance to this chapter.

ATTACHMENT 4 – LIST OF UNIT EXCHANGE SPARES TO BE MAINTAINED BY THE CONTRACTOR

*(*Wherever the Unit is mentioned as 'Set', it means '6-Car Train Set' and material should be proposed for DMG-TG-MG-MG-TG-DMG and wherever it is mentioned as 'No', it means 'Numbers'. Where unit is written as Set but in description it is for 3-Car unit, this means material required for DMG-TG-MG to be proposed)*

Sl. No.	Description	Unit	Quantity
1	Current Collector Set complete	Set	2
2	Traction Motor without half coupling	No	8
2-1	Half Coupling	No	8
3	Power Inverter	No	2
4	Auxiliary Converter with battery charger	No	2
5	High Speed Circuit Breaker Circuit Breaker with control box	No	4
6	Complete Motor Bogie equipped with Traction Motors with power and earthing cables, Wheel Sets and brake units etc.	Set	1
7	All types of Complete Trailer Bogie equipped with Wheel Sets and brake units etc.	Set	1
8	Driving Motor car wheel sets complete with drive mechanism, brake discs, axle box and bearing etc.	Set	1
9	Trailer car wheel set complete with brake discs, axle box, bearing etc.	Set	1
10	Battery cell for 6-car unit with inter-connectors	Set	2
11	All Electrical monitoring, control and protection panels etc. including pneumatic gauges, sensors as applicable. (list to be furnished by the Bidder)	Set	2
12	Coupler: Auto (without electrical head); Semi-permanent;	Set	1
13	Gangways (in pair).	Set	1
14	Master controller & mode selector	No	12
15	PWM Generator with interface panel	No	10
16	Motor Compressor Set for pneumatic system	No	4

Sl. No.	Description	Unit	Quantity
17	Air dryer	No	4
18	Secondary suspension (Air suspension) complete set	Set	1
19	Primary springs	Set	1
20	Brake caliper unit without parking, with parking and brake pad	Set	2
21	Brake control unit (Electronic and pneumatic)	Set	4
22	Complete PA/ PIS set including connectors but excluding interconnecting cable.	Set	6
23	Complete saloon door (including operating mechanism and all types of door leaves)	No	60
24	Saloon Air conditioning Unit	No	12
25	TCMS Equipment set	Set	4
26	WFL (complete with fasteners including holder and sticks)	Set	2
27	Current Transformer	Set	3
28	Potential Transformer	Set	3

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ATTACHMENT 4 - LIST OF UNIT EXCHANGE SPARES TO BE MAINTAINED BY THE CONTRACTOR FOR ALL 3 DEPOTS (REVISED)

(*Wherever the Unit is mentioned as 'Set', it means '6-Car Train Set' and material should be proposed for DMC-TC-MC-MC-TC-DMC and wherever it is mentioned as 'No', it means 'Numbers')

Sl.no.	Description	Unit	Quantity for 3 Depots
1	Current Collector Set complete	Set	2
2	Traction Motor without half coupling	No	8
2-1	Half Coupling	No	8
3	Power Inverter (VVVF)	No	6
4	Auxiliary Converter-Inverter with battery charger	No	6
5	High Speed Circuit Breaker Circuit Breaker with control box	No	6
6	Complete Motor Bogie equipped with Traction Motors with power and earthing cables, Wheel Sets and brake units.	Set	3
7	All types of Complete Trailer Bogie equipped with Wheel Sets and brake units.	Set	3

8	Driving Motor car wheel sets complete with drive mechanism, brake discs, axle box and bearing.	Set	1
9	Trailer car wheel set complete with brake discs, axle box, bearing.	Set	1
10	Battery cell for 6-car unit with inter connectors	Set	2
11	All Electrical monitoring, control and protection panels. including pneumatic gauges, sensors as applicable. (list to be furnished by the Bidder)	Set	2
12	Coupler: Auto (without electrical head); Semi-permanent;	Set	2
13	Gangways (in pair).	Set	2
14	Master controller & mode selector	No	12
15	Motor Compressor Set for pneumatic system	No	6
16	Air dryer	No	6
17	Secondary suspension (Air suspension) complete set	Set	2
18	Primary springs	Set	3
19	Brake caliper unit without parking, with parking and brake pad	Set	3
20	Brake control unit (Electronic and pneumatic)	Set	4
21	Complete PA/ PIS set including connectors but excluding interconnecting cable.	Set	6
22	Complete saloon door (including operating mechanism and all types of door leaves)	No	24
23	Saloon Air-conditioning Unit	No	12
24	TCMS Equipment set	Set	3
25	WFL (complete with fasteners including holder and sticks)	Set	2

ATTACHMENT-5: SCHEDULE OF PAYMENT FOR COST CENTRE-F

1. The price for undertaking Maintenance Obligations of Trains, Depot M&Ps and Driving Simulator shall be apportioned as part of Cost Centre F of the Price Bid as Annual Maintenance Fee per Train per year for different Service Years of the Maintenance. F1, F2, F3 (as indicated in Cost Center-F of Price Bid) represents Applicable Annual Maintenance Fee of one Trainset for Service Year 1, Service Year 2, Service Year 3 and so on. These fees shall deem to include all cost towards maintenance of Trains including maintenance and operation of Depot facilities, Depot M&Ps, Driving Simulator, tools, spares except cost towards supply of Depot M&Ps, supply of Driving Simulator and such other cost for which separate payment is explicitly indicated in the Cost Centre E of the Price Bid.
2. 'First Service Year' with respect to a particular Trainset shall be defined as a period of one year commencing from the Date of its commercial operation. Subsequent Service Years of this Trainset shall be defined as a period of one year after the preceding Service Year.
3. ~~Payment of Maintenance Fee shall be applicable from the date of start of Revenue Operation of last Train set, i.e., from the date of start of DLMP.~~

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Payment of Maintenance Fee shall be applicable **after commencement of revenue service of the first train set in GoA2.**

4. The Maintenance Fees shall be payable on quarterly basis on completion of each quarter of Accounting Year. The 1st Quarter (Q1) of the Accounting Year shall begin on 1st April of each year and 2nd Quarter (Q2) on 1st July, 3rd Quarter (Q3) on 1st October and 4th Quarter on 1st January.
5. The Total Maintenance Fee applicable for a quarter of any Accounting Year shall be calculated as Sum total of the Maintenance Fee of each Trainset under DLMP obligations during the quarter where Maintenance Fee of each of the Trainset shall be calculated as below: –

$$RSDLMP_{Fn} = 0.25 \times RSDLMP_{Fa} \times (RSD_{AM} / RSD_Q)$$

Where;

$RSDLMP_{Fn}$ = Maintenance Fee applicable for each 6-car Train set for the quarter, where suffix 'n' is the Trainset number

$RSDLMP_{Fa}$ = Applicable Annual Maintenance Cost of the Train for the corresponding Service Year of Maintenance

RSD_{AM} = Train-Days under Maintenance Obligations for the corresponding Service Year of maintenance during the Quarter

RSD_Q = No of Days in the relevant Quarter

6. The illustration given below calculates Maintenance Fee of first quarter of 2026 (01.01.2026 to 31.03.2026) for a hypothetical fleet of 3 Trains where revenue operation dates of these Trains are considered as 10.02.2023, 20.10.2024 and 01.03.2025 respectively and it is assumed that start of DLMP is from 01.03.2025.

Train No.	Date of Revenue operation	Service Year / Annual Maintenance Cost				Total Maintenance Fee
		1	2	3	4	
		F1	F2	F3	F4	
1	10/02/2023	-	-	40 (01.01.26-09.02.26)	50 (10.02.26-31.03.26)	$[(40 * F3 + 50 * F4) / 90] * 0.25$
2	20/10/2024	-	90 (01.01.26-31.03.26)	-	-	$[(90 * F2) / 90] * 0.25$
5	01/03/2025	59 (01.01.26-28.02.26)	31 (01.03.26-31.03.26)	-	-	$[(59 * F1 + 31 * F2) / 90] * 0.25$

7. ~~For trainset which complete 15 Service years before the end of DLMP, the maintenance fees applicable for the years after completion of the Fifteenth service year shall be as per the percentages specified for service years 16, 17 and 18 under Cost Center – F of Annexure PD2 of Section: IV – Bidding Forms. However, the apportioned maintenance fees for service year 16, 17 and 18 shall not be considered for Bid Evaluation.~~

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For trainset which complete 15 Service years before the end of DLMP, the maintenance fees applicable for the years after completion of the Fifteenth service year shall be as per the percentages specified for service years 16, 17, 18, **19 and 20** under Cost Centre - F of Annexure-PD2 of Section: IV - Bidding Forms. However, the apportioned maintenance fees for service year 16, 17,18, **19 and 20** shall not be considered for Bid Evaluation.

15. MANAGEMENT OF MAINTENANCE DEPOT

15.1. General

- 15.1.1. The 'Depot Site or Depot' and 'RS Maintenance Depot' are defined in Clause 1.1 of PC of Section VIII of the Bid document. The tentative layout of Depot Sites at Kothanur Depot, Airport Depot and Baiyappanahalli Depot, is attached at Section X: Drawings of Part 4. Clear demarcation and jurisdiction of the RS Maintenance Depot within the depot site shall be however finalized during the Joint Survey to be conducted as specified in 15.2.1 below.
- 15.1.2. BMRCL shall handover the RS Maintenance Depots at Kothanur Depot, Airport Depot and Baiyappanahalli Depot for carrying out Contract '5RS-DM' obligations. Upon Termination or expiry of Contract period, the Contractor shall hand back the RS Maintenance Depot according to the terms of the Contract.
- 15.1.3. Broadly the RS Maintenance Depot shall include Stabling Bay Lines (SBL), Inspection Bay Line (IBL), Repair Bay Lines (RBL) for heavy repair etc., M&Ps, Cleaning Sheds, Washing, Pit Wheel Lathe, other maintenance facilities etc. Refer Appendix 11 to ERGS for details of depot facilities including M&P required for Kothanur Depot, Airport Depot and Baiyappanahalli Depot. Bidders are advised to visit the depot sites to take a note of the existing M&Ps in Baiyappanahalli Depot. Contractor shall arrange to design, supply, install and commission Depot M&P, Mechanical & Electrical Measuring and testing equipment Mechanical, pneumatic and electric tools, special tools, Special jigs & fixtures activities and any other items required for maintenance as per Clause 8.8 of ERGS. Once all the required Depot M&Ps and Driving Simulator are commissioned, contractor shall submit detailed list of all M&Ps commissioned along with their Bill of Quantities.
- 15.1.4. Presently Baiyappanahalli depot is nominated for maintenance of East-West corridor DTG trains and subsequently shall be upgraded for maintenance of CBTC trains for Phase-2A and 2B. The Contractor shall inspect and examine the suitability of depot facilities including M&P available there for maintenance of CBTC trains and if required shall upgrade or procure additional items of Depot M&P, Mechanical & Electrical Measuring and testing equipment Mechanical, pneumatic and electric tools, special tools, Special jigs & fixtures activities, for which cost shall be quoted in Cost Centre E1 of Annexure PD-2, Price Schedule of Section IV: Bidding Forms
- 15.1.5. The maintenance Responsibility of Depot M&P, Mechanical & Electrical Measuring and testing equipment Mechanical, pneumatic and electric tools, special tools, Special jigs & fixtures activities shall be as per Clause 8.8.6 of ERGS.

15.2. Handing over of RS Maintenance Depot from BMRCL to the Contractor

15.2.1. Joint Survey

- i) BMRCL and the Contractor shall nominate at least 2 (two) representatives each of appropriate level and stature to carry out a joint survey of the RS Maintenance Depot no later than 30 (thirty) days prior to the handover of RS Maintenance Depot by BMRCL to the Contractor in accordance with the terms of this Contract (**Joint Survey**).

- ii) During the Joint Survey, the Contractor shall make complete assessment of the RS Maintenance Depot. Pursuant to the Joint Survey, any observations/remarks arising out of the Joint Survey shall be discussed, recorded and finalized as a Joint Survey report a copy of which shall be provided to the Parties (**Joint Survey Report**).
- iii) Within 7 (seven) days of receipt of the Joint Survey Report, the Contractor and BMRCL shall acknowledge the findings of the Joint Survey Report by signing it. In the event that any Party fails to acknowledge the findings of the Joint Survey Report by signing it within the time specified above, the findings of the Joint Survey Report shall be deemed to have been acknowledged by such Party. Upon acknowledgement of the Joint Survey Report by each Party, the Joint Survey Report shall become final and binding on the Parties.
- iv) The metering arrangement and detailed procedure of metering related technical and procedural issues etc. shall be finalized during Joint Survey at the time of hand over.
- v) After the finalization of the Joint Survey Report, the RS Maintenance Depot shall be handed over to the Contractor.

15.2.2. Handing Over of the RS Maintenance Depot

- i) The RS Maintenance Depot shall be handed over after finalization of the Joint Survey Report in accordance with clause 15.2.1 above and in accordance with the conditions of this Chapter and the terms of the Contract.
- ii) The Contractor shall have rights to the use the RS Maintenance Depot in accordance with the provisions of this Contract. A License agreement shall be executed as per Contractual requirements after award of Contract.
- iii) The Contractor shall not use the RS Maintenance Depot other than for the Works specified in the Contract.
- iv) The Contractor shall not sublet the whole or any part of the RS Maintenance Depot save and except as may be expressly set forth in this Contract provided however that nothing contained herein shall be construed or interpreted as restricting the right of the Contractor to appoint contractors for the performance of its obligations hereunder including for maintenance of all or any part of the RS Maintenance Depot.

15.3. Maintenance of RS Maintenance Depot

15.3.1. Maintenance obligations of the Contractor

- 15.3.1.1. The Contractor shall provide trained personnel(s) at all levels for the maintenance of the RS Maintenance Depot capable for successfully managing the RS Maintenance Depot activities and safely maintaining the equipment, systems and subsystems. Refer to **Attachment 1** and **Attachment 2** of this Chapter regarding day-to-day work management.
- 15.3.1.2. The Contractor shall be solely responsible for all day-to-day operations at the RS Maintenance Depot activities including the safety of the personnel and the Trainsets and shall duly observe the Safety Health & Environmental Manual of BMRCL.

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- 15.3.1.3. The Contractor shall be responsible for management, proper upkeep, housekeeping and maintenance of the RS Maintenance Depot handed over to him during the Contract Period in accordance with the terms of the Contract.
- 15.3.1.4. The Contractor shall be responsible for proper upkeep and maintenance of all M&Ps including those procured by the Contractor.
- 15.3.1.5. The Contractor shall undertake all Scheduled Maintenance and Unscheduled Maintenance works on the Trainsets at RS Maintenance Depot.
- 15.3.1.6. Contractor shall provide Blocks in the RS Maintenance Depot as requested by BMRCL in a planned manner by giving a notice to the Contractor in accordance with clause 15.3.2.5 below, without affecting the Required Availability of the Available Trainset.
- 15.3.1.7. Contractor shall be responsible for making timely payment of the electricity consumption charges for the RS Maintenance Depot to BMRCL upon receipt of the bill in accordance with clause 15.3.3 of this Chapter before the due date of the bill indicated by BMRCL.
- 15.3.1.8. Contractor shall optimize the consumption of the water required for maintenance and other Project activities and all the water consumption charges in the RS Maintenance Depot shall be borne by the Contractor. Considering the scarcity of the water resources at present & in future, Contractor by all innovative means shall progressively make efforts to limit the water consumption. Contractor shall make payments of the water charges bill(s) for RS Maintenance Depot to BMRCL/ the Government Instrumentality (if applicable), upon receipt of the bill before the due date of the bill indicated by BMRCL/ the Government Instrumentality (if applicable).
- 15.3.1.9. The Contractor shall be liable to pay the penalties on any delayed payment of water bills to water supply utilities arising due to the delayed and non-payment of the water bills advised by BMRCL/ the Government Instrumentality to Contractor. In case the Contractor does not make the payment of water bills to BMRCL/ the Government Instrumentality in the stipulated time, then BMRCL shall be at liberty to recover the dues including any penalty imposed by the Government Instrumentality for non-payment of the utility bills from the Monthly Maintenance Charges due to the Contractor. The Contractor shall be liable to indemnify BMRCL for any loss which BMRCL may incur on account of non-payment of the utility bills.
- 15.3.1.10. Contractor shall maintain the cleanliness in the RS Maintenance Depot and regularly service and clean all M&Ps.
- 15.3.1.11. The Contractor, in order to optimize available resources and maximize reliability and Available Trainsets, shall install a proven web-based Asset Management System, e.g. SAP, Maximo, etc. for comprehensive management of all physical assets on a common platform with key features like:
- a) Asset management;
 - b) Work management;
 - c) Procurement, inventories, contracts and services management;
 - d) Maintenance scheduling of Project Assets;
 - e) Predictive maintenance;
 - f) Failure Notification Procedure.

The data entry and update in the Asset Management System shall be done by Contractor's personnel. However, BMRCL shall be given access to the data, information and reports generated by the Asset Management System through dedicated terminals / workstations / servers provided by the Contractor at DCC, OCC and at any other BMRCL offices through the internet.

- 15.3.1.12. The Contractor shall provide access to the Trainsets and the RS Maintenance Depot to the BMRCL's Representatives and any other person authorized by BMRCL for undertaking cab foot plating, conducting periodical current collection Tests and any other activities of the BMRCL in the line and the assets on the depot which are in control of BMRCL and have not been handed over to the Contractor.
- 15.3.1.13. The Contractor acknowledges that BMRCL shall provide the security for the entire Depot site perimeter at the entry/exit points of the depots. However, it is responsibility of Contractor to provide security at various locations of the depots based on the requirement. Contractor shall liaison with BMRCL security for providing access/entry pass for the RS Maintenance Depot.
- 15.3.1.14. The Contractor shall comply to the Safety requirements as set out in Attachment 3 of this chapter.
- 15.3.1.15. The Contractor shall ensure coordination with the BMRCL's Representative and personnel for operation of Traction and auxiliary power supply system by the Contractor's personnel including requesting for power blocks required for the maintenance activities to be undertaken by the Contractor or BMRCL at depot. The Contractor shall be responsible for deployment of competent personnel for: (a) the safe operation of the Traction and auxiliary power supply system; and (b) the safety of all persons including BMRCL's personnel and any third party at the RS Maintenance Depot.

15.3.2. Maintenance obligations of BMRCL

- 15.3.2.1. All maintenance works related to Civil works, E&M, fire safety, Traction, all S&T installations and Track Installation including all its fittings shall be undertaken by BMRCL.
- 15.3.2.2. BMRCL shall maintain the security of the Depot Site perimeter and shall provide the Contractor, its personnel(s), staff or persons authorized by it, entry access to the Depot Site in accordance with the terms of the Contract. The detailed methodology for the security arrangement shall be finalized by BMRCL before handing over of RS Maintenance Depot.
- 15.3.2.3. BMRCL from Operational Control Centre (OCC) and through its personnel(s) at Depot Control Centre (DCC) shall coordinate for movement of the Available Trainsets from the RS Maintenance Depot as part of the overall operational management. The head of BMRCL's team positioned in DCC shall be the overall in charge for coordination between RS Maintenance Depot and OCC for finalizing all Trainsets schedule/unscheduled visits to RS Maintenance Depot, time tabling issues, monitoring Available Trainsets vis-à-vis required no. of Trainsets on Line and planning of maintenance Blocks for maintenance activities to be done by BMRCL.
- 15.3.2.4. BMRCL shall make efforts to ensure that maintenance Blocks taken in RS Maintenance Depot do not cause hindrance in the Availability of Trainsets by the Contractor.

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- 15.3.2.5. All maintenance works related to Traction, all S&T installations and Track Installation including all its fittings shall be undertaken by BMRCL in a planned manner with intimation to the Contractor given on weekly basis notice in advance generally and the Contractor shall ensure that the Required Availability for the Trainset is not affected by BMRCL's maintenance activity, except for unsafe or Emergency conditions, in which case, no Damages shall be levied on the Contractor if the Required Availability of the Trainsets is not met.
- 15.3.2.6. BMRCL receives the electricity at its receiving substations and then distributes it to the Maintenance Depot for traction and non-traction usage. Details shall be shared after award of Contract.
- 15.3.2.7. BMRCL shall provide suitable energy meter(s) to measure the electrical energy consumption for the Maintenance Depot(s) including both traction and non-traction usage of electrical energy. BMRCL shall make available the bill for the electricity consumption to the Contractor for non-traction usage. The Contractor shall pay the bill in accordance with clause 15.3.3 of this Chapter.
- 15.3.2.8. BMRCL shall ensure that the RS Maintenance Depot activities related to providing Trainsets available for commercial / revenue services shall generally be given preference above the scheduled maintenance activities undertaken in the Depot Site by BMRCL, unless the activity carried out by BMRCL is unavoidable and may lead to unsafe conditions for Trainset operation.
- 15.3.2.9. BMRCL shall ensure that any maintenance activities taken for safety related issues, or safety of staff/passengers and/or for the safety of Available Trainsets, does not generally result in complete shutdown of RS Maintenance Depot and BMRCL shall make efforts that any unscheduled maintenance activities, if taken, should be limited to at most one line/bay.
- 15.3.2.10. BMRCL shall make sincere efforts to ensure that the Required Availability of Available Trainsets to be provided by the Contractor shall not be affected by the maintenance activities performed by BMRCL (either at the maintenance Blocks or Emergency Blocks). However, if the Required Availability is affected due to the reasons solely and directly attributable to the maintenance activities taken by BMRCL, the Damages for Non-Available Trainsets shall not be levied by BMRCL. In such case, the onus to prove that delay of any Non-Available Trainset was on account of BMRCL's maintenance activities in the Depot Site shall be on the Contractor.
- 15.3.2.11. BMRCL shall undertake the civil and electrical maintenance in the ETU building.
- 15.3.2.12. BMRCL shall provide adequate training and subsequently issue a competency certificate to the personnel deployed by the Contractor at the DCC.
- 15.3.2.13. In case of any maintenance related dispute, the Parties shall refer such dispute to Project Manager/Employer for resolution. The resolution shall be realized by end of the week. If the dispute is unresolved by end of the week, the dispute shall be resolved as per the Dispute Resolution Procedure as per GC clause 45.
- 15.3.3. Obligations regarding Energy Metering and payment at Maintenance Depot:**
- 15.3.3.1. BMRCL receives the electricity at its receiving substations from the designated utilities and then distributes it to the RS Maintenance Depot for traction and non-

traction usage. The power supply arrangement of BMRCL to RS Maintenance Depot shall be provided during Contract stage.

- 15.3.3.2. BMRCL shall install suitable energy meter(s) to measure the electrical energy consumption by Contractor at the RS Maintenance Depot(s) for non-traction usage of electrical energy. The energy meter reading shall be jointly recorded as per the billing cycle and BMRCL shall advise the Contractor on the energy bills to be paid by the Contractor, the payment of which shall be made by Contractor to BMRCL within the stipulated time.
- 15.3.3.3. Contractor shall make the payment to BMRCL for electrical energy consumed by it and BMRCL shall make payments to the electrical supply utilities including Solar Power Developer according to the prevailing electricity tariffs, rules and regulations and as per Power Purchase Agreement (PPA) conditions applicable for BMRCL. Without prejudice to the provisions contained herein, Contractor agrees that the BMRCL shall not be liable for any change in the availability of electrical energy, power quality and applicable tariffs, which are governed by the Government Instrumentalities and Contractor shall bear the cost incidental to such changes, if any, during the Contract Period.
- 15.3.3.4. BMRCL shall raise the bills for the electricity consumption to the Contractor in units (kilo Watt- hour) based on the Average Unit Cost (expressed in INR) calculated by BMRCL for each utility including the Solar Power Developer. "Average Unit Cost" means the ratio of total amount of the electricity bill raised by the designated electricity utilities including all levies and the total no. of units (kWhr) consumed. For example, if the total amount of bill raised by designated utilities including all levies = INR 1000; and total no. of units consumed = 100; then the Average Unit Cost will be equal to 1000/100 i.e. INR 10.
- 15.3.3.5. Contractor shall be responsible for making timely payment of the electricity consumption charges for the Maintenance Depot to BMRCL upon receipt of the bill from BMRCL before the due date indicated in the bill by BMRCL.
- 15.3.3.6. The Contractor shall be liable to pay the penalties on any delayed payment and/or non- payment of bills to BMRCL. In case the Contractor does not make the payment of the bills to BMRCL in the stipulated time BMRCL shall be at liberty to recover the dues including any penalty for non-payment of the bills from the Monthly Maintenance Charges due and payable to the Contractor under and in accordance with the Contract. Without prejudice to and notwithstanding anything to the contrary contained herein, the Contractor shall be liable to indemnify BMRCL for any loss which BMRCL may incur on account of delayed payment and/or non-payment of the utility bills.

15.4. Hand back of Maintenance Depot

15.4.1. General

Not less than 3 (three) Months prior to the expiry of the Contract Period, or in the event of earlier Termination of this Contract, immediately upon but not later than 45 (forty-five) days from the date of issue of Termination Notice, the Contractor and BMRCL shall conduct a joint inspection of the Depot premises before the hand back of Maintenance Depot and facilities from the Contractor to BMRCL. The joint inspection report shall record the list of assets at the Maintenance Depot, whether any defect or deficiency is noted in the assets at the Maintenance Depot etc. BMRCL shall review the

joint inspection report in line with the Join Survey Report and the Contractor shall remove any discrepancy noted by BMRCL upon review.

Upon Termination or expiry of the Contract Period, the Contractor shall comply with and conform to the following requirements, no later than 15 (fifteen) days from the date of Termination or expiry of the Contract Period, as the case may be:

- a) All movable and immovable assets at the Maintenance Depot i.e. depot facilities, M&Ps, E&M utilities etc. shall have been cured of all defects and deficiencies as necessary, by the Contractor at its sole cost and expense and should be in working condition. Any loss or damage identified at the time of inspection shall be rectified by the Contractor at its cost and expense prior to the handover of the Maintenance Depot;
- b) All the UES (full quantity as specified in Attachment of Chapter-14) shall be handed over by the Contractor to the Employer at free of cost.
- c) ~~Minimum 25% maintenance staff and supervisor of the Contractor shall be transferred to BMRCL payroll after expiry of Comprehensive maintenance contract to ensure continuity and quality of maintenance of the train till alternative arrangements are made by BMRCL. Selection procedure shall be finalized jointly by BMRCL and Rolling stock contractor.~~

Addendum-1 dated 05.12.2022, Sl. No. 55

Minimum 25% maintenance staff and supervisor of the Contractor shall be **deputed to BMRCL** after expiry of Comprehensive maintenance contract to ensure continuity and quality of maintenance of the train till alternative arrangements are made by BMRCL. Selection procedure shall be finalized jointly by BMRCL and Rolling stock contractor. **Payments for which shall be based on the mutually agreed terms and conditions.**

- d) All information technology (IT) systems and equipment shall be in working condition;
- e) The Contractor shall deliver to BMRCL the relevant records and reports pertaining to the Project and its Design, engineering and maintenance including all maintenance records and programs and manuals pertaining thereto and complete as built drawings;
- f) The Contractor shall ensure that all Project Contracts which are required to be novated in favour of BMRCL have been thus novated;
- g) The Contractor executes such deeds of conveyance, documents and other writings as BMRCL may reasonably require to convey, divest and assign all the rights, title and interest of the Contractor in the Maintenance Depot as per Applicable Laws free from all Encumbrances absolutely and free of any charge or tax unto BMRCL or its nominee;and
- h) The Contractor shall submit the Hand back Package to BMRCL, as specified in sub- clause 15.4.2 below.

15.4.2. Handback Package

The Contractor, at the time of Termination or expiry of the Contract period, shall ensure that the Handback Package contains, at a minimum, the following information:

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- a) Premises – a list of Maintenance Depot and facilities handed over to and maintained by the Contractor under the Contract;
 - b) Trainset details - its maintenance history, Spares position, equipment history, maintenance planning for next 6 (six) Months and TCMS data of all Trainset in digital form in formats to be agreed mutually between Contractor and BMRCL;
 - c) Contracts – a list of all contracts, permits, licenses or other documents which are material to the operation of the Contractor's business showing (as appropriate) the contact number, name, address, telephone and facsimile numbers of counterparties, contract price, value and subject matter;
 - d) Systems – a list of systems used (computer and otherwise) for the maintenance and operation of the Project, together with a description of the systems and master passwords where applicable;
 - e) Daily operations – a list of any other information key to the daily operation of the Contractor's business, including:
 - (i) the names, work and home telephone numbers of each person in possession of keys accessing the premises owned, leased or operated by the Contractor within the Maintenance Depot; and
 - (ii) lists of machinery and plant and other assets procured by, handed over to and operated by the Contractor material to the operation of the Contractor's Business.
 - f) Drawings – current and accurate “as built” drawings showing all maintenance facilities installed during the Contract Period, showing precise locations as installed, including three sets of all drawings and documentation, and one complete set of drawings and documentation stored in labelled CD-ROM format;
 - g) Manuals – copies of the most recent Operation and Maintenance Manual and quality assurance manual;
 - h) Maintenance Depot Assets - listing giving life status and associated operation and maintenance specifications for each asset along with the maintenance schedule for its residual life; and
 - i) Co-ordination procedures with Emergency services.

ATTACHMENT 1 - MAINTENANCE DEPOT**1 Maintenance Depot**

- 1.1 For discharging its Maintenance Obligations under and in accordance with the provisions of this Contract, the Contractor shall operate and maintain the RS Maintenance Depot in accordance with the provisions of this Attachment.
- 1.2 The RS Maintenance Depot part of the Depot Site shall be handed over by BMRCL to the Contractor in accordance with this chapter.
- 1.3 Electricity and water charges as applicable throughout the contract period for the RS Maintenance Depot shall be paid for by the Contractor in accordance with Chapter.
- 1.4 The Contractor shall be responsible, at its own cost, man power and expenses, for any upgradation if required, operation and maintenance of all infrastructure handed over to it inside the RS Maintenance Depot. The Contractor may undertake any structural change or any additional construction work to the buildings handed over to the Contractor at the Maintenance Depot, if required, after submission of details of work proposed for seeking prior approval of BMRCL.

2 Maintenance and upkeep of RS Maintenance Depot

- 2.1 ~~The Contractor shall be responsible for undertaking the maintenance of the RS Maintenance Depot including cleanliness, upkeep, housekeeping, repair work, civil maintenance and electrical maintenance for the entire premises of the RS Maintenance Depot. It is clarified that the Contractor shall be responsible for the site which are handed over to Contractor by BMRCL and Contractor is in possession of such areas.~~

Addendum-1 dated 05.12.2022, Sl. No. 56

The Contractor shall be responsible for undertaking the maintenance of the RS Maintenance Depot including cleanliness, upkeep, housekeeping, repair work, civil maintenance and electrical maintenance **(for civil & electrical infrastructure created by the Contractor)** of the RS Maintenance Depot. It is clarified that the Contractor shall be responsible for the site which are handed over to Contractor by BMRCL and Contractor is in possession of such areas.

- 2.2 The Contractor shall, at RS Maintenance Depot, operate the maintenance facilities and install and maintain any equipment necessary for performing its Maintenance & Upkeep Obligations under and in accordance with this Contract.

3 Inspection of Maintenance Depot

The Contractor shall acknowledge that the BMRCL and/or Railway Statutory Authority may at any time during the Contract Period inspect:

- a) the Maintenance Depot;
- b) conduct safety inspection at the Maintenance Depot;
- c) competency of the staff employed by the Contractor for the maintenance of the Trainsets; and

The Contractor shall provide access and all reasonable support to the officials for inspection as detailed above. Based on the inspection report by the Railway Statutory Authority, the Contractor shall carry out such improvements and rectification as may be required by the BMRCL or Railway Statutory Authority.

ATTACHMENT 2- PROGRESS, PLANNING AND INVESTIGATION OFFICE (PPIO) AND ROLLING STOCK CONTROLLER (RSC)**1. Role of PPIO/RSC**

- a) PPIO shall be the nodal agency of the depot. All coordination within the depot regarding job card management, train maintenance, power block coordination, shunting management, trial management etc. shall be done by PPIO.
- b) PPIO shall be manned by Contractor's staff. However, BMRCL shall also depute its Supervisory Personal(s) monitoring this Contract, for availability reconciliation and other co-ordination activities.
- c) All maintenance work of train including testing, trial & modifications by Contractor generally be carried out on a train only after issue of a job card from the PPIO. Thus, it shall be the single point of contact with BMRCL for all Depot and Train operational management.
- d) Contractor shall plan well in advance for various scheduled checks & other seasonal Drives/Modifications/Auto wash/IHC/EHC, etc. of train.
- e) Contractor shall plan in advance for trains required to be undertaken for maintenance.
- f) Contractor through PPIO shall coordinate with concerned BMRCL officials if trains are not returning back to depot as per scheduled ID's/scheduled time.
- g) Contractor shall maintain all records related to maintenance of train in PPIO.
- h) Contractor shall give fitness of the trains to DCC for commercial / revenue service on main line through PPIO.
- i) Operational Control Centre (OCC) manned by BMRCL shall be responsible for overall train operation. Similarly, Depot Control Centre (DCC) shall also be manned by BMRCL and it shall be responsible for all movement of trains to & from depot and Shunting within depot shall be responsibility of Contractor in coordination with DCC. Contractor's shunter shall be used for this purpose.
- j) Rolling Stock Controller (RSC) as a part of OCC shall be deployed by BMRCL round the clock at OCC for managing the rolling stock operations on line including line failures.
- k) RSC and DCC shall coordinate with PPIO of the depot about all train operation related issues including movement of trains, fitness/readiness of trains for commercial / revenue service, scheduled maintenance planning and line failures of train.
- l) RSC shall intimate line failures to PPIO and may ask it to deploy maintenance personnel on train for accompanying or attending minor defects and can also seek its help in guiding train operator in trouble shooting purely at its own discretion.
- m) The train operator and line failure management shall be solely under the guidance of BMRCL through RSC and Contractor shall oblige to follow the instructions of RSC in this regard.
- n) PPIO without any delay shall plan for Distress /Rescue operation of the train with the assistance of RSC on main line in case of any emergency. The decision of BMRCL/RSC shall be final and binding on the Contractor.

2. Information available at PPIO

- a) PPIO shall have all related information about trains duly displayed and updated every day in the PPIO.
- b) PPIO shall have the information about occupancy at IBL (Inspection Bay Line), SBL (Standing Bay Line), RBL (Repair Bay Line), Transfer Track, Test Track, Escape Route and their locations with their numbering in the depot.
- c) PPIO shall take the position from rolling stock controller on regular interval regarding mainline failures, train arrival/departure particularly during off peak hours for fault rectification, minor maintenance, modification etc.
- d) PPIO shall take details of information of action taken by RSC staff to attend incident on main line.
- e) PPIO shall have the list of personnel's (with mobile/contact no) in hierarchy order of BMRCL and Contractor staff to be contacted during any emergency situation.
- f) PPIO shall maintain train log book register, communication register, (communication with RSC/DCC/Supervisors/Departments/Officers), Instruction register (from Officers/Failure Management /Depot Management/Procedure /Material Management), shift diary, shuntingRegister (from- to with reason, train, time, shunting request to DCC) etc.
- g) Maintenance schedule, train withdrawal plan, job cards etc. will be generated by PPIO through Asset management system supplied and installed by the Contractor.

ATTACHMENT 3 - SAFETY REQUIREMENTS**1 Safety Requirements**

- 1.1 The Contractor shall develop, implement and administer a safety program for providing a safe environment on or about the Trainsets, T.O.s and Maintenance Depot, and shall comply with the safety requirements set forth in this Contract and particular Applicable Laws including but not limited to 'Metro Railway General Rules (MRGR), 2020 and amendments thereof'.

Safety, Health and Environment (SHE) manual as provided in the Part 4 is a standard form manual of BMRCL which is applicable on BMRCL and its contractors. It is expected that the Contractor shall follow the same for carrying out its obligations under this Contract.

- 1.2 Safety Requirements shall apply to all phases of manufacturing, supply, augmentation, operation and maintenance with emphasis on identification of factors associated with accidents, consideration of the same, and implementation of appropriate remedial measures.

2 Obligations of the Contractor

- 2.1 The Contractor shall abide by the following to ensure safety of the Trainsets and Maintenance Depot, human life and property:
- a) Applicable Laws and Applicable Permits (including without prejudice to the foregoing the Metro Railway General Rules (MRGR), 2020 and amendments thereof);
 - b) safety, health and environment manual
 - c) instructions issued by BMRCL and Railway Statutory Authority from time to time;
 - d) provisions of this Contract;
 - e) relevant standards/guidelines contained in internationally accepted codes; and
 - f) Good Industry Practice.
- 2.2 The Contractor shall impart safety training to its employees and shall at all times be responsible for observance of safety procedures by its personnel, Contractors and agents.
- 2.3 The Contractor shall be responsible for undertaking all the measures under its control to ensure safe operation of Trainsets and safety of all its personnel.
- 2.4 The Contractor agrees that BMRCL or BMRCL's Representatives shall be entitled to inspect any Trainset and/or the Maintenance Depot and/or Depot Sites any time during the Contract Period to verify adherence to Safety Requirements and the Contractor shall be obliged to facilitate such inspection and implement the corrective measures identified in such inspection.
- 2.5 Notwithstanding anything to the contrary contained herein and without prejudice to Clause 2.4, the Contractor agrees and acknowledges that upon occurrence of any Accidents and/or Emergency the Railway Statutory Authority shall have the right to undertake independent inspection on or conduct enquiry on Trainsets. The decision of the Railway Statutory Authority pursuant to such independent inspection or enquiry shall be final and binding on the Contractor. The Contractor further undertakes that it

shall comply with such decision and carry out necessary activities on the Trainsets promptly at its sole cost and expense and shall indemnify BMRCL or any third party for any losses incurred as may be determined by the Railway Statutory Authority.

- 2.6 If the Railway Statutory Authority enquiry, in case of an Accident found to be occurred on account of any Fault, BMRCL on its sole discretion shall assess the loss caused and shall recover the same from the Contractor either from monthly payments or from securities available.
- 2.7 The Contractor shall extend all necessary data, information and cooperation to the Railway Statutory Authority at the time of enquiry of an Accident. If the Contractor does not cooperate with the Railway Statutory Authority then BMRCL may require the Contractor, by issuing a notice, to cooperate with the Railway Statutory Authority within 7(seven) days of such notice. If the Contractor fails to cooperate with the Railway Statutory Authority, within the 7(seven) days of such notice, then BMRCL shall be entitled to terminate the Contract forthwith.

3 Safety Requirements for the Trainsets

- 3.1 The Contractor shall ensure safe conditions for the passenger use of the Trainsets throughout the Contract Period. In the case of unsafe conditions, track damage, vehicle breakdowns and Accidents, the Contractor shall follow the relevant operating procedures, which shall be in accordance with Applicable Laws, Applicable Permits and the provisions of this Contract.
- 3.2 The Contractor shall ensure that any interruption of operations of the Trainsets is remedied promptly without undue delay.
- 3.3 The Contractor shall ensure that all the safety obligations at 2.1, are strictly complied with. Compliance shall also be monitored by BMRCL and a breach by the Contractor of its obligations in respect of this Chapter identified by BMRCL shall be notified immediately and is required to be cured within 24 (twenty-four) hours of its notification notwithstanding inspection, reporting procedures outlined elsewhere in this Contract.

4 Safety measures during upgradation

The Contractor shall, during upgradation of the Maintenance Depot, provide an environment for ensuring the safety of human life and property in accordance with Applicable Laws, Applicable Permits and Good Industry Practice.

5 Annual Safety Report

- 5.1. The Contractor shall submit to BMRCL before the 31st (thirty first) March of each Accounting Year, an annual report containing, without limitation, a detailed listing and analysis of all Accidents occurring on account of the Trainsets and/or in the Depot Site and/or the Maintenance Depot during the preceding Accounting Year and the measures taken by the Contractor for averting or minimizing such Accidents in future ("**Annual Safety Report**").
- 5.2. Once in every Accounting Year, a safety audit shall be carried out by BMRCL. It shall review and analyse the Annual Safety Report and Accident data of the preceding Accounting Year, and undertake an inspection of the Trainsets and Project Assets. BMRCL shall provide a safety report recommending specific improvements, if any, required to be made in the Trainsets and Project Assets. Such recommendations shall be implemented by the Contractor in accordance with Safety Requirements,

Specifications and Standards and Applicable Laws.

6 Accident

In case of occurrence of any Accident the Contractor shall follow the procedures set out in Accident and Disaster Management Manual and shall comply with Applicable Laws. The Contractor agrees and acknowledges that the Contractor while following the procedures set out above will be bound by decision of BMRCL during any enquiry conducted by BMRCL and shall follow the Accident reporting requirements.

7 Emergency Breakdown Equipment and Rail-cum-Road Vehicle

- 7.1. The Contractor shall maintain appropriate re-railing and rescue equipment at the Depot Sites in a box container loaded on a rail-cum-road vehicle ("**RRV**") to cater for any eventuality of Accidents, unusual occurrences or any other incidence requiring lifting and shifting of one or more axles of the train to clear the Line, in addition to rescue of the stranded passengers, hereinafter referred to as Emergency Breakdown Equipment ("**EBE**"). The Contractor shall also provide an assisting Trainset to BMRCL without any delay for clearing the stranded Trainset at Accident/ or any unusual occurrence site on the Line.
- 7.2. BMRCL and/or the Railway Statutory Authority may, in its sole discretion, inspect the EBEs and the preparedness of the Contractor and its personnel in dealing with any Accident or unusual occurrence on the Line and accordingly suggest improvements or changes in EBE or procedures which shall be binding on the Contractors.
- 7.3. The EBE shall be maintained by the Contractor at all times and shall be kept in ready to be used conditions such that the EBE can be deployed at the site of Accident or unusual occurrence within minimum possible time.
- 7.4. The Contractor shall ensure that its personnel in sufficient numbers are fully trained to operate/handle the EBE. These personnel shall be made available along with EBE by the Contractor within minimum time to attend any Accident or unusual occurrence at any site on the Line.

16. TRAIN OPERATION PLAN

- 16.1. BMRCL shall provide to the Contractor the weekly Train Operation Plan in accordance with the Availability Plan, not later than 7 (seven) days prior to the commencement of each month, which shall contain *inter-alia* the Scheduled Trips of the Trainsets (Trainset running timetable), Interchange Points, Required Time-In and Required Time-Out (**Master Train Operation Plan**).
- 16.2. The Contractor shall offer trains for commercial / revenue service as per the details provided in the **Attachment 1** of this Chapter based on the Master Train Operation Plan.
- 16.3. The Contractor shall not deviate from the Master Train Operation Plan in providing the Available Trainsets during the relevant week.
- 16.4. In the event that a Replacement Trainset is provided by the Contractor to BMRCL in accordance with ERTS Chapter 19, the Contractor shall promptly but no later than providing such Replacement Trainset, notify BMRCL the Trainset identification number of such Replacement Trainset.
- 16.5. The entire process pertaining to monitoring of Train Operation Plans shall be administered.

ATTACHMENT 1

Train fitness management and induction from depot to main line is briefly explained as under:

1. Contractor shall submit fitness of the trains to DCC at least 30 minutes before departure of first train induction on main line as per time table.
2. No train shall be given ready by Contractor for commercial / revenue Service unless it has been tested and checked for all safety and functional aspect duly documenting the same. BMRCL can call at random for all the documents related to testing and checking of any trains prior to giving fitness as deemed necessary.
3. On receipt of train fitness, DCC shall allow train for induction to commercial / revenue service on main line. In case of UTO operation, the Contractor shall finalize train withdrawal and induction plan shall be finalized in consultation with respective signaling & Train Control contractor and OCC/DCC.
4. PPIO while advising DCC of train no. along with train fitness will take care so that a train required for maintenance returns to depot in off-peak hour as per scheduled time-table, rather than changing train no. on mainline & requiring adjustments in T.O roster.
5. No maintenance/housekeeping activity is permitted on train, after train fitness is conveyed to DCC.
6. No train shall be allowed with pending defect on commercial / revenue service. However, PPIO shall inform to concerned BMRCL official, immediately to seek their permission before allowing any train with pending defects in special circumstances.
7. DCC shall assign TOs to different nominated fit trains in case of GoA-2 mode of operation of the train.
8. While testing of train-by-train operator for pre departure checks, Contractor shall depute their one staff to the train to help during train departure in case of any problem & quick action.
9. Shunting within depot shall be responsibility of Contractor in coordination with DCC. Contractor's shunter shall be used for this purpose.
10. Train induction to main line from depot/train receiving from main line and placement to depot and main line train operation, testing of train on main line shall be performed by BMRCL's train operator.
11. Sample of TOP is placed at **Attachment 2** of this Chapter.
12. Sample of Time table of train induction and commercial / revenue service is placed at **Attachment 3** of this Chapter.
13. Detailed joint procedure order(s) for train operation interface between BMRCL and Contractor shall be made after award of Contract.

ATTACHMENT 2

Hourly Train Operation Plan(From- To)			
Time of Day	Year		
	Date and Time		
	Headway (minutes)		
	Headway in Minutes	No. of Trains trip per day	
		UP	DN
5 to 6			
6 to 7			
7 to 8			
8 to 9			
9 to 10			
10 to 11			
11 to 12			
12 to 13			
13 to 14			
14 to 15			
15 to 16			
16 to 17			
17 to 18			
18 to 19			
19 to 20			
20 to 21			
21 to 22			
22 to 23			
23 to 24			
Total No. of train trips per direction per day			

17. HANDOVER REQUIREMENTS

17.1. Handover requirements

17.1.1. Upon Termination or expiry of the Contract Period, the Contractor shall comply with and conform to the following Handover requirements (the "**Handover Requirements**"), no later than 15 (fifteen) days from the date of Termination or expiry of the Contract Period, as the case may be:

- a) notify to BMRCL forthwith the location and particulars of all "Project Assets" herein defined as Trains, M&Ps, tools, plants, test benches, etc. including Civil Infrastructure, building etc. under Contractor possession either handover by BMRCL or installed, deployed or commissioned by Contractor for the purpose of maintenance.
- b) deliver forthwith the actual or constructive possession of the Project Assets, along with the infrastructure therein, free and clear of all Encumbrances;
- c) all Project Assets including the structure and equipment shall have been cured of all defects and deficiencies. At the time of completion of Contract or earlier termination of this Contract, the RS contractor shall submit the certificate of completion of all scheduled maintenance till last day of preceding month and all project assets including structures and equipment shall be handed over in working condition.
- d) cure all Trainset of all defects and deficiencies so that the Trainset are compliant with the Maintenance Obligations; provided that if such defects and deficiencies have arisen on account of Accident, vandalism, arson, riot or natural calamity occurring no earlier than 120 (one hundred and twenty) days prior to such Termination or expiry of the Contract Period, BMRCL shall grant to the Contractor such additional time, not exceeding 240 (two hundred forty) days, as may be reasonably required for repair and rectification thereof;
- e) All the UES (Full quantity as specified in Attachment-4 of Chapter-14) shall be handed over by the Contractor to the Employer at free of cost.
- f) cure all the equipment at the Maintenance Depot of any defect or deficiency such that it can continue to be used efficiently and economically in accordance with Good Industry Practice;
- g) deliver and transfer relevant records, reports and Intellectual Property pertaining to the Trainsets and Maintenance Depot including all software and manuals pertaining thereto, and complete "as built" Drawings as on the Termination Date so as to enable BMRCL to operate and maintain the Trainsets and Maintenance Depot and execute such deeds of conveyance, documents and other writings as BMRCL may reasonably require in connection therewith. For avoidance of doubt, the Contractor represents and warrants that the Intellectual Property shall be adequate and complete for the operation and maintenance of the Trainsets and shall be assigned or licensed to BMRCL free of any Encumbrance;
- h) transfer and/or deliver all Applicable Permits in respect of the Project Assets including Trainsets to the extent permissible under Applicable Laws;
- i) execute such deeds of conveyance, documents and other writings as BMRCL may

reasonably require for conveying, divesting and assigning all the rights, title and interest of the Contractor in respect of the outstanding insurance claims to the extent due and payable to BMRCL;

- j) execute such deeds of conveyance, documents and other writings as BMRCL may reasonably require for conveying, divesting and assigning all the rights, title and interest of the Contractor in the Maintenance Depot and Trainsets;
 - k) comply with all other requirements as may be prescribed or required under Applicable Laws for completing the Handover and assignment of all rights, title and interest of the Contractor in the Trainsets, Maintenance Depot and Insurance Cover, free from all Encumbrances, absolutely unto BMRCL or to its nominee; and
 - l) pay all dues pending towards its staff and/or Contractors, energy and water consumption charges etc. and any other amounts due and payable under this Contract.
- 17.1.2. Subject to the exercise by BMRCL of its rights under this Contract or any of the Project Contracts to perform or procure the performance by a third party of any of the obligations of the Contractor, the Parties shall continue to perform their obligations under this Contract notwithstanding the giving of any Termination Notice until the Termination of this Contract becomes effective in accordance with its terms.
- 17.1.3. In order to assist BMRCL, the Contractor shall be responsible for preparing and updating a Handback Package. The Handback Package must include details of all the matters listed in ERGS Chapter 15 of this Contract. The Contractor must update the Handback Package regularly and in the same manner as a competent provider of similar services would do and promptly provide an electronic and 2 (two) hard copies of the updated Handback Package to BMRCL. For each version of the Handback Package provided to BMRCL, the Contractor must provide written confirmation to BMRCL that the Handback Packages contains the information required under ERGS Chapter 15. Where the Contractor decides that the Handback Package is not required to be updated in a 6 (six) month period on the basis that it is already up to date, the Contractor must advise BMRCL in writing within 20 (twenty) days after the end of each 6 (six) month period that the Handback Package is up to date. The Contractor must also retain copies of the most recent version of the Handback Package and provide these to BMRCL.

17.2. Inspection and cure

Not earlier than 3 (three) months before the expiry of the Contract Period but not later than 15 (fifteen) days before such expiry, or in the event of earlier Termination of this Contract, immediately upon but not later than 15 (fifteen) days from the date of issue of Termination Notice, BMRCL shall verify, in the presence of a Contractor's Representative, compliance by the Contractor with the Handover Requirements set forth in Clause 17.1 in relation to the Project Assets and, if required, cause appropriate tests to be carried out at the Contractor's cost for determining the compliance therewith. All Depot M&Ps and Driving Simulator shall be inspected against the list and Bill of Quantities submitted by the contractor as per ERGS 15.1.3. If any shortcomings in the Handover Requirements are found by either Party, it shall notify the other of the same and the Contractor shall rectify the same at its cost. The provisions of Clause 17 shall apply *mutatis mutandis* in relation to repair or curing of defects under this Clause 17.

17.3. Cooperation and assistance on transfer of Maintenance Depot

- 17.3.1. The Parties shall cooperate on a best effort basis and take all necessary measures, in goodfaith, to achieve a smooth transfer of the assets specified in Clause 17.1.1 in accordance with the provisions of this Contract so as to protect the safety of and avoid undue delay orinconvenience to the users, other members of the public or the lawful occupiers of any partof the Depot Sites and Maintenance Depot.
- 17.3.2. The Parties shall provide to each other, 9 (nine) months prior to the Termination Date in the event of Termination by efflux of time and immediately in the event of either Party conveying to the other Party its intent to issue a Termination Notice, as the case may be, as much information and advice as is reasonably practicable regarding the proposed arrangements for operation of the Project following the Termination Date. The Contractor shall further provide such reasonable advice and assistance as BMRCL, its nominee or agent may reasonably require for operation of the Project until the expiry of 6 (six) months after the Termination Date.

18. DEFECTS LIABILITY AFTER CONTRACT PERIOD**18.1. Liability for defects after Termination**

- 18.1.1. Not less than 30 (thirty) months nor more than 36 (thirty-six) months prior to the expiry of the Contract Period, or in the event of earlier Termination of this Contract, immediately upon but not later than 15 (fifteen) days from the date of issue of Termination Notice, the Contractor and BMRCL shall conduct a joint inspection (the **"Initial Inspection"**) of the Project Assets. In the event of earlier Termination of this Contract, the Contractor shall be responsible for all defects and deficiencies in the Trainsets for a period of 180(one hundred and eighty) days after Termination, and it shall have the obligation to repair or rectify, at its own cost, all defects and deficiencies observed by BMRCL in the Trainsets during the aforesaid period.
- 18.1.2. Within 90 (ninety) days after the completion of the Initial Inspection, the Contractor shall provide to BMRCL a report on the condition of the Project Assets and a notice setting out the Contractor's proposals as to the works required to comply with the Handover Requirements as stated in Chapter 17 of ERGS.
- 18.1.3. BMRCL may, within 90 (ninety) days after receipt of the notice from the Contractor in accordance with clause 18.1.2, by notice to the Contractor object to the proposals giving details of the grounds for such objection.
- 18.1.4. If no Contract is reached between the Contractor and BMRCL within 30 (thirty) days of receipt of such notice, then either the Contractor or BMRCL may refer the matter to the Disputes Resolution Procedure.
- 18.1.5. Upon contract, or determination in accordance with the Disputes Resolution Procedure as to what the scope of the renewal works shall be, the Contractor shall carry out the renewal works at its own cost.
- 18.1.6. Not less than 9 (nine) months nor more than 12 (twelve) months prior to the expiry of the Contract Period, the Contractor and BMRCL shall conduct a joint inspection (the **"Second Inspection"**) of all elements of the Project (whether or not the Renewal Works have been carried out).
- 18.1.7. Within 30 (thirty) days after the completion of the Second Inspection, the Contractor shall provide to BMRCL a report on the condition of the Project and a notice setting out any revisions or additions to the renewal works required in order to ensure compliance with the Handover Requirements.
- 18.1.8. BMRCL may, within 30 (thirty) days after receipt of the notice from the Contractor in accordance with Clause 18.1.7, by notice to the Contractor object to the proposed revisions giving details of the grounds for such objection.
- 18.1.9. If no Contract is reached between the Contractor and BMRCL within 30 (thirty) days of receipt of such notice, then either the Contractor or BMRCL may refer the matter to the Dispute Resolution Procedure.
- 18.1.10. Upon Contract, or determination in accordance with the Disputes Resolution Procedure as to what the scope of remaining renewal works may be, the Contractor shall carry out the renewal works (as so revised) at its own cost.

18.2. Retention of payments due

- 18.2.1. Notwithstanding anything to the contrary contained in this Contract, but subject to the provisions of Clause 18.2.3, a sum equal to 10% (ten per cent) of the Maintenance Charges payable for the Fleet in respect of the Accounting Year immediately preceding the expiry of Contract or Termination Date shall be retained by BMRCL for a period of 180 (one hundred and eighty) days after Termination for meeting the liabilities, if any, arising out of or in connection with the provisions of Clause 18.1.
- 18.2.2. Without prejudice to the provisions of Clause 18.2.1, BMRCL shall carry out an inspection of the Project Assets including Trainsets at any time between 210 (two hundred and ten) and 180 (one hundred and eighty) days prior to the Termination and if it determines that the status of the Trainsets is such that a sum larger than the amount stipulated in Clause 18.2.1 should be retained by BMRCL and for a period longer than the aforesaid 180(one hundred and eighty) days, the amount so determined, subject to a ceiling equivalent to twice the amount specified in Clause 18.2.1 shall be retained by BMRCL for a period not exceeding 240 (two hundred and forty) days.
- 18.2.3. The Contractor may, for the performance of its obligations under this Clause 18, provide to BMRCL a guarantee from a Bank for a sum equivalent to the amount determined under Clause 18.2.1 or 18.2.2, as the case may be, and for the period specified therein, substantially in the form set forth for (the "Performance Guarantee"), to be modified, mutatis mutandis, for this purpose, and BMRCL shall, without prejudice to its other rights and remedies hereunder or in law, be entitled to encash and appropriate the required amounts from the Performance Guarantee for undertaking the repairs or rectification at the Contractor's risk and cost in accordance with the provisions of this Clause 18. Upon furnishing of a Performance Guarantee under this Clause 18.2.3, the retention of funds in terms of Clause 18.2.1 or 18.2.2, as the case may be, shall be dispensed with. The validity of the Performance Guarantee shall not be less than 240 (Two Hundred Forty) days from the Termination Date, inclusive of an additional claim period of 60 (Sixty) days, and may be extended as may be mutually agreed between BMRCL and the Contractor.

18.3. Epidemic Defect Warranty

The Contractor shall investigate and rectify the epidemic defect of the trainsets as specified in ERGS clause 14.9. The Contractor shall submit the methodology for identification of epidemic defects during the Contract period to the Project manager for approval.



BANGALORE METRO RAIL CORPORATION LIMITED

BID No. 5RS-DM

**DESIGN, MANUFACTURE, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING
OF 318 NOS. OF STANDARD GAUGE METRO CARS AND TRAINING OF PERSONNEL
INCLUDING COMPREHENSIVE MAINTENANCE UPTO FIFTEEN (15) YEARS UNDER
BANGALORE METRO RAIL PROJECT PHASE-2, 2A AND 2B**

PART- 2

**SECTION-VI A: APPENDICES TO ERGS (EMPLOYER'S REQUIREMENTS –
GENERAL SPECIFICATIONS)**

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APPENDICES TO ERGS (EMPLOYER'S REQUIREMENTS – GENERAL SPECIFICATION)

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1. APPENDIX 1 - PROGRAM**1.1. Time-Scaled Network / Bar Chart**

- 1.1.1. All programs shall be developed by computerised Critical Path Method (CPM) using the Precedence Diagramming Method (PDM) and shall be presented in either bar chart or time-scaled network diagram format, suitably coloured to enable easy reading. All duration for the purpose of programming shall be in calendar days. All reference to network shall mean time-scaled network unless otherwise specified.
- 1.1.2. The coding structure shall be such that the activities can be summarised to the various levels. Each level shall be summarised and collapsed to the next level using the programming software. The Contractor shall propose essential codes and activity codes to be used for review of the Project Manager. The Project Manager may require additional activity codes subject only to restrictions imposed by the programming software. Additional codes where necessary may be created by the Contractor with the approval of the Project Manager. Each activity in the network shall be coded, as a minimum, with the following:
- (i) Contract number, activity type, and unique identification numbers.
 - (ii) Activity codes to indicate Unit, Segment, Stage or Phase, for e.g. design, manufacturing, delivery, installation, etc.
 - (iii) The Contractor shall note that breakdown of system into sub-systems is essential and shall be carried out not through further coding but through activity descriptions in a consistent manner such as to allow storing. However, the Project Manager shall have the right to require the Contractor to code sub-systems, using codes approved by him, if necessary.
 - (iv) Area, location and location details under Activity Code – Unit.
 - (v) Cost and resources
 - (vi) Cost and resources codes shall be submitted for the approval of the Project Manager. For Bid purposes, the Bidder shall use his own codes.
- 1.1.3. All logical and necessary relationships between activities shall be shown.
- 1.1.4. All key dates indicated in the Contract shall be shown. In addition to the key dates, the Contractor may require certain events that are critical to his work to be reflected in his programs. These shall be reflected as "milestones". Appropriate activity codes shall be used to distinguish "milestones" from the key dates.
- 1.1.5. The level of program development, information and detail shall be sufficient to permit the Project Manager to have a good appreciation of the Contractor's project management plan especially with regard to the co-ordination and timing of his work in relation to the work of the other Designated contractors and the obtaining of necessary approvals from the relevant local authorities. It shall demonstrate ability to meet specified key dates through a logical work sequence that has taken account of the Project constraints.
- 1.1.6. Activities pertaining to review/acceptance by the Project Manager and local authorities shall be identified. Where duration for review of the Contractor's submissions are specified elsewhere in the Contract, they shall be used. Where they are not specified, a duration of 21 days for review of each submission shall be used.

-
- 1.1.7. Activities outside the scope of the Contract that may affect the Contractor's progress shall be shown.
 - 1.1.8. The activity network shall be organised so that major work sections are carefully co-ordinated with the Civil Contractor and the System-wide Contractors to allow opportunity for all to work with as minimal disruption as possible. Critical paths shall be identified.
 - 1.1.9. Activity descriptions shall be brief (<48 characters) and shall convey the nature and scope of the work. Uncommon abbreviations shall be explained in the legend. Float time shall be distinguished from schedule performance.
 - 1.1.10. The CPM Network Diagram shall be developed to permit modification to the schedule and allow for impacts on the schedule to be analysed by introduction of "what if" statements into the input data.
 - 1.1.11. Critical paths shall be identified

1.2. Time Scaled Network/Bar Chart Details

- 1.1.1. Design: The Design network/bar chart shall detail the various design, submission and acceptance stages including approval by local authorities and the Project Manager, preparation, submission and approval of drawings, manuals and all other activities related to the design.
- 1.1.2. Manufacturing: The manufacturing network chart shall indicate the relationship and duration of the activities necessary to procure, fabricate manufacture, assemble equipment/complete car tests, ship and deliver Rolling Stock in time to support the activities at site. It shall establish milestones for monitoring the progress of the manufacturing process. Major areas of work shall be shown as separate and distinct activities. The network shall also cover activities of Sub-Contractor as appropriate, including testing.
- 1.1.3. Testing, Commissioning and acceptance: The Factory and On-Site Testing and Commissioning network/bar chart shall present the relationship and duration of those items relating to Commissioning tests including those related to other Designated Contractors. The network/bar chart shall present testing approach to be used, the deployment of resources in accordance with train delivery dates.
- 1.1.4. Instrumentation Tests for Prototype Rake: Instrumentation Tests network/bar chart shall indicate that activities related to Instrumentation Tests, including Oscillation Trials, followed by statutory approval, on the Prototype Rake including those related to Designated Contractors.
- 1.1.5. Integrated Testing: The Integrated Testing network/bar chart shall indicate the activities required to verify the functioning of the Rolling Stock in conjunction with activities of the System-wide and Civil Contractors.
- 1.1.6. Service Trials: After completion of Commissioning, the Contractor shall be required to carry out service trials. The network/chart shall indicate tests, measurements and interface tests required to be carried out to verify system performance and readiness for commercial / revenue service.

1.3. Work Program Software

- 1.3.1. The computerised Critical Path Method (CPM) using the Precedence Diagramming Method (PDM) shall be employed by the bidder in preparing their Part One submission, and the Contractor in his Part Two submissions as well as all other programme submissions required during execution of the Contract.
- 1.3.2. Programming software shall be Primavera Project Planner for Windows Version 2.0b or latest, obtainable from Primavera Systems Inc.
- 1.3.3. Should the Bidder wish to propose an alternative programming software, he shall demonstrate in his bid submission the proposed software's capability for direct data exchange with Primavera Project Planner for Windows Version 2.0b or later. Such data exchange compatibility shall include, but not be limited to activity and resource coding.
- 1.3.4. Full electronic data transfer to Primavera is required. The various levels of reporting and coding capabilities shall be at least equivalent to Primavera. Comparable performance between Primavera and the Contractor's proposed system shall be demonstrated. Scheduling Software and relevant instruction manuals, licensed for use in connection with the Contract, shall be provided by the Contractor.
- 1.3.5. Should the Project Manager accept the Bidder's proposed software, he shall upon award of the Contract supply the Authority with an original copy, including manuals and approved training, of the software and any subsequent versions thereof at no extra cost.
- 1.3.6. All terminology, definitions and conventions shall be in accordance with BS 4335 (Glossary of terms used in Project Network Techniques) or the Associated General Contractors (AGC) manual entitled "The use of CPM in Construction".

2. APPENDIX 2 - MONTHLY PROGRESS REPORTS

2.1 Contract Stages

2.1.1 The Contractor shall submit to the Project Manager, a Monthly Progress Report. This Report shall be submitted by the end of each calendar month and shall account for all work actually performed from 26th day of the last month and up to and including the twenty-fifth (25th) day of the month of the submission. It shall be submitted in a format to which the Project Manager shall have given his consent and shall contain sections/sub-sections for, but not be limited to, the topics listed in clauses 2.2 to 2.11 below.

2.2 Financial Status

2.2.1 A narrative review of all significant financial matters, and actions proposed or taken in respect to any outstanding matters.

2.2.2 A spreadsheet summarising each Cost Centre, the budget, costs incurred during the period, costs to date, costs to go, cost forecast (total of costs to date and costs to go) and cost variance (difference between cost forecast and budget).

2.2.3 A spreadsheet indicating the status of all payments due and made.

2.2.4 A report on of the status of any outstanding claims. The report shall in particular provide interim updated accounts of continuing claims.

2.3 Physical Progress

2.3.1 It shall describe the status of work performed, significant accomplishments, including critical items and problem areas, corrective actions taken or planned and other pertinent activities, and shall, in particular, address interface issues, problems and resolutions.

2.3.2 It shall include a simplified representation of progress measured in percentage terms compared with percentage planned as derived from the Works Program.

2.4 Program Update (For Entire Project)

2.4.1 Program updating shall include:

- (i) The monthly Program Update which shall be prepared by recording actual activity completion dates and percentage of activities completed up to the twenty-fifth (25th) of the month together with estimates of remaining duration and expected activity completion based on current progress. The Program Update shall be accompanied by an Activity Report and a Narrative Statement. The Narrative Statement shall explain the basis of the Contractor's submittal:
 - Early Work and Baseline Submittals – explains determination of activity duration and describes the Contractor's approach for meeting required Key Dates as specified in the Contract.
 - Updated Detail Program Submittals – state in narrative the Works actually completed and reflected along Critical Path in terms of days ahead or behind allowable dates. Specific requirements of narrative are:
 - If the Updated Detailed Work Program indicates an actual or potential delay to Contract Completion date or Key Dates, identify causes of delays and provide explanation of Work affected and proposed corrective action to meet Key Dates

or mitigate potential delays. Identify deviation from previous month's critical path.

- Identify by activity number and description, activities in progress and activities scheduled to be completed.
- Discuss Variation Order Work Items, if any.

(ii) the Program Status which shall:

- show Works Programme status up to and including the current report period, display Cumulative progress to date and a forecast of remaining work.
- be presented as a bar-chart size A3 or A4 and as a time-related logic network diagram on an A1 media, including activity listings;

(iii) the Activity Variance Analysis which shall analyse activities planned to start prior to or during the report period but not started at the end of the report period as well as activities started and/or completed in advance of the Works Program.

2.5 Milestones Status

2.5.1 A report on the status of all Milestones due to have been achieved during the month and forecasts of achievement of any missed Milestones, and those due in the next month.

2.6 Three Month Rolling Program

2.6.1 The monthly issue of the Three-Month Rolling Program.

2.7 Planning and Co-Ordination

2.7.1 A summary of all planning/co-ordination activities during the month and details of outstanding actions.

2.7.2 A schedule of all submissions and consents/approvals obtained/outstanding.

2.8 Procurement Report

2.8.1 A summary of all significant procurement activities during the month, including action taken to overcome problems.

2.8.2 A report listing major items of plant and materials, which will be incorporated into the Works. The items shall be segregated by type as listed in the Specifications and the report should show as a minimum the following activities:

- (i) purchase Order Date - Scheduled/Actual,
- (ii) manufacturer/Supplier and Origin,
- (iii) letter of Credit Issued date,
- (iv) manufacturer/Supplier Ship Date - Scheduled/Actual,
- (v) method of shipment,
- (vi) arrival date in India- Scheduled/Actual.

2.9 Production and Testing

2.9.1 A review of all production and manufacturing activities during the month.

2.9.2 Summaries of all production and manufacturing outputs during the month together with forecasts for the next month.

2.9.3 Review of all testing activities (both at site or at the manufacture's premises) during the month

2.10 Safety

2.10.1 A review of all safety aspects during the month including reports on all accidents and actions proposed to prevent further occurrence.

2.11 Environment

2.11.1 A review of all the environmental issues during the past month to include all monitoring reports, mitigation measures undertaken, and activities to control environmental impacts.

3. APPENDIX 3 - KEY DATES

ATTACHMENT TO APPENDIX LB-1
PROPOSED KEY DATES OF CONTRACT NO. 5RS-DM

Key Dates	DESCRIPTION OF STAGE	Weeks from Effective Date
1	Preliminary Design Completion	20
2	Pre-Final Design Completion	40
3	Completion of Mock-ups in the works of Contractor and review by the Engineer/Employer	64
4	Final Design Completion	88
5	Final Design Document Delivery	
5.1	Final Design Document Delivery – Preliminary	100
5.2	Final Design Document Delivery – Final	205
6	Manufacture, Despatch, Delivery and Receipt in Depot of Proto type 6-Car Train set (*DMC-TC-MC-MC-TC-DMC*) with CBTC Signalling system at nominated Depot of Reach-6.	90
7	Formation of prototype 6-car train set in depot, Preliminary Testing and Commissioning of Prototype 6-Car Train Set with CBTC Signalling system in BMRCL Depot Test Track, Type Tests, Integrated Testing on the Mainline with other designated Contractor, Instrumentation of the Prototype Train, conducting oscillation trials, Dynamometer Test etc. and obtaining sanction of statutory authority for introducing train for carriage of passenger and Service Trials including Road learning by the train operator in GOA2 mode of operation.	107
8	Manufacture, Despatch, Delivery and Receipt in Depot for 52 Nos. of 6-Car Train sets with CBTC Signalling system @ 3 Trains per month at nominated Depot.	
8.1	15 Nos. Train sets for nominated Depot for nominated line for Line -6	121
8.2	16 Nos. Train sets for nominated Depot for nominated line for Phase-2A	144
8.3	21 Nos. Train sets for nominated Depot for nominated line for Phase-2B	176
9	Preliminary Testing and Commissioning of 6-Car Trains in BMRCL Depot Test Track, Type Test / Routine Test & Integrated Testing and Commissioning of Trains on Mainline including Service Trials @ 3 Trains per month.	

Key Dates	DESCRIPTION OF STAGE	Weeks from Effective Date
9.1	15 Nos. Train sets for nominated Depot for nominated line in GoA2 for Line-6	126
9.2	16 Nos. Train sets for nominated Depot for nominated line in GoA2 for Phase-2A	149
9.3	21 Nos. Train sets for nominated Depot for nominated line in GoA2 for Phase-2B	181
9.4	Prototype Train set for nominated Depot in GoA4	190
9.5	15 Nos. Train sets for nominated Depot for nominated line in GoA4 for Line-6	206
9.6	16 Nos. Train sets for nominated Depot for nominated line in GoA4 for Phase-2A	216
9.7	21 Nos. Train sets for nominated Depot for nominated line in GoA4 for Phase-2B	234

Notes:

- ~~1. The Key Date Nos. '1', '2', '3', '5' (5.1 & 5.2) are Minor Key dates and Key Date No. '6', '7', '8'(8.1, 8.2, 8.3) & '9' (9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7) are Major Key dates.~~
- ~~2. The nominated Depot and Line for delivery and commissioning of Cars will be advised within 60 weeks of issuance of LOA.~~
- ~~3. Employer at his sole discretion may advise the contractor about the change of Depot and line any time sixteen weeks before the scheduled Key date for 'Manufacture, Dispatch, Delivery and Receipt in Depot'.~~
- ~~4. Project Manager at his sole discretion will decide about substantial completion of Scope of Supply under the Contract regarding Key Dates i.e., '1', '2' & '3'.~~

Addendum-1 dated 05.12.2022, Sl. No. 29

ATTACHMENT TO APPENDIX LB-1(REVISED)
KEY DATES OF CONTRACT NO. 5 RS-DM

Key Dates	DESCRIPTION OF STAGE	Weeks from the Date of Effective Date
1	Preliminary Design Completion	20
2	Pre-Final Design Completion	40
3	Completion of Mock-ups in the works of Contractor and review by the <u>Project Manager</u> /Employer	64
4	Final Design Completion	88

Key Dates	DESCRIPTION OF STAGE	Weeks from the Date of Effective Date
5	Final Design Document Delivery:	
5.1	<u>Final Design Document Delivery – Preliminary</u>	<u>120</u>
5.2	<u>Final Design Document Delivery – Final</u>	<u>250</u>
<u>6</u>	<u>Manufacture, Despatch, Delivery and Receipt in Depot of Prototype 6-Car Train set (DMC-TC-MC-MC-TC-DMC) with CBTC Signalling system at nominated Depot of Reach-6.</u>	<u>96</u>
<u>7</u>	<u>Formation of prototype 6-car train set in depot, Preliminary Testing and Commissioning of Prototype 6-Car Train Set with CBTC Signalling system in BMRCL Depot Test Track, Type Tests, Integrated Testing on the Mainline with other designated Contractor, Instrumentation of the Prototype Train, conducting oscillation trials, Dynamometer Test etc. and obtaining sanction of statutory authority for introducing train for carriage of passenger and Service Trials including Road learning by the train operator.</u>	<u>117</u>
8	Manufacture, Despatch, Delivery and Receipt in Depot for 52 Nos. of 6-Car Train sets with CBTC Signalling system at the rate of 2 or 3 Trains * per month at nominated Depot	
<u>8.1</u>	<u>15 Nos. Train sets for nominated Depot for nominated line for Line - 6</u>	<u>130</u>
<u>8.2</u>	<u>16 Nos. Train sets for nominated Depot for nominated line for Phase-2A</u>	<u>156</u>
<u>8.3</u>	<u>21 Nos. Train sets for nominated Depot for nominated line for Phase-2B</u>	<u>195</u>
9	Preliminary Testing and Commissioning of 6-Car Trains in BMRCL Depot Test Track, Type Test / Routine Test & Integrated Testing and Commissioning of Trains on Mainline including Service Trials at the rate of 2 or 3 Trains * per month at nominated Depot	
<u>9.1</u>	<u>15 Nos. Train sets for nominated Depot for nominated line in GoA2 for Line-6</u>	<u>138</u>
<u>9.2</u>	<u>16 Nos. Train sets for nominated Depot for nominated line in GoA2 for Phase-2A</u>	<u>164</u>
<u>9.3</u>	<u>21 Nos. Train sets for nominated Depot for nominated line in GoA2 for Phase-2B</u>	<u>203</u>

Key Dates	DESCRIPTION OF STAGE	Weeks from the Date of Effective Date
9.4	Prototype Train set for nominated Depot in GoA4	<u>200</u>
9.5	15 Nos. Train sets for nominated Depot for nominated line in GoA4 for Line-6	<u>216</u>
9.6	16 Nos. Train sets for nominated Depot for nominated line in GoA4 for Phase-2A	<u>226</u>
9.7	21 Nos. Train sets for nominated Depot for nominated line in GoA4 for Phase-2B	<u>244</u>

*** If 2 Train Sets are delivered in a particular month then for the following month 3 Train Sets shall be delivered and so on.**

Notes:

- 1. The Key Date Nos. '1', '2' '3', '5' (5.1 & 5.2), '6' & '8'(8.1, 8.2, 8.3) are Minor Key dates and Key Date No. '4', '7' & '9' (9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7) are Major Key dates.**
- The nominated Depot and Line for delivery and commissioning of Cars will be advised within 60 weeks of issuance of LOA.*
- Employer at his sole discretion may advise the contractor about the change of Depot and line any time sixteen weeks before the scheduled Key date for 'Manufacture, Dispatch, Delivery and Receipt in Depot'.*
- Project Manager at his sole discretion will decide about substantial completion of Scope of Supply under the Contract regarding Key Dates i.e., '1', '2' & '3'*

4 APPENDIX 4 - DRAUGHTING AND CAD STANDARDS

4.1 Introduction

- 4.1.1 The purpose of this document is to define the minimum Draughting and CAD standard to be achieved by the Contractor for all drawings produced by the Contractor for the purpose of the Works.
- 4.1.2 By defining a common format for the presentations of drawings and CAD files, the exchange of drawn information is improved and will maximise the use of CAD in the co-ordination process.
- 4.1.3 All submissions shall be made to the Employer's Requirement in a format reviewed without objection by the Employer's Requirement and in accordance with the requirements in:
 - (i) the Contract;
 - (ii) the Document Submittal Instructions to Consultants and Contractors.
- 4.1.4 Paper and drawing sizes shall be “A” series sheets as specified in BS 3429.
- 4.1.5 The following software compatible for use with Intel-Windows based computers shall be used, unless otherwise stated, for the various electronic submissions required:

<u>Document Type</u>	<u>Electronic Document Format</u>
Text Documents	MS office 2007 Professional version or latest version
Spread Sheets	MS office 2007 Professional version or latest version
Data Base Files	MS office 2007 Professional version or latest version
Presentation Files	MS office 2007 Professional version or latest version
Programs Ver 2.0a	Primavera Enterprise (latest version) for Windows (latest)
AutoCAD Graphics	AutoCAD 2016 or latest version
Photographic	Adobe Photoshop, Ver.7.0 or latest version
Desktop Publishing	Page Maker 6.5,5 or latest version
CADD Drawings	AutoCAD 2016 or latest version

- 4.1.6 Media for Electronic File Submission: One copy shall be submitted unless otherwise stated in DVD/USB stick.
- 4.1.7 Internet File Formats/Standards
 - (i) The following guidelines shall be followed when the Contractor uses the Internet browser as the communication media to share information with the Project Manager
 - (ii) All the data formats or standards must be supported by latest version of Microsoft Internet Explorer or other web browser.
 - (iii) The following lists the file types and the corresponding data formats to be used on the Internet. The Contractor shall comply with them unless prior consent is obtained from the Employer's Requirement for a different Data format:

File Type	Data Format
Photo Image	Joint Photographic Experts Group (JPEG)
Image other than Photo	GIF or JPEG
Computer Aid Design files (CAD)	Computer Graphics Metafile (CGM)
Video	Window video (.avi)
Sound	Wave file (.wav)

4.1.8 The following states the standards to be used on Internet when connecting to database(s). The Contractor shall comply with them unless prior consent is obtained from the Employer's Requirement for a different standard:

Function to be Implemented	Standard to be Complied With
Database connectivity	Open Database Connectivity (ODBC)
Publishing hypertext language on the World Wide Web	Hypertext Markup Language (HTML)

4.1.9 The hard copy of all documents shall be the contractual copy.

4.2 General Requirements

4.2.1 The Contractor shall adopt a title block similar to that used in the Drawings for all drawings prepared under the Contract.

4.2.2 Each drawing shall be uniquely referenced by a drawing number and shall define both the current status and revision of the drawing.

4.2.3 The current status of each drawing shall be clearly defined by the use of a single letter code as follows:

- P - Preliminary Design Drawing
- D - Definitive Design Drawing
- C - Construction Reference Drawing
- W - Working Drawing
- B - As-Built Drawing
- M - As Manufactured Drawing
- E - Employer's Drawing

4.3 Drawing Numbering System

4.3.1 A suitable drawing numbering systems shall be evolved by the Contractor and submitted to Project Manager for his review. It shall present unique numbers and take care of revisions.

4.4 Types of Drawing

4.4.1 'Design drawings' mean all drawings except shop drawings and as-built drawings.

-
- 4.4.2 'Working drawings' are design drawings of sufficient detail to fully describe the Works and adequate to use for construction or installation.
- 4.4.3 Site drawings and sketches' are drawings, often in sketch form, prepared on site to describe modifications of the Working drawings where site conditions warrant changes that do not invalidate the design.
- 4.4.4 'Shop drawings' are special drawings prepared by the manufacturer or fabricator of various items within the Works to facilitate manufacture or fabrication.
- 4.4.5 'As-built drawings' show the Works exactly as constructed or installed. They are usually prepared by amending the working drawings to take into account changes necessitated by site conditions and described in Site drawings. These drawings shall be completed on a regular basis as the works progress, and shall not be left until completion of the entire works.

4.5 Computer Aided Design & Draughting (CAD) Standards

4.5.1 Scope of Use

Data input procedures between the Project Manager and Contractors must be co-ordinated, and the key parameters used to form CAD data files must be standardised. The production of all CAD data files shall comply with the Objectives as specified in the clause 4.5.2.

4.5.2 The main objectives of the CAD standards are as follows:

- (i) To ensure that the CAD data files produced for Project are co-ordinated and referenced in a consistent manner.
- (ii) To provide the information and procedures necessary for a CAD user from one discipline or external organisation to access (and use as background reference), information from a CAD data file prepared by another discipline or external organisation.
- (iii) To standardise the information contained within CAD data files, which may be common to more than one discipline such as drawing borders, title boxes, grid lines etc.
- (iv) To establish procedures for the management of CAD data files.
- (v) To ensure all contractors use 'Model space' and 'Paper space' in the production of their CAD files'.

4.6 General

- 4.6.1 To facilitate co-ordination between contractors, it is a requirement that all drawings issued by Contractors for co-ordination or record purposes shall be produced using CAD methods. Drawings shall be issued in digital format in addition to the paper copies.
- 4.6.2 The intent of the issue of digital information is to aid the related design by others. The definitive version of all drawings shall always be the paper or polyester film copies, which have been issued by the Contractor or organisation originating the drawing.
- 4.6.3 Drawings and drawing packages issued for co-ordination, record purposes or for acceptance shall be accompanied by a complete set of the corresponding CAD data files.

4.6.4 Any contractor or organisation making use of the CAD data from others shall be responsible for satisfying himself that such data is producing an accurate representation of the information on the corresponding paper drawing, which is satisfactory for the purpose for which he is using it. Provided the general principles of this section have been achieved by the originator of the CAD data, contractors making use of the CAD data from others shall not be entitled to require alterations in the manner in which such CAD data is being presented to them.

4.6.5 In particular, automatic determination of physical dimensions from the data file shall always be verified against the figured dimensions on the paper or polyester drawings. Figured dimensions shall always be taken as correct where discrepancies occur.

4.7 Terminology & Associated Standards / Guidelines

4.7.1 Any terminology used within this section that is ambiguous to the user shall be clarified with the Employer's Requirement. British Standard BS1192 is used in principle as a guide for drawing practice, convention, CAD data structure and translation.

4.8 Paper Drawings

4.8.1 For the Project "Paper" drawings are considered to be the main vehicle for the receipt and transmittal of design and production information, typically plans, elevations and sections.

4.8.2 The Project wide accepted media for the receipt and transmittal of "Paper" drawings will be paper and polyester film of various standard ISO 'A' sizes. The composition of this information shall be derived from a CAD "Model".

4.8.3 The CAD derived "Paper" drawing composition will reflect a window of information contained within a CAD "Model Space" file together with a selection of information contained within the associated CAD "Paper Space" file.

4.9 CAD Data Creation, Content & Presentation

4.9.1 A consistent method of CAD data creation, together with content and presentation is essential. The method of CAD "Model Space and Paper Space" creation is as follows:

(i) Model Space Files

- Typically CAD "Model Space" files are required for general arrangement and location plans and will consist of a series of other "Model Space" referenced CAD files covering the total design extents at a defined building level (the number of referenced files should be kept to an absolute minimum). Data contained within a CAD "Model Space" files is drawn at full size (1:1) and located at the correct global position and orientation on the Project Grid / or defined reference points.
- Each CAD "Model Space" file will relate to an individual discipline. Drawing border / text, match / section lines or detailed notation shall NOT be included within a CAD "Model Space" file. Dimensions shall be included within a CAD "Model Space" but located on a dedicated layer. Elevations, Long Sections and Cross Sections shall also be presented in CAD "Model Space" as defined above, but do not need to be positioned and orientated on the Project Grid.

(ii) Paper Space CAD Files

- Paper Space” CAD files are utilised to aid the process of plotting “Paper” drawings and are primarily a window of the CAD “Model Space” file. A “Paper Space” CAD file will typically contain drawing borders, text, match or section lines & detailed notation. Once these files are initially set up and positioned, the majority of “Paper Drawing” plots at various approved scales are efficiently and consistently generated by displaying different combinations of element layers and symbology contained within the “Paper Space” file and the referenced “Model Space” files.
- The purpose is to ensure that total co-ordination is achieved between the CAD “Model Space” file and the “Paper Drawing” output during the revision cycle of the design and production process. Duplicated data in “Model and Paper Space” files will not be acceptable unless an automatic update link exists between the two data sets. “Paper Space” files are not typically required as part of the CAD Media Receipt from contractors, unless specifically requested.

4.10 CAD Quality Control Checks

4.10.1 Random CAD Quality Control Audits will be carried out by Project Manager on all CAD media received and transmitted.

4.10.2 These checks DO NOT verify the technical content of the CAD data received or transmitted (as this is the responsibility of the originating organisation), however compliance with Project CAD and Draughting Standards shall be checked.

4.10.3 In addition, all contractors who transmit and receive CAD data from the Project shall have CAD quality control procedures in place. A typical quality control procedure shall contain CAD data quality checking routines coupled with standards for CAD data transmittal and archiving.

4.11 CAD Data Transfer Media and Format

4.11.1 When CAD data is received & transmittal between Project Manager and the Contractor, the media shall be as follows:

- (i) Data Exchange Format - AutoCAD as stated above in clause 4.1.5.
- (ii) Operating System - Window 7/10 or latest version.
- (iii) Data Transfer Media: DVDs/ Hard disc (or other better means)
- (iv) All disks or tapes must be labelled on the data shield with:
 - Name of Company
 - Project Title
 - Drawing Filenames (for diskettes only)
 - Diskette No. / Total No. of diskettes or Tape No. / Total No. of Tapes
- (v) All media shall be submitted with a completed Form (CAD Disk/Tape Sheet).
- (vi) The Contractor must ensure the supplied media is free from virus.
- (vii) Sub-directories on tapes or disks are not permitted. If CAD Data is created using UNIX, archive commands must be unrooted.

4.12 CAD Media Receipt & Transmittal

4.12.1 CAD Media Transmittal (from the Contractor to Project Manager) - this will consist of the following:

- (i) CAD Digital Media [disk(s), CD's or tape (s)] shall typically contain CAD "Model Space" and "Paper Space" files.
- (ii) CAD data sheet
- (iii) CAD issue / revision sheet
- (iv) CAD Quality Checklist confirming compliance.
- (v) Plot of each "Model Space" file issued on an A1 drawing sheet (to best fit).

4.12.2 The above CAD media will be collectively known as "CAD Media Transmittal Set". The CAD data file transmittal format required by Project Manager from all contractors shall be in AutoCAD.

4.12.3 All CAD media received from contractors will be retained by Project Manager except for SCSI disk (if used) as an audit trail / archive of a specific contractor's design evolution.

4.12.4 CAD Media Receipt (from Project Manager to the Contractor)

- (i) CAD media should normally be obtained from the respective Designated contractor(s), but should Project Manager issue CAD media it will consist of the following:
 - CAD Digital Media (disk (s) or tape (s)) typically contain only CAD "Model Space" files.
 - CAD data sheet.
 - CAD issue / revision sheet
- (ii) The above CAD media will be collectively known as the "CAD Media Receipt Set". The CAD data file transmittal format used by Project Manager to all contractors will be in AutoCAD version as stated in clause 4.1.5.
- (iii) Each CAD transmittal disk / tape will be labelled with proper disk label as approved by the Project Manager. Any CAD data transmitted without this label is assumed to be provisional information not to have been quality checked and therefore not formally issued.

4.13 Revisions

4.13.1 All 'Revisions', 'In Abeyance' and 'Deletions' shall be located on a common layer. This layer can be turned on or off for plotting purposes.

4.13.2 The following example text indicates the current CAD file revision, i.e. 'Revision [A]'. This shall be allocated to a defined layer on all CAD "Model Space" files, in text of a size that will be readable when the CAD "Model Space" file is fitted to the screen, with all levels on.

4.14 Block Libraries, Blocks, & Block Names

- 4.14.1 All Construction Industry symbols produced as CAD Cells shall typically conform to British Standard BS1192 - part 3.
- 4.14.2 All Blocks created shall be Primitive (i.e. NOT Complex) and shall be placed Absolute (i.e. NOT Relative).
- 4.14.3 The Contractor's specific block libraries shall be transmitted to Project Manager together with an associated block library list containing the filename (max. 6 characters) and block description. The Contractor shall ensure that the library is regularly updated and circulated to all other users, together with the associated library listing.
- 4.14.4 All Blocks of a common type, symbols or details should initially be created within a CAD “Model Space File” specifically utilised for that purpose. These files will be made available on request by Project Manager.
- 4.14.5 All Blocks created will typically be 2D unless 3D is specifically requested. In both instances they shall have an origin at a logical point located within the extents of each Block’s masked area or volume.

4.15 CAD Dimensioning

- 4.15.1 Automatic CAD Dimensioning will be used at all times. Any dimensional change must involve the necessary revision to the model space file. If the CAD Quality Control Checks find that the revisions have not been correctly carried out, the rejection of the entire CAD submission will result.

4.16 CAD Layering

- 4.16.1 All CAD elements shall be placed on the layers allocated for each different discipline. The layer naming convention to be adopted by the Contractor shall be submitted for acceptance and inclusion within these standards.

4.17 Global origin, Location & Orientation on the Alignment Drawing.

- 4.17.1 Location or Plan information in “Model Space” files shall coincide with the correct location and orientation on the Project grid for each specific contract.
- 4.17.2 Location plans shall have at least three setting out points shown on each CAD “Model Space” file. Each setting out point shall be indicated by a simple cross hair together with related Easting and Northings co-ordinates. The Civil Contractor(s) will establish the three setting out co-ordinates for their respective works, which will then be used by all other contractors including the Contractor.

4.18 Line Thickness and Colour

- 4.18.1 To assist plotting by other users, the following colour codes will be assigned to the following line thickness / pen sizes.

Colour	Code No.	Line Thickness
Red	10	0.18
White	7	0.25
Yellow	2	0.35

Colour	Code No.	Line Thickness
Brown	34	0.5
Blue	130	0.7
Orange	30	1.0
Green	3	1.4
Grey	253	2.0

4.19 CAD Utilisation of 2D & 3D Files

4.19.1 Although the project standard is 2D CAD files, certain disciplines and contractors may use 3D CAD files for specific applications or where the isolated use of 3D aids the design and visualisation process (i.e. Architecture, Survey and Utilities). In these specific instances 3D CAD data will only be transmitted if all other users can use this data. If this is not the case, a 3D to 2D translation shall be processed by the creator prior to issue.

4.20 CAD File Numbering

4.20.1 Contractors CAD File Numbering shall be described in 4.3 above.

4.20.2 Employer CAD File Numbering: Unlike most of the contractors, Employer will not be required to produce numerous CAD files. This will follow the numbering system Except that the status of the drawing shall be "E".

4.21 CAD File Naming Convention – General

4.21.1 CAD "Model Space" files shall be named in accordance with general drawing conventions.

5 APPENDIX 5 - DESIGN CERTIFICATE

This Design Certificate refers to Submission No. which comprises:

[description of the Works to which the submission refers]

The contents of this submission are scheduled in Section A below.

Section A: Submission No.. comprises the following:

Drawings: (Title, drawing number and revision)

Other: (Title, reference number and revision)

(i)

(ii).

(iii)

(iv)

etc.

The documents scheduled in Section B below, for which a Notice of No Objection has been issued, are of relevance to this submission.

Section B: Documents for which a Notice of No Objection has been issued and which are of relevance to this Submission No.

Item Reference: (Title, reference number and revision)

(i)

(ii).

(iii)

(iv)

etc.

Contractor's Statement

We certify that:

- (a) the design of the Works, as illustrated and described in the documents scheduled in Section A above, complies with the Employer's Requirements General /Technical Specification

Clause.....

Covering.....
.....
.....

- (b) an in-house check has been undertaken and completed to confirm the completeness, adequacy and validity of the design of the Permanent Works as illustrated and described in the documents scheduled in Section A below;
- (c) all necessary and required approvals relating to the design of the Works, as illustrated and described in the documents scheduled in Section A, above have been obtained and copies of such approvals are annexed in Section C below;
- (d) all effects of the design comprising the submission on the design of adjacent or other parts of the Works have been fully taken into account in the design of those parts.

Name.....
Position/ Designation.....
Date.....

Signed by Contractor's Authorised Representative

Contractor's Certification

This Certifies that all design has been performed utilizing the skill and care to be expected of a professionally qualified and competent designer, experienced in work of similar nature and scope. This further certifies that all works relating to the preparation, review, checking and certification of design has been verified by us.

	Name
	(for Contractor)
	Position/Designation
Signed by 'Authorized Representative'	Date

Note 1

The Contractor shall insert one of the following, as applicable:

- (i) the Contractor's Technical Proposals
- (ii) the Contractor's Technical Proposals and Design Packages Nos. for which a Notice of No Objection has been issued.
- (iii) Design Packages Nos. for which a Notice of No Objection has been issued if such Design Packages develop and amplify the Contractor's Technical Proposals.
- (iv) The Definitive Design

Section C

[Contractor to attach copies of necessary and required approvals]

- (i)
- (ii).
- (iii)
- (iv)
- etc.

6 APPENDIX 6 –DELETED.

7 APPENDIX 7 - ABBREVIATIONS

Abbreviation	Description
A0-A6	International Document Paper Sizes
AC	Alternating Current
AGC	Associated General Contractors
ATO	Automatic Train Operation
ATP	Automatic Train Protection
BS	British Standard (s) (Institution)
CAD	Computer Aided Design
CATC	Continuous Automatic Train Control
CPM	Critical Path Method
CR	Contractor Representative
DC	Direct Current
DCA	Design Certificate Application
DCC	Design Certificate (of) Consent (Sheet)
DLP Addendum-1 dated 05.12.2022, Sl. No. 57 Deleted	Defect Liability Period Deleted.
DLMP	Defect Liability Maintenance Period
DMI	Driver Machine Interface
DRCA	Design Review Certificate Application
EMC	Electro-Magnetic Compatibility
EN	European Standards (Organization)
GCC	General Condition of Contract
ISO	International Standards Organization (Standard)
MRTS	Metro Rail Transport System
NTP	Notice To Proceed
OEM	Original Equipment Manufacturer
OSR (S)	Operational Safety Report (Software)
PDM	Precedence Diagramming Method
RAM	Reliability availability and maintainability
RDSO	Research, Design and Standard Organization
RS	Rolling Stock (metro train Cars)
SECP	Software Engineering Change Proposal
HECP	Hardware Engineering Change Proposal
SCC	Special Condition of Contract
SI	International System (of Metrication)
SI	Static Inverter
SIL	Safety Integrity Level
UTO	Unattended Train Operation

8 APPENDIX 8 - SUBMITTALS REQUIRED**8.1. Submittals:**

Following plans & other details as required by Employer's Requirements: General Specifications, shall be submitted by the Bidders along with the bids.

Table 8A: Submissions

Sl. No.	Description	ERGS Clause reference
1	Outline Project Management Plan,	2.2
2	Outline Work Management plan program including Scheduling approach to the design, manufacture, testing and commissioning, integrated tests and an Outline document submission program	2.4
3	Outline Quality Assurance Management Plan	2.5.3
4	Outline Safety Assurance Management Plan	2.6
5	Environmental Management Plan	2.10
6	Recommended list of consumable spares	8.3
7	Priced list of the recommended spares as per Price Bid	8.5
8	List of Testing and Diagnostic Equipments and Gauges	8.7
9	List of Depot M&P, Mechanical & Electrical Measuring and testing equipment, Mechanical, pneumatic and electric tools, special tools, jigs & fixtures and any other items required for maintenance.	8.8
10	List of commissioning and Maintenance Spares	8.11
11	Spares for maintenance, overhaul and repair of cars for a period of 5 years	8.13
12	List of overhauling spares	8.6

[Addendum-1 dated 05.12.2022, Sl. No. 58](#)**8. APPENDIX 8 - SUBMITTALS REQUIRED (Revised)****8.1. Submittals:**

Following plans & other details as required by Employer's Requirements: General Specifications, shall be submitted by the Bidders along with the bids.

Table 8A: Submissions

Sl. No.	Description	ERGS Clause reference
1	Outline Project Management Plan,	2.2
2	Outline Work Management plan program including Scheduling approach to the design, manufacture, testing and commissioning, integrated tests and an Outline document submission program	2.4
3	Outline Quality Assurance Management Plan	2.5
4	Outline Safety Assurance Management Plan	2.6
5	Environmental Management Plan	2.10
6	Recommended list of consumable spares	Chapter 8 & 14.5
7	Priced list of the recommended spares as per Pricing document	
8	List of Testing and Diagnostic Equipments and Gauges	
9	List of Depot M&P, Mechanical & Electrical Measuring and testing equipment, Mechanical, pneumatic and electric tools, special tools, jigs & fixtures and any other items required for maintenance.	
10	List of commissioning and Maintenance Spares	
11	List of Spares for maintenance, overhaul and repair of cars for a period of 5 years after DLMP.	
12	List of overhauling spares	

9 APPENDIX – 9 TECHNICAL SPECIFICATION OF TRAIN SIMULATOR, MAINTENANCE SIMULATOR AND COMPUTER BASED TRAINING

9.1. GENERAL DESCRIPTION AND SCOPE OF SUPPLY

9.1.1. ~~Train Simulator~~

~~The specification covers the design, manufacture, supply, installation, testing and commissioning of Two Desk type Train driving Simulators, Maintenance simulators for all major subsystem and CBT package covering all system/subsystems including the troubleshooting. The train driving simulator desk type shall be capable of providing advanced and detailed training to improve:~~

- ~~i) Driving techniques of train operators.~~
- ~~ii) Troubleshooting technique of train operators~~
- ~~iii) Preparing the train for service~~
- ~~iv) General development of train handling skills~~
- ~~v) Operation of the train under normal service conditions in all operating modes, while adhering to rules, signals, timetable and efficiency objectives~~
- ~~vi) Training of accurate station stops, Cab change and time optimization~~
- ~~vii) Route familiarization~~
- ~~viii) Correct response to train failures and efficient troubleshooting capabilities~~
- ~~ix) Correct and safe response to critical situations, emergencies and abnormal situations~~

[Addendum-1 dated 05.12.2022, Sl. No. 59](#)

Train Simulator

The specification covers the design, manufacture, supply, installation, testing and commissioning of **One Cab Replica Train driving Simulator (Without Motion System) along with associated Instructor and Observers Station**, Maintenance simulators for all major subsystem and CBT package covering all system/subsystems including the trouble shooting. The train driving simulator desk type shall be capable of providing advanced and detailed training to improve:

- i) Driving techniques of train operators.
- ii) Troubleshooting technique of train operators
- iii) Preparing the train for service
- iv) General development of train handling skills
- v) Operation of the train under normal service conditions in all operating modes, while adhering to rules, signals, timetable and efficiency objectives
- vi) Training of accurate station stops, Cab change and time optimization
- vii) Route familiarization
- viii) Correct response to train failures and efficient troubleshooting capabilities
- ix) Correct and safe response to critical situations, emergencies and abnormal situations

9.1.2. Maintenance Simulator:

The Maintenance simulators for all major sub-system shall be capable of providing advanced and detailed training to improve:

- a) Understanding of system behavior under Normal working condition along with the basic philosophy of each system, flow of logical commands and the detailed view of Vehicle Control Circuit.
- b) Troubleshooting and maintenance techniques for the maintenance personnel.
- c) Replacement (Assembly and disassembly) of all major parts in each sub- system.
- d) Upload and download software of relevant systems and usage of test points.
- e) By watching a fault or symptom, reach to actual failure by means of support of all actual instruments and test points and software as used in real train to identify a reason of fault and then to troubleshooting solution.

9.1.3. Computer Based Training:

The Computer Based Training package should cover all the available systems / subsystems in the train. The entire course shall be suitably arranged in modules. Provisions should be available to assign individual or part of a module to a trainee / trainee. The modules shall be of Sharable Content Object Reference Model (SCORM) compliant and should be structured for tutorial as well as evaluation of the trainee.

9.1.4. The train driving simulator shall be capable of simulating the BMRCL cars/trains with maximum possible realism. The Simulator shall comprise a cab, visual system, sound system, Instructor console, and all required computational and support equipment including UPS. The Contractor shall make provisions in the system for adding additional Desktop and full scope simulators in future as required.

9.1.5. As such the main components of the Simulator system are:

- i) Realistic desk controls and indicators.
- ii) Sound system capable of simulating all real time train sounds.
High-Definition Visual system, based on a high resolution, realistic and flexible Computer-Generated Imagery (CGI) system.
- iii) One Instructor console for the simulation management through scenarios which allow operation by the trainee with little or no instructor interaction as well as the ability to allow significant instructor interaction.
- iv) Intercom device between the instructor and the trainee desk. Provisions shall be made for Radio communication system as in the real train which enable the trainee to communicate with OCC, Stations and Other trains.
- v) Detailed modeling of train performance
- vi) Detailed modeling of the BMRCL signaling system,
- vii) All required computational and support equipment.
- viii) Representative vehicle control circuit
- ix) Representative pneumatic circuit
- x) Other equipment / logic which shall be required for training of maintenance staff.

-
- 9.1.6. The debriefing equipment shall be linked to the desk simulator that will enable replay of training exercises. It shall enable a trainee to be debriefed by an instructor to provide performance assessment of training exercises.
- 9.1.7. The Contractor shall provide full descriptive manuals of Operation, Maintenance and Training in the use of the simulator and associated equipment. The Contractor shall also supply a catalogue of spare parts for the equipment. All supplied documentation shall be in English language.
- 9.1.8. The Contractor shall supply a set of as-built drawings, wiring diagrams and schematics for the equipment supplied including that of pneumatic circuits.
- 9.1.9. The scope of supply shall include all accessories to make the Simulator fully functional and the cost of such accessories shall be included in the price of the Simulator. In addition, other accessories, which can contribute to improved efficiency; maintainability and reliability of the Simulator shall also be supplied.
- 9.1.10. The defect liability period of simulator and other equipment supplied shall be 24 months from date of acceptance or expiry of the defect liability period of trains, whichever is later (As per clause 5.1.4 of ERGS).
- 9.1.11. The Contractor shall provide the optimized layout of the Simulator and other auxiliary rooms required to house the simulator. Adequate rooms and space shall be incorporated in the same layout for classroom for the trainees, rest rooms, pantry, chamber of instructor and office for the Employer's engineers. The building shall be built by the Employer at its expense as per the broad details and layout provided by the Contractor.
- 9.1.12. The Contractor shall simulate the track of Line-6, Phase-2A & 2B of BMRCL Metro network. Interface with signaling systems shall also be required for the design and procurement of the signaling equipments.
- 9.1.13. The display system should bring out the exact replica of actual train indications the platform displays at station and visuals of all the line elements, structures etc. from the operator's seating position (minimum horizontal view of 40 degrees on either side from center line of vision of operator). Additional high-definition display panels may be used for this purpose to simulate the real time environment.

9.2. Scope of Supply

The simulator configuration shall be as follows:

- 9.2.1. ~~One Desk simulators (Without motion system) in the adjoining compartment and one corresponding Instructor Station with possible view of the desk type simulator and ability to interact seamlessly.~~

Addendum-1 dated 05.12.2022, Sl. No. 60

One Cab Replica Train driving Simulator (without Motion System) in the adjoining compartment and one corresponding Instructor Station and Observer Station with possible view of the simulator and ability to interact seamlessly.

- 9.2.2. PC based training module depicting equipments/controls/located at under floor/other cab/inside saloon/coupler and linked to the simulator to provide training in running of the train especially for rescue operation. This should also show 2-D/3-D representation of running line.

- 9.2.3. A scale down physical working model of the DMC car along with 3D Virtual Train Navigator in which operation of all relevant cocks, MCBs, switches, Emergency door, door isolation, releasing of parking brake, operation of Passenger Alarm Emergency Handle Operation (PAEH operation) and operation of Obstacle Detection Device, etc. can be done physically. Any additional left out cock/switch etc. as above which may not be available in DMC shall be suitably incorporated to simulate the real time environment. All provisions shall be made available for troubleshooting the malfunctions.
- 9.2.4. A suite of Computer-Based Training (CBT) equipment comprising 12 PC workstations networked to one instructor PC Master server with backup server to networked with entire Bangalore Metro intranet network on web based application for training including training and assessment modules. Two independent hardware with the suitable configuration shall be used one as Master and other as backup server. The CBT software package will comprise training and assessment modules.
- 9.2.5. TCMS based Trouble Shooting Directory (TSD) for train operators. The TSD shall be menu driven and user friendly and exact replica of the TSD provided on the train.

9.3. TECHNICAL CHARACTERISTICS

9.3.1. Operating principle

The Simulator shall be used for following main uses:

- i) **Basic training:** To provide experience of realistic operation prior to the actual training on Train running on service lines. Visual, sound and motion cues shall be accurately represented. This includes training in the response to abnormalities.
- ii) **Training in the response to train failures:** This is to improve and develop the driver's experience in how to identify and do remedy for rolling stock and signaling system failures.
- iii) **Training in emergency responses:** This is to improve the ability to respond to emergencies by simulating abnormal situations that could not be set or experienced with actual trains in normal working.

A virtual Emergency Evacuation operation shall be implemented. Dedicated multimedia sequences shall be developed in order to represent the different phases of operation of the Emergency Evacuation. Evacuation procedure shall be simulated for planned evacuation and emergencies like fire /blast cases. The visuals for the operation of tunnel ventilation fans etc. shall also be simulated. It should be possible to assess time for evacuation under simulated conditions as above

Disaster situations scenarios should be simulated for blast and derailment of train in synchronized mode with option of derailment of different level e.g. bogie derailment, coach derailment, derailment with infringement of adjacent track etc.

- iv) **Training for rescue operation:** The instructor shall be able to simulate rescue operations. The instructor shall be able to place a defective train at any place on the database. The Train Operator should be able to approach the defective train following the rules and procedures in force. The coupling to the defective train shall be simulated for both pneumatic and electrical circuits as applicable. During coupling, specific sounds are to be generated. The simulation software shall monitor the coupling speed which shall be configurable. After successful coupling, the Train

Operator shall be able to push / pull the defective train to the desired location. During the coupling exercise, the instructor playing the role of the defective/assisting train driver. The controls required for coupling operation which are not located on the desk simulator shall be represented by multimedia controls/pictures on additional monitor.

Rescue operations of the simulated train by another metro or by a rescue locomotive controlled by the instructor shall also be simulated.

Provisions shall be made available with instructor station in synchronization mode, to assign any one simulator as defective / assisting train for future additions of simulators.

9.3.2. The Simulator shall be used to train the trainees in the following operational scenarios:

- i) Preparing the train for service in depot / designated stabling point on main line and removing the train from service including starting and stopping the train.
- ii) Coupling and uncoupling of trains and movements related to rescue operation of a failed train.
- iii) Boarding and de-boarding of passengers including accurate stopping of trains at platforms and nominated stopping points during reversals.
- iv) Operation on the Metro trains in respect of the schedule.

9.3.3. The role of the Simulator shall include:

- i) The introduction of the rolling stock.
- ii) The training of new drivers in metro train operation, Train driving / handling, rules and regulation compliance and faults and failures procedures.
- iii) Training on train signaling equipment.
- iv) Training for scheduled operation.
- v) Training for maintenance personnel.

9.3.4. Cab Controls and line map

- i) The BMRCL shall provide all required information, in particular the line map and the details of the Rolling Stock procured earlier or to be procured.
- ii) The cab controls shall mean generally real equipments set of cab controls and indications as provided in the train. The Contractor will be responsible for any modifications to real equipment required for simulator application. Use of Replica of any item, if inescapable shall have approval of the Project Manager.

9.3.5. Cab mock-up for desk type train driving simulator

9.3.5.1. The desk simulators shall be capable of simulating BMRCL trains with sufficient realism in terms of control equipments of the driver's desk, for the driver to be able to repeat the exact same movements and tasks as in the real train cab. To achieve so, the equipment of the driver's desk shall closely enough reproduce the existing OEM controls in terms of function and dimensions. The desk simulator shall have dimensions equivalent to the ones of the real train control desk, in front of the driver seat. The Contractor shall make provisions for the backwall panels if any and the controls available including of MCBs, Switches, Indicators etc. simulations respecting

the distance and dimensions for the trainee to perform the same movements as in the real train.

- 9.3.5.2. Detailed drawing of desk type train driving simulator and its site plan shall generally be decided during design.
- 9.3.5.3. Other cab equipment (co-driver's desk, saloon partition doors, ceiling etc.) shall not be simulated.
- 9.3.5.4. The track database is to be displayed on minimum 65" High definition LED monitor suitably placed to maintain the distance from the operator eye as in the real train The operator seat and the screen in front shall have provisions for adjustments to maintain ergonomics.

9.3.6. Radio

- 9.3.6.1. The Cab equipment shall include the radio system – either real, replica or a modification of real equipment (i.e. hardwired to permit simulation of normal radio communications functions but without actual radio frequency transmissions).
- 9.3.6.2. ~~Radio / Communications functions will be detailed by the Contractor through the interface with signaling contractors. However, Simulator shall allow the trainee driver to perform the following functions relating to the radio:~~
 - ~~i) Log on to the metro system,~~
 - ~~ii) Receive messages from the controllers.~~
 - ~~iii) Receive Emergency messages,~~
 - ~~iv) Dial a standard set of phone numbers for the following staff:~~
 - ~~a) Control operator~~
 - ~~b) Maintenance Control operator~~
 - ~~c) Respond correctly to Passenger Emergency alarms~~

Addendum-1 dated 05.12.2022, Sl. No. 61

Radio / Communications functions will be detailed by the Contractor through the interface with Signaling Contractor. **Radio device shall be provided as free issue to Rolling Stock (Simulator) Contractor for required interface and integration in the simulator.** However, Simulator shall allow the trainee driver to perform the following functions relating to the radio:

- i) Log-on to the metro system,
- ii) Receive messages from the controllers.
- iii) Receive Emergency messages,
- iv) Dial a standard set of phone numbers for the following staff:
 - a) Control operator
 - b) Maintenance Control operator
 - c) Respond correctly to Passenger Emergency alarms.
- 9.3.6.3. The instructor should be able to know whom the driver is calling to.
- 9.3.6.4. The instructor will be provided with a communications module that permits the instructor to play the various roles for voice communication with the driver. There will

be a simple means of selecting communications mode and will have provision of recording the last 2 hours of verbal communication.

- 9.3.6.5. Group mode communication simplex for one train radio to all other train radio and instructor of same rolling stock type desk simulator and vice-versa when simulation is in synchronized mode.
- 9.3.6.6. One hardwired communication should also be available between cab and Instructor console in parallel to software which can be used in case of software hang/failure.

9.3.7. Visual system of train driving simulator

- 9.3.7.1. A forward vision with computer-generated images (CGI) is required. Hardware architecture shall be PC-based.
- 9.3.7.2. The forward view shall include a minimum horizontal field of view of 40 degrees. The forward view screen shall be placed as far away as possible to enhance and assist the driver's view, approximately 3 meters.
- 9.3.7.3. The simulator shall be provided with forward vision quality (non interlaced) with latest available in the industry.
- 9.3.7.4. The forward view visual system shall include, dynamic cloudy, stormy, rainy and foggy weather and heat haze and the time of day, which shall vary from daylight to dusk to night.
- 9.3.7.5. Signals must be recognizable by the driver at a distance of 1.0 km. The maximum speed of the train to be modelled as per maximum design speed of train.
- 9.3.7.6. Signal number should be readable by the driver at a distance of 80-100 meters.
- 9.3.7.7. A scenario may include any simulated line or a part of it. Any simulated track of the selected line may be used in both directions.
- 9.3.7.8. Headlights and other front lights i.e. flasher, tail and marker lights shall be visible in the forward scene and respond to cab controls including emergency flashing. The effect of headlights on refectories signs should be noticeable.

9.3.8. The Visual Database

- 9.3.8.1. The length of different sections (routes) to be included in the visual database are advised in the GS. Route database(s) shall be usable in both directions.
- 9.3.8.2. All the metro routes are modelled in databases, which are to be used in scenario generation.
- 9.3.8.3. All routes that are available shall be filmed for the CGI. Those sections which will be under construction, either available data may be extrapolated or artist's impressions may be used and the actual images on CGI should be updated after functioning of line without additional cost.

9.3.9. Reflecting Mirror/Platform CCTV/ Rear View cameras

- 9.3.9.1. The left and right side cab door window view shall be suitably simulated keeping the ergonomics and the operator's viewing angle. The simulator must be able to reproduce a specified range of typical scenarios that form part of a driver's task e.g. boarding and de-boarding of passengers with option of fast, slow, boarding stopping time from 0 to 100 seconds (0 means no passengers on platform at station),

Passenger trapped between doors, passenger skidding with train on platform as part of his/her cloth/other object wrapped to passenger body remain inside the saloon and door get closed. The CGI technology must be suitable for simulation of reflecting mirror/Platform CCTV.

9.3.9.2. The reflecting mirror/platform CCTV / Rear View cameras images from specified station platforms shall be incorporated into the simulator database.

9.3.10. General visual data base requirements

In general, the visual database shall include the following features:

- i) Temporary, emergency and permanent speed restrictions as place-able by the Client.
- ii) Faulty signal function with option of effecting/not effecting cab signal.
- iii) Track with compatible to simulate on different ground level as per actual
e.g. in IBL train should be on Inspection bay pillar rail and other on ground.
- iv) Controllable areas of track default to be simulated with sound e.g. jerk, lurch, broken rail minor crack, small and large piece as place-able by the client and derailment can be attached with any one of these by the instructor.
- v) Detonators
- vi) Bomb Blast with fire
- vii) Mileposts at least 2 types. Signs at least 20 types
- viii) Obstructions:
 - a) Debris on track
 - b) Passengers on track.
 - c) People:
 - Track workers (static)
 - Flag man.
 - d) Stabled trains and moving trains:
 - Stabled trains shall be in depot area or the nominated stabling places on main line as well.
 - e) Passengers at stations
 - Platforms as per actual with ramps/stairs at each end for Surface
 - Elevated and Underground section
 - Optional platform safety strips
 - Station buildings most of them specific, the other generic in 6 types
 - At least 200 people (50 different) on platforms
 - Stairs above and below the platforms
 - f) All dynamic elements of CGI should be functional e.g. washing plant etc.
 - g) Third Rail should be full realistic with its all elements with facility of different malfunctions.

- h) Disaster situations scenarios should be simulated including the derailment of train with option of derailment of different level e.g. bogie derailment, coach derailment, derailment with infringement of adjacent track etc.
- i) Railroad buildings visuals as of actuals.
 - i) Signal boxes -2 types.
 - ii) Equipment boxes 2 types.
 - iii) Signal post telephone.

Above list is not exhaustive. The final list will be evolved during the design stage with approval of the Project Manager.

9.3.11. Place-able objects and animation

9.3.11.1. The following objects visible in the scene shall have their state controllable by the scenario or the instructor in runtime:

- (a) Points switch.
- (b) Light signals.

9.3.11.2. The following objects shall be place-able anywhere along the track route by command from the scenario or the instructor in run time.

- (a) Temporary and emergency speed restrictions
- (b) Stabled and moving trains
- (c) People
- (d) Obstructions
- (e) Signs

9.3.12. Sound System

9.3.12.1. The sound system shall include quadraphonic reproduction of sound, which provides a realistic simulation of the audio environment in the simulator. It shall preferably use the real time Doppler-effect. The system shall be capable of reproducing all independent and dependent sounds during the actual train run.

9.3.12.2. The following is a list of the sounds to be simulated:

- i) Traction motor, which varies with speed and load
- ii) Air brake sounds
- iii) Brake pad sounds
- iv) Cabin air sounds, whistling air, especially in tunnels, trains passing by in opposite direction.
- v) Track clatter on jointed and welded rail at frogs and points
- vi) Air/ Electric horn.
- vii) Detonators
- viii) Bomb blast
- ix) Passing train noise (related to train length and velocity).

- x) Wheel squeal on curves
- xi) Warning sounds and alarms in the cab

Above list is not exhaustive. The final list will be evolved during the design stage with approval of the Project Manager.

9.3.13. Instructor station

9.3.13.1. The major functions of the instructor station must include:

- i) CCTV from driver's cab for future use
- ii) Forward view monitor.
- iii) Cab controls graphic display, circuit breaker status and in-cab display~ repeater.
- iv) Radio interface panel with intercom (with Switches that determine what role he plays).
- v) Instructors control workstation.
- vi) Sound monitor.

9.3.13.2. Reflecting mirror/platform CCTV monitor/ Rear View cameras of all desk type simulators. Instructor station shall be capable of choosing display of selected simulator in one click.

9.3.13.3. ~~Provisions shall be available on the Instructor MMI of Desk type train simulator to display a simultaneous view of all three Simulators (if available) control MMI simultaneously. It will enable to select one simulator for display on the other screens of the instructor station.~~

Addendum-1 dated 05.12.2022, Sl. No. 62

Provisions shall be available on the Instructor MMI of Desk type train simulator to display a simultaneous view of a Simulator (if available) control MMI simultaneously. It will enable to select simulator for display on the other screens of the instructor station.

9.3.13.4. ~~The instructor of desk type train simulator shall be able to interact with all the three simulators seamlessly if available.~~

Addendum-1 dated 05.12.2022, Sl. No. 63

The instructor of desk type train simulator shall be able to interact with simulator seamlessly if available.

9.3.13.5. ~~There will be a synchronization mode at both Instructor station by selecting it all three desk simulator and will use same CGI line but at different locations as specified by Instructor. In this mode all features will be same as all three simulated trains are running on same line as in real environment. It will be specially useful for coupling scenarios when defective train needs to be rescued by assisting train.~~

Addendum-1 dated 05.12.2022, Sl. No. 64

There will be a synchronization mode at both Instructor station by selecting desk simulator and will use same CGI line but at different locations as specified by Instructor. In this mode all features will be same as **all** simulated trains are running

on same line as in real environment. It will be specially useful for coupling scenarios when defective train needs to be rescued by assisting train.

9.3.13.6. In desk type simulator instructor station, if Instructor is engaged in communication with one desk and at the same time if other desk type simulator (if available) communicates with Instructor the sound of other desk will also be available to Instructor.

9.3.13.7. The Instructor Station computer shall be PC-based.

9.3.13.8. A colored laser printer and a data backup facility shall be included.

9.3.14. Power and video control panel

This panel shall allow the instructor to power up all simulator sub-systems within 05 minutes from fully off conditions. This panel shall include equipment, which can control the displays, which are present in a classroom. The system shall have UPS of adequate capacity to run the system for at least 45 minutes in the event of power failure. UPS shall incorporate the required features for filtered, steady power supply.

9.3.15. Instructor workstation functionalities

9.3.15.1. An instructor station with full graphical capabilities shall allow for easy intuitive scenario configuration.

9.3.15.2. Man-machine interface:

- (i) The instructor station man machine interface shall consist of the following sub-windows:
 - (a) **Headline:** display of the simulation time and of the real time and date.
 - (b) **Scenario creation functions:** buttons and menus for all simulation creation functions (specifying route, starting point, position of events, signal states, faults etc.).
 - (c) **Simulation management functions:** buttons and menus for all simulation management functions (freeze, start, initial states, replay, fault management etc.). Functions requiring more information to be entered (initial states, fault management, traffic control etc.) shall result in the displaying of a particular menu or dialogue box.
 - (d) **Global Route Display:** the route shall be divided into sections for legibility purposes. This window shall give an overview of the whole route, enabling the Instructor to know which section is displayed on the "Local 2D Map" (as per Clause 9.3.15.2 (e) below) or to go directly to a given section. The current position of the simulated train shall also be shown on this display.
 - (e) **Local 2D Map:** The selected area shall be shown as a top view 2D map with all information about the track (topology, gradient and curve) and signaling status as well as train and other important vehicles positions (for example: trainee's train and other trains are shown in different colour). The route followed by the train should also be marked in different colors.
- (ii) This display shall enable the Instructor to enter commands about track, traffic and signaling in a user-friendly manner as clicking on a given device with the mouse. For instance, a window then appears with the corresponding commands. The Instructor must validate all its actions

- (iii) ~~Selection of detailed view out of three desk type simulator in desk type simulator instructor station.~~

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Selection of detailed view of desk type simulator in desk type simulator instructor station.

9.3.15.3. Scenario creation information:

- i) Input scenario objective information
- ii) Pick a train
- iii) Determine pre-programmed events (pending events position & delay)
- iv) Scenario preview

9.3.15.4. Simulation management functions:

- i) Prompt for instructor & student I D Start
- ii) Freeze
- iii) Stop
- iv) Restart from check point
- v) Replay from check point with save and backup option (saved replay file can be replayed on observer and instructor stations in future)
- vi) Display graphical data summary
- vii) Insert malfunctions and visual events
- viii) Alter the route and the signal states
- ix) Changing visibility and weather conditions (sunshine, cloud, rain, dust and storm, heat, haze and mist).
- x) Time of day (dawn, day, dusk and night).
- xi) Scenario management: delete, copy, re-name etc.

9.3.15.5. Malfunction manipulation

- i) All malfunctions on the train shall be accessible by menu and classified by systems.
- ii) Malfunctions on infrastructure such as signals, substations, platforms, other train shall be accessible by clicking on the 2 D top view instructor stations.
- iii) Malfunction and place-able objects can be set and reset either alone or with combination:
 - (a) Immediately.
 - (b) With delay.
 - (c) On specific track location.
 - (d) On condition.
- iv) Track location shall be specified by mouse click on the 2 D top view.

- v) Approximately 250 faults and failures will be required to be simulated. The details of the minimum required fault conditions would be dealt with Contractor. Fault troubleshooting steps/hints should be available at Instructor MMI.
- vi) Maximum faults shall be simulated alone but some faults may arise execute together. The combination / faults arising out of another fault shall not be counted towards the total number of faults.

9.4. Modelling of Train Operation:

9.4.1. The Simulator shall include models of the Rolling Stock. This shall include models of the cab logic, traction, safety, brake system, door system and coupler systems including effect of vehicle rolling and air resistance.

9.4.2. In particular the following systems need to be modelled:

- i) Automatic train protection (ATP).
- ii) Automatic train supervision (ATS).
- iii) Automatic train operation (ATO).
- iv) Unattended Train Operation (UTO).
- v) TCMS
- vi) Door control logic including door fault training,
- vii) Operation of MCBs
- viii) Brake Control system with wheel-slip control, traction control, pneumatic brake control, dynamic brake etc. It shall model:
 - a) Service brakes
 - b) Emergency brakes
 - c) Auto brakes
 - d) Holding brakes
 - e) Parking brakes
- ix) Dead-man control, vehicle dynamics.
- x) Train faults (about 250), which will be implemented in the model.
- xi) Coupling and uncoupling procedure of trains for rescue operation
- xii) Emergency Evacuation.

9.4.3. The Train operator is required to execute few instructions and visually verify related cocks etc. during the course of trouble shooting. The software replica of these equipments/controls shall be provided on the touch type computer screen and integrated with simulator for required exercise. The equipments/controls required for operations shall be operated by the train operator through the touch screen and once correctly done, shall permit to resume the train working in normal operation.

9.4.4. Actual operation of these shall be separately taught to train operators on the train.

9.5. Modelling of Maintenance and Troubleshooting

9.5.1. The modules for training to maintenance personnel shall enable the instructor to

simulate various faults for maintenance training.

- 9.5.2. The faults, its severity and levels shall be reviewed by the Project Manager.
- 9.5.3. The Contractor shall submit detailed proposal listing out various modules and means to impart training on maintenance and troubleshooting to the Employer's maintenance personnel for review and acceptance of the Project Manager.
- 9.5.4. ~~Physical components should be exact replica of real one and in exact location in a scale down model which can be accessed by the trainee physically and on 3D model. Option should be there for trainees regarding representation of data downloading in actual train (an electrical opening / socket for connecting laptop/device). All MCB and switches related to faults should be simulated. All test points should be available in the model and real reading should be simulated with actual equipments and meters.~~

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Physical components should be exact replica of real one and in exact location in a scale down model which can be accessed by the trainee physically and on 3D model. All MCB and switches related to faults should be simulated. All test points should be available in the model and real reading should be simulated with actual equipments and meters.

- 9.5.5. Maintenance modules: Computer based training (simulation) modules using replica/original equipment of major sub-systems shall be supplied. The modules shall aim at providing simulated hands on experience of the maintenance, overhaul and understanding of equipment functionality. These shall have facility to fault activation, trouble shooting, diagnostics, maintenance and repair, overhaul and test procedures, linkages with spares and related activities, 3D cut sections of equipment shall be used to the maximum and shall also include the interface &, integration with other system. Use of original equipment or scale down models shall be to maximum extent and shall be ensured unless specifically got approved from the Engineer or Project Manager. For training on trouble shooting and diagnostics etc. these sub systems shall be suitably integrated. Detailed specifications shall be drawn, discussed and finalized after getting approval of the Project Manager during design stage of the simulator. The major sub systems to be included are:

- i) TCMS
- ii) Vehicle control Circuits and pneumatic circuits
- iii) Converter-Inverter & aux. converter
- iv) HVAC
- v) Doors including detrainment door.
- vi) PA/PIS & CCTV
- vii) Brake & Pneumatics
- viii) Traction motor & Gear Case
- ix) Bogies and suspension
- x) Gangway and Couplers

9.6. Automatic Assessment

9.6.1. Performance Criteria

- 9.6.1.1. It shall be possible to prepare a set of performance criteria and place them in a library. The definition of a scenario will then include the selection of the specific criteria set. The Contractor shall propose a proven performance criteria solution. It shall include the scoring criteria.
- 9.6.1.2. The software shall be capable to generate supporting documents for the post analysis of the evaluation and print the hard copies of the various performance activities along with train configuration, weather conditions duration of features, energy consumed / regenerated etc.
- 9.6.1.3. Evaluation of trainee shall also be provided for Fault handling, i.e. whether the trainee adopted correct steps or not, time taken for troubleshooting a fault and access of concerned HMI page. This will also include check and penalty in case TO forget to perform special recorded announcement in case of failure of train. This will also include information by train radio to OCC (Simplex communication) when necessary to do so (in this case, the oversight of the communications will be evaluated, but not the wording of TO). These both point will be the part of scenario making or a predefined step of a fault.
- 9.6.1.4. Evaluation of trainee shall also be done for Coupling and uncoupling movements.
- 9.6.1.5. Evaluation of trainee shall also be done for train movement when train is not in ATP mode i.e. degraded mode e.g. stopping of train at platform as per correct stopping point i.e. 6-car when train is not in ATP, also check on private number exchange by trainee and validity of private number etc.
- 9.6.1.6. Evaluation of trainee shall also be done on Computer Based Training modules. The evaluation shall be both module wise and complete course wise. Evaluation shall focus on various aspects of training content covered during tutorial and test the candidate for basic system philosophy, system functionality, location of system / sub system components, operation of various controls, to check the understanding of degraded mode of system operation, troubleshooting etc.
- 9.6.1.7. The Maintenance Simulator should be capable of evaluating the trainee on various aspect of maintenance practices, understanding of system working including the basic philosophy, removal and fitment of subsystem components, replacing of Line Replaceable Units, fault identification and troubleshooting etc.

9.6.2. Exercise monitoring

An exercise library containing 25 exercises each of approx. 45 minutes to 1-hour duration shall be provided. These exercises shall be prepared in consultation with the Project Manager's representative and shall be capable of evaluation of driving technique. It will be possible for the instructor to modify the stored exercises also.

9.6.3. End of run report

The Contactor will supply a printed end of run report after each run. This report will include the following components:

- (i) Run Identifier

- (ii) Includes train and route information, summary of run information like Kilometers travelled, time taken, Narrative from scenario definition, driver ID.
- (iii) Performance criteria definition.
- (iv) Describes each scoring item and the scoring algorithm. Score report.
- (v) Each scoring item and sum of the score, Penalty Log.
- (vi) Outputs a line of info for each point of deduction made.

9.6.4. 3D Database Editor

9.6.4.1. The Contractor shall provide a 3D database editor. With this tool, the Employer's representative will be able to:

- i) Derive new tracks from those supplied with the simulator. For example: by modifying the position of some signals or by adding track elements on a part of the track network.
- ii) Create tracks from scratch including specific building, platform and specific object by a simple and user-friendly technique i.e. without any specific knowledge of 3-D objects development.

9.6.4.2. This shall enable the creation of new lines while the simulator is in use. The tool shall not require any knowledge about 3D modelling and shall be user friendly so as to be used by instructor or Specialists in track design. The tool shall use a point and click interface. Copy and paste functions shall also be available. The tool shall be interactive i.e. give immediate visual feedback to the data input by the user. Further, this tool shall be able to produce a 3D view of the database for validation purpose after a short processing period.

9.6.4.3. The hardware to run this tool shall be supplied.

9.6.4.4. The tool should not only assist in assembling large section of tracks but also allow fine creation by assembling various track elements in order to model a wide range of track layout, different kinds of switching points, curvature between 100 and 5000 meters, gradients etc.

9.6.4.5. The Contractor shall demonstrate the tool by adding new track elements as requested by the Employer.

9.6.4.6. The tool shall use the library of components specified above to create a line including:

- i) Signals, Switches/Points
- ii) Stations: platforms with furniture, lamp standards, fixed passengers etc.
- iii) Buildings: houses, high-rise buildings, tunnels, bridges
- iv) Standing trains, people
- v) Miscellaneous: advertising panel, telephone line etc.
- vi) Third rail elements

9.6.4.7. For some components a schematic top view will not be enough especially for the signals. So, the tool shall provide a detailed temporary front view for these components.

9.6.4.8. The tool shall provide macro-components with a small set of parameters to enable the populating of the database in a very efficient way.

9.6.4.9. Other facilities required for expansion of track and visual sceneries base shall be supplied. Contractor shall train Employer's personal for carrying out the activities as discussed in this chapter.

9.7. CBT Module

9.7.1. To train the maintenance and operation staff for the training of procedures, safety precautions, different subsystem of train and to maintain various equipments of the trains, activities of all preventive maintenance training shall be imparted through computer-based Training modules.

9.7.2. The CBT software package will comprise necessary training and assessment modules. The general guidelines for hardware and software shall be same as that of the desk simulator. CBT should have different type of CBT techniques e.g. "Theoretical and basic technical knowledge" portion i.e. different multimedia pages including, photo, 2-D or 3D animation, videos, text and sound etc., "Operational procedures" to train trainees for a process and situation based exercises, (The idea is to place the trainee into a realistic virtual environment and to give him the possibility to observe indicators and operate controls. The virtual environment is made of a set of predefined views (realistic perspective drawings) with animated indicators and controls. The situation and assessment criteria are defined as scenario to be played).

9.7.3. CBT editing addition and modification software should be supplied with CBT.

9.8. SPECIAL REQUIREMENTS

9.8.1. Training of instructors

9.8.1.1. The training for instructor personnel and maintenance personnel shall also be provided. The Rolling Stock Contractor shall detail the training program and its location. The program shall cover complete hardware and simulation software and also a 3D database-editing tool described above.

9.8.1.2. The training shall include following:

- (i) Minimum of 02 weeks for 12 instructor personnel for Simulator,
- (ii) 06 working days for 06 personnel for maintenance of Simulator,
- (iii) 15 working days for 4 personnel for 3D database editing tool,
- (iv) Working days for 12 instructors for CBT module.
- (v) 15 Working days for 04 personnel for CBT editing and modification software.

9.9. Training of BMRCL Engineers

~~The Rolling Stock Contractor shall also impart training to 04 BMRCL Engineers in the mathematical modelling and computer simulation programming and photographic techniques required for use in the Simulator hardware and software maintenance of the simulator for a minimum period of 10 working days. After completion of this training these BMRCL Engineers will be authorized for minor modifications and additions in modelling in close coordination with Simulator contractor which if find out of scope from this Contract up to completion of DLP.~~

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[Training of BMRCL Engineers](#)

[The Rolling Stock Contractor shall also impart training to 04 BMRCL Engineers in the mathematical modelling and computer simulation programming and photographic](#)

techniques required for use in the Simulator hardware and software maintenance of the simulator for a minimum period of 10 working days. After completion of this training these BMRCL Engineers will be authorized for minor modifications and additions in modelling in close coordination with Simulator contractor.

9.10. Warranty

9.10.1.1. ~~The defect liability period of simulator and other equipment supplied shall be 24 months from date of acceptance (See clause 5.1.4 of ERGS).~~

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The Defect Liability and Maintenance Period (DLMP) of simulator and other equipment supplied shall be in accordance with clause 5.1.1, ii) of ERGS.

9.10.1.2. All modifications done on actual train must be reflected on simulators within 6 months i.e., modification up gradation should be done twice in a year without any additional cost.

9.10.1.3. All observations raised by BMRCL and within the scope should be corrected within 90 days i.e. observation correction up gradation should be done on quarterly basis in each year.

9.11. Quality of the software

9.11.1.1. The following items are mandatory in relation to the proposed software:

- i) Evolution of the software
- ii) Maintainability of the software
- iii) Validation of the software
- iv) Conceptual quality of the software

9.11.1.2. The proposed software shall meet these criteria. The proposed software must already be developed and validated on similar training systems.

9.12. Asset Register

An asset register shall be prepared for all the equipments supplied. The record must include description, serial number, location in the installation and repair / replacement history. The Engineer will approve the format of this register.

9.13. Spares, Special Tools & Test Equipment

9.13.1.1. ~~Spares for maintenance up to DLP is also required to be delivered as part of the Contract.~~

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Sufficient spares for maintenance during DLMP shall be made available by the Contractor.

9.13.1.2. The Contractor will recommend a suitable spares inventory to be held for first-line repairs.

9.13.1.3. The Contractor will provide a recommended set of spare parts for emergency replacement, to be held on-site with the simulator. The Contractor will ensure that the local holding of spare parts is promptly replenished and maintained at the level agreed in the Contract.

9.13.1.4. Any special tools and test equipment required for normal operation of the simulator will be provided by the Contractor and handed over along with the simulator.

9.14. PROTECTIONS AND SAFETY

The equipment shall be in accordance with the hygiene and safety legislation in force at order time.

9.15. STANDARDS

The entire supply shall satisfy the requirements in the standards and regulations in force.

9.16. FINISH

9.16.1.1. Special care shall be taken as regards the anti-corrosion protection scheme.

9.16.1.2. All components shall be identified and marked corresponding to the panel by means of a stainless steel engraved label. The manufacturer's identification plate and the year of manufacture shall be affixed to the equipment.

9.17. CHECKS AND TESTS

9.17.1. Quality Assurance

- a) The Contractor shall document his QA System and must be certified to ISO:9000 or similar. The Contractor must show how he manages software development in the framework of his QA System.
- b) The Contractor shall supply a Quality Assurance Plan specific to the project consistent with the international standards ISO 9001. This plan shall describe at least the project organization, the detailed time schedule, the software and hardware development cycle, the follow up of the main subcontractors and the applicable testing methodology.

9.17.2. In-Manufacturer's-Plant

- a) The Contractor shall be required to prepare and submit test plans for conducting sub-system level tests and system acceptance tests that verifies proper operation for all equipment and software included in the simulator. The test plans shall include a description of the sub-system or system test level employed. Test objectives and a description of the method for verifying acceptable operation of the hardware and software configurations.
- b) In addition, the test plans shall clearly describe the test sequence and procedures, test equipment, and data-reporting format. The test plans are subject to the approval of the Engineer or Project Manager who shall reserve the right to witness all factory test and on-site testing.

9.17.3. At-Site

- a) Following installation, the Contractor shall have the system fully operational and demonstrate complete operational compatibility of all sub-systems as per the approved test plans. Tests involving subjective criteria for verification of performance such as the simulated traction motor sound must be defined as such in the test plan and performed to the satisfaction of the Engineer or Project Manager.

9.18. DOCUMENTS TO BE PROVIDED**9.18.1. Design Submissions and Approvals**

- a) Contractor shall submit a program of design, development, manufacture, testing, delivery, installation, commissioning and acceptance for the project for approval of the Project Manager.
- b) At each stage the Contractor will submit reports and request No Objection by the Project Manager before moving to the next stage.
- c) All documents shall be provided in English.

9.19. In the Bid

9.19.1. The sub-supplier of the Bidder must have experience in developing similar systems for driver training and must have delivered at least 3 train driving simulators with CGI technology preferably combined with a motion system in the past 5 years. These references will form the basis of a performance evaluation taking into account the criteria stated below. The Bidder shall provide full contact details of these references along with Customer satisfaction letters and show his ability to deliver and maintain such systems in foreign countries.

9.19.2. The Bidder shall provide:

- i) A detailed technical note including a description of the installation, main dimensions and total electrical power required.
- ii) Photographs or sketches of similar equipment with a list of references.
- iii) Diagrammatic plan view with main dimensions showing compatibility between the equipment dimensions and the provisions indicated in the specification.
- iv) General drawings substantiating the good installation of the equipment.
- v) References of the sub-contractors.
- vi) References and characteristics of the main assemblies.
- vii) The standards and specifications that the main components used in the installation satisfy.

9.19.3. The Bidder shall also furnish the following information: -

- A. Main Computer
 - Central memory capacity
 - Number of Central processors
 - Number of graphic generation cards
 - Number of graphic generation cards
 - Main Memory
 - Hard Disk Memory
 - Other configuration details

Submission of above information in the bid is for general information and does not mean that the supply shall be exactly as per the submission. The Contractor shall

submit detailed specifications and obtain the Project Manager's approval during design review stage.

9.20. For Execution of Work

9.20.1. Prior to manufacture of equipment, the Contractor shall send the following documents for approval:

- i) Detailed dimensional drawing of the foundations and anchoring of the elements of the machine and dimensions of the cabinet.
- ii) A detailed technical note
- iii) General drawings, Detailed assembly drawings, Detailed drawings of mechanical parts.
- iv) Preliminary design of system software
- v) Descriptive and operating note.
- vi) Detailed electrical diagram for troubleshooting including cable index. Connection diagram with markings.
- vii) List of basic spare parts to be kept in stock for repairs, documentation, drawings. Notes and references of sub-contractors.
- viii) Installation and commissioning procedure.
- ix) Schedule of work and completion period

9.20.2. The Contractor shall plan and conduct technical review associated to the major milestones of the project such as specification review, preliminary design review and final design review.

9.20.3. The Contractor shall provide the review report and full documentation deemed necessary to evaluate the progress of the work.

9.21. At Completion of Work

9.21.1. The Contractor shall provide the entire documentation up to date:

- i) Software documentation including system software design, licenses and reference manuals. System software operating manual. Operating system utility programs. Interface control reference. Symbol dictionary and software listing. In addition, the software is to be delivered with **all application software** and utilities that must include compiler editor and linker program such that the Employer may regenerate and/or modify system software.
- ii) The list of general drawings and detailed drawings of electronic and electrical diagrams.
- iii) The general nomenclature of the supply including sub-contractors.
- iv) Mechanical drawings and electrical diagrams required for maintenance and troubleshooting of the machine.
- v) Illustrated lists of mechanical and electrical parts itemized in accordance with the diagrams and drawings mentioned above and including the addresses of the various Contractors.
- vi) Maintenance and adjustment manual with Summary of circuits and functions and

among other information.

- vii) An operating manual including start up and user's instructions.
- viii) Complete documentation of equipment from sub-contractors.
- ix) List of recommended spare parts for 3 years requirements.
- x) All documents, manuals, software's etc. to be provided by Contractor in soft copy should also be provided in one Portable hard drive

10 APPENDIX-10 PROJECT CALENDAR

1. The Project Weeks shall be commenced on a Monday. A day shall be deemed to commence at 0001 hour on the morning of the day in question. Where reference is made to the completion of an activity or Milestone by a particular week, this shall mean by midnight on the Sunday of that week.
2. Requirements for the computation of Key Dates are given in Appendix 2B to the Employer's Requirements.
3. A 7-day week calendar shall be adopted for various (Work) program schedules for scheduling purposes.
4. For Project purposes, the presentation shall be in 'Week'" units.

11 APPENDIX-11 DEPOT FACILITIES INCLUDING M&P

A - Mandatory Depot M&Ps to be kept in Airport Depot & Kothanur Depot			
Sl. No.	Description of Equipment	Quantity	
		Airport Depot	Kothanur Depot
1	Pit Wheel Lathe with Electric Shunter	1 set	1 set
2	Pit lifting jacks (6-car unit)	1 set	1 set
3	Mobile lifting jacks (6 car unit)	1 set	1 set
4	Automatic train wash plant with side, roof and end washing facility.	1 set	1 set
5	Bogie Turn Tables	5 nos.	5 nos.
6	Electric bogie tractor	2 nos.	2 nos.
7	Fork lift truck 5 ton (diesel)	1 Nos	1 Nos
8	Fork lift truck 3 ton (electrical)	2 Nos	2 Nos
9	Mobile lifting table 3 ton	2 Nos	2 Nos
10	Under frame blowing plant	1 unit	1 unit
11	Cleaning booth for Traction Motor	1 unit	1 unit
12	Automatic filter cleaning machine	1 unit	1 unit
13	Compressors 400 CFM	1 units	1 units
14	Other lifting devices	Lump sum	Lump sum
15	Mechanical and electrical measuring and testing equipment	Lump sum	Lump sum
16	Mechanical, pneumatic and electrical tools	Lump sum	Lump sum
17	Special jigs, fixtures	Lump sum	Lump sum

18	Rail Cum Road Vehicle (RRV)	1 unit	1 unit
19	Any other items required for Maintenance	Lump sum	Lump sum

B - Depot M&Ps available in Baiyappanahalli Depot

Sl. No.	Description of available Equipment	Quantity	Remarks
1	Pit Wheel Lathe with Electric Shunter	1 unit	-
2	Pit lifting jacks (3-car unit)	1 set	Needs to be provided for lifting 6 car unit
3	Mobile lifting jacks (3-car unit)	2 set	Needs to be provided for lifting 6 car unit
4	Automatic train wash plant with side, roof and end washing facility.	1 set	Relocated or procured
5	Bogie Turn tables	5 nos.	-
6	Electric bogie tractor	2 nos.	-
7	Rail Cum Road Vehicle	1 no.	Relocated or procured

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B - Depot M&P's available in Baiyappanahalli Depot (REVISED)

Sl. No	Description of Equipment	Quantity	Remarks
1	Pit Wheel Lathe with Electric Shunter	1 unit	Available Make- M/s Talgo Paseo del tren Spain Model- 2112 Year of supply and Installation - 2012 Residual life – 20 years
2	Pit Lifting Jacks (6car unit)	1 set	To be supplied and installed by the Contractor
3	Mobile Lifting Jacks (6 car unit)	1 set	Available Make- M/s Neuero Technology Gmbh, Germany Model - 09/084-002 Year of supply and Installation- 2012 Residual life – 20 years

4	Automatic Train Wash Plant with side, roof and end washing facility	1 set	To be supplied and installed by the Contractor
5	Bogie Turn Tables	5 nos.	Available Make- M/s Windhoff Bahn-und Anlagentechnik GmbH Germany Model – 09/11/373 Year of supply and Installation- 2012 Residual life – 20 years
6	Electric Bogie Tractor	2 nos.	To be supplied and installed by the Contractor
7	Rail Cum Road Vehicle	1 no.	Available Make- M/s Zagro Bahn-Und Baumaschinen GmbH. Germany Model – Unimog U 400 L Year of supply and Installation- 2011 Residual life – 15 years
8	Any other items required for Maintenance	Lumpsum	-

C - Specifications of Machinery and Plant but not limited to: -

I. Pit Wheel Lathe and Electric Shunter

1. Scope of Work:

Design, Manufacture, Supply, Installation, Testing and Commissioning of Fully Automatic CNC Under Floor Wheel Lathe & Electric Shunter along with supply of tools, software, and manuals, training of Operation and Maintenance (O&M) personnel.

2. Description:

The Fully Automatic CNC Under Floor Wheel Lathe & Electric Shunter is used for re-profiling of wheels of Metro vehicles. The Metro vehicle shall be driven inside the under-floor wheel lathe building by means of the remote-controlled Electric Shunter duly interlocked wheel lathe.

The Fully Automatic CNC Under-floor Wheel Lathe shall have the following minimum features but not limited to while working in fully automatic mode:

- a) Accurate positioning of vehicle on machine by Electric Shunter
- b) Automatic job setting & clamping/unclamping
- c) Automatic measurement and display of wheel parameters before machining.

- d) Automatic turning operation of the wheels and optimisation of metal removal by comparison with the stored profile and stored wheel parameters limits to obtain specified surface finish & accuracy. Options to take partial cut and resultant profile with partial cut shall be determined by the system
- e) Automatic measurement, storage and display of wheel parameters after machining.
- f) Display of important wheel parameters like tread diameters, flange thickness and QR of both wheels of an axle before and after turning
- g) Automatic stoppage of machining cycle in case of critical faults.
- h) On-line and off-line programming of a new profile and PART programme should be possible.

The machine shall be capable of re-profiling in situ & also in isolation, simultaneously at both wheels of a wheel set, old work hardened and new wheels of all types of rolling stocks without the need of removing any components such as wheel sets, bogie brake gear, axle box covers etc.

3. The fully automatic CNC under floor wheel lathe and electric shunter shall include following minimum features:

- a) Machining cycles
- b) measurement cycles.
- c) Measuring devices.
- d) Machine performance requirements.
- e) Chip Disposal.
- f) Electrical control systems.
- g) Electric shunter.

II. Automatic Train Wash Plant

1. Scope of Work:

Design, Manufacture, Supply, Installation, Testing and Commissioning of Fully Automatic Train Wash Plants along with supply of tools, software and O&M manuals, training of Operation and Maintenance (O&M) personnel.

2. Description:

The Fully Automatic Train Washing Plant is designed to carry out automatic washing of body Pre-wet, Front/Rear Application, Roof Brush Application, Side Brush Application, Roof Brush Application, Side Brush Application, Roof Brush Fresh Water, Side Brush Fresh Water First Rinse Fresh Water, Final Rinse RO Water, Blower Station of the Metro Coaches.

The Fully Automatic Train Wash Plant shall have the following minimum features but not limited to while working.

- a) The Plant is used to wash trains (130.4m length) for a minimum of 3 Nos 6 car Train sets (130.4m length) each per hour and is available for 24 hours in a day.
- b) The Plant is of drive-through type and operated in a single direction of train movement. The plant is designed to satisfactorily wash the train running through the plant under its own power at a specified washing speed. (3 – 5 km/h).
- c) The wash plant shall allow trains to pass through the plant in either direction at a maximum speed of 25 km/h without the washing.
- d) The wash plant contractor shall design for washing trains operating on CBTC & Distance-to-Go signalling system.
- e) The train-washing plant is designed for automatic, semiautomatic and manual mode washing process with selection switches. In automatic mode, the automatic wash

cycle is activated by the train movement in to wash plant and deactivated by wash plant exit command. In semiautomatic mode each stage of washing sequence shall be activated and deactivated by wash plant operator and manual mode shall be for maintenance.

- f) Selection switch for wash/No wash shall be provided.
 - g) Monitoring of details i.e., status/health, operating hours of the plant is monitored at control panel along with audio, Visual Display Unit (VDU) and Printer facility to be supplied by the Contractor.
 - h) Complete graphical Indication of completion of washing cycle is available at control console. The Plant is equipped with all safety provisions for safeguarding equipment as well as the operator.
 - i) In the event of lack of water, the pumps of the corresponding stations shall be automatically shut down and the corresponding brushes shall be retracted.
 - j) The plant shall be protected against deterioration of the structure and base due to chemical contacts, site and operation conditions.
 - k) The brush material shall be soft enough so that it doesn't make mark on the car body.
 - l) All structures and frames shall be of stainless steel SS316 as per ASTM standard.
3. **The Fully Automatic Train Wash Plant shall include following minimum features:**
- a) Pre-wet Station
 - b) Front and Rear (Gantry) wash station with water & detergent.
 - c) Roof brush water and detergent application
 - d) Side brush water and detergent application
 - e) First Rinse Fresh Water
 - f) Final Rinse RO Water
 - g) Blower Station
 - h) Pump Work
 - i) Piping and Steelwork
 - j) Control Console (DDC & Local)
 - k) Electrical / Electronic Equipment
 - l) Water treatment stations.

III. Synchronized Pit Jacks

1. **Scope of Work:**

Design, manufacture, Supply, Installation, Testing and commissioning of Synchronized Pit Lifting Jacks for lifting 6 car train along with supply of tools, software and O&M manuals, training of Operation and Maintenance (O&M) personnel.

2. **Description:**

The Synchronized Pit Lifting Jacks (under floor lifting system) is designed to lift and support of 6 Car trainset. Each Metro Car weighs 40.5 tonnes (body and bogie weight) approximately.

Each Bogie lifting Jacks shall be raised or lowered. Lifting column shall consist of a spindle-lifting element, a lifting beam, guiding box, one automatic following gap cover and associated electrical equipment.

One set of Synchronized Pit Lifting Jacks consists of 12 bogie lifting Jacks and 12 (24 nos.) pairs of body lifting Jacks suitable for lifting of 6 car trainsets. The Jacks have selection arrangement for servicing of a single Metro Car or 2 or 3 or 4 or 5 or 6 Metro Cars coupled.

3. The Synchronised Pit Lifting Jacks shall have the following minimum features but not limited to while working:

- a) Operating car load: 40.5T per car
- b) Bogie lifting Jacks lift: 1.6m
- c) Body stand lift: Not less than 2.5m

Note: The body stand lift should match the Rolling Stock needs to hold the Metro Car body when maximum Jacking is done at bogie lift.

- d) Bogie lifting Jacks lifting speed: Not less than 0.4 m/min
- e) Body stand lifting speed: Not less than 0.4 m/min
- f) track gauge: 1435mm
- g) Bogie wheel base: 2,200 mm to 2400 mm.
- h) Auxiliary track capacity with bogie lifting Jacks raised: 60 kN/axle
- i) Main Track capacity with bogie lifting Jacks lowered: 170kN/axle
- j) Gap between platform rails and shop rail: ≤ 5 mm
- k) Bogie lifting Jacks level tolerance within individual bogie: ± 3 mm
- l) Bogie lifting Jacks level tolerance within adjacent bogies: ± 5 mm
- m) Bogie lifting Jacks level tolerance within six Metro Cars: ± 10 mm
- n) Body stand level tolerance within a pair: ± 3 mm
- o) Body stand level tolerance within adjacent pairs: ± 5 mm
- p) Body stand level tolerance within six Metro Cars: ± 10 mm

4. The Synchronised Pit Lifting jacks shall include following minimum features:

- a) Jack Configuration
- b) Jack Structure
- c) Jack Mechanism
- d) Control and Interlock Provision

IV. Synchronized Mobile Lifting Jacks

1. Scope of Work:

Design, Manufacture, Supply, Installation, Testing and Commissioning of Synchronized Mobile Lifting Jacks for lifting along with supply of tools, software and O&M manuals, training of Operation and Maintenance (O&M) personnel.

2. Description:

The Synchronized Mobile Lifting Jacks is used for lifting of 6 Metro car train.

The Metro Cars Lifting Synchronized Mobile Lifting Jacks for lifting 6 car trainset consisting of 24 nos. of mobile lifting jacks of 12.5T capacity each is required for lifting and supporting of Metro Cars during its scheduled inspection, repairs and unscheduled repairs.

The Synchronised Mobile Lifting jacks shall have the following minimum features but not limited to while working.

- a) **Main Frame:** The main frame of the jack body is of welded steel construction and shall consist of side plates with guides for the lifting carriage. The Lifting Jacks shall be provided with suitable means to prevent relative sliding of coach and the lifting pad. The approximate area for reinforced is of 1300mm x 1600mm under each jack.

<p>b) Lifting Spindle & Drive: The spindle is driven through a fully enclosed reduction gear running in an oil bath by a squirrel cage flanged brake motor designed to IP55 with VFD to each motor. All motor and gear bearings is of roller type. It shall be placed at the top of the jack frame. The spindle is a robust, vertical, self-locking screw shaft driving a spindle load-lifting nut, which is manufactured from cast bronze.</p> <p>c) Lifting Carriage: A carriage is mounted on each body. The carriage is fitted with a bronze nut guided by the lower rollers of the body running on sections added to the jack framework.</p> <p>d) Control Console: The control console is mounted on a trolley for the operator to move around for effective monitoring of the operation.</p> <p>3. The machine complies with the following configurations: -</p> <p>i) Track Gauge: 1435 mm</p> <p>ii) Minimum width of rolling stock: 2,880 mm</p> <p>iii) Length over body: 20,800 mm (21,050 mm Driving car)</p> <p>iv) Bogie wheel base: 2,200 mm to 2400 mm.</p> <p>v) Distance between bogie centres: 14,700 + /- 250 mm</p> <p>vi) Bogie weight: - DMC 8-ton (approx.) MC 8-ton (approx.) TC 6-ton (approx.)</p> <p>vii) Body weight: - DMC 25- ton (approx.) MC 24- ton (approx.) TC 27- ton (approx.)</p> <p>4. The Synchronised Mobile Lifting Jacks shall include following minimum features:</p> <p>a) Jack Configuration</p> <p>b) Operating principle</p> <p>c) Key parameters</p> <p>d) Jack Construction</p> <p>e) Control Provision</p>
<p>V. Electric Bogie Tractor</p> <p>1. Scope of Work: Design, Manufacture, Supply, Testing and commissioning of Electric Bogie Tractors along with supply of tools, software and O&M manuals, training of Operation and Maintenance (O&M) personnel.</p> <p>2. Description: The Electric Bogie Tractor is battery operated and is used for shunting and positioning of 6 cars train on different lines of Depots. The Electric Bogie Tractor shall have the following minimum features but not limited to while working.</p> <p>3. The machine complies with the following configurations: -</p> <p>a) Track Gauge: 1435 mm for standard gauge</p> <p>b) Track Grade: 1% max</p> <p>c) Minimum Curve Radius: 120 m for standard gauge in depot, wheel base shall support the requirement.</p> <p>d) Passage over Switch: 1:7 turnouts with 190-meter radius.</p>

- e) Rail car Length: 22.10 m
- f) Rail car width: 2.9m for standard gauge
- g) Empty rail car weight: 40 tons
- h) Maximum axle load (Fully loaded) permissible on track 15 tons.
- i) The Electric Bogie Tractor is designed to start and haul 300 tonne 6 cars train on tracks with a maximum track gradient of 1.5 %, turnouts and crossings with a curve radius of 90m in DRY condition including turnouts & crossings. The vehicle is able to generate a continuous draw bar pull of 50 KN while pulling the cars at straight level track.
- j) The Electric Bogie Tractor has a maximum height above top of rail app. 1245 mm.
- k) The Bogie Tractor is driven by electric motors and powered by batteries. The control of motors is through VFD.
- l) The Electric Bogie Tractor is of Rail cum Road type (RRV) with metal wheels for running on tracks and rubber tyres for travelling on concrete floor of the workshop/depot preferably with separate individual drive for running on tracks and separate drive for travelling on concrete floor/ road of the workshop/depot but Bidder may also propose any other alternative proven design for movement on track as well as on the road and test report for the satisfaction of the client for similar application in the technical offer.
- m) The Electric Bogie Tractor has a battery capacity for approximate 20KMs travelling under unloaded condition and at least 9 Km travelling under fully loaded condition on a single charging straight and flat track conditions.
- n) Battery capacity is sufficient for travelling at least 20 Km under unloaded condition and for travelling at least 6 Km under fully loaded condition (300 ton) on single charging basis. Battery has life time up to 2000 charging cycles.
- o) The travel speed is infinitely variable from 0 to 6 Km/hr running on roads and on tracks under unloaded conditions.
- p) The Electric Bogie Tractor is of Rail cum Road type (RRV) with metal wheels for running on tracks and rubber tyres for travelling on concrete floor of the workshop/depot.
- q) The travel speed is infinitely variable from 0 to 3 Km/hr running on maximum of 1.5 % gradient tracks towing 6-car train with a curve radius of 90m towing 6-car train (300 tonne).

4. The Electric Bogie Tractor shall include following minimum features:

- a) Bogie Tractor Travelling
- b) Coupling
- c) Tractor Construction
- d) Control Requirements
- e) Battery and Battery Charger

VI. Road cum Rail Vehicle with Re-Railing equipment

1. Scope of Work

Design, manufacture, supply, installation, testing and commissioning of one (1) set each Road cum Rail Vehicle with Re-Railing Equipment and rescue devices along with supply of tools, software and O&M manuals, training of Operation and Maintenance (O&M) personnel.

2. Description

The vehicle should be designed for Standard rail gauge (1435mm) and curve radius of 120 m for Depot.

The vehicle shall be used to carry re-railing, rescue equipment and personnel. A partition shall separate the two compartments. It shall be powered by diesel engine. The vehicle shall be able to move easily on road and rail. The road to rail and vice versa changeover functions shall be easy effortlessly.

The Re-railing and rescue equipment shall be capable of quick lifting, displacing, tilting and slewing into position the de-railed rolling stock operating on Bangalore Metro Rail System (Metro Corridor as well as inside depot areas). The equipment shall be suitable for use in tunnel as well as on viaducts. The Re-railing and rescue equipment's shall be suitable for operation under dusty smoke-filled atmosphere at accident site.

The machine shall comply with the following configurations: -

Track Gauge	1435 mm
Minimum width of rolling stock	2,880 mm
Length over body	20,800 mm (21,050 mm Driving car)
Bogie wheel base	2,200 mm to 2400 mm.
Distance between bogie centres	14,700 + /- 250 mm
Maximum height of coupler above rail level for unloaded vehicle	815 mm
Maximum height of coupler above rail level for loaded vehicle	740 mm

3. The re-railing shall include following minimum features:

- Petrol/Diesel engine driven Hydraulic Pumping set
- Auxiliary hand pump with 2 connections and about 30 litres tank
- Control Console Complete with all necessary valves Controls and safety features
- Pairs of high-pressure hose
- Low-pressure oil Return hose (10 m)
- Telescopic Jacks
- Displacing jack
- Roller Carriages
- Re-Railing Bridge
- Bridge Coupling
- Tilting Jack
- Lifting jacks
- Single Piston step jack
- Lifting cable ladder complete
- Auxiliary Truck (trolley)
- Hauling Device
- One set of air-bags
- Axle pusher unit
- Rescue devices
- Distributor Valve
- Compressor

4. The Road Cum Rail Vehicle shall include following minimum features:

- General Requirements of Rail guidance system Vehicle
- Body work for accommodation of personal, re-railing equipment and tools
- Coupling system
- Accessories & tools

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