



# CHENNAI METRO RAIL LIMITED

## CHENNAI METRO RAIL PROJECT – PHASE 2

BID No. CP26 / ARE02A

### **PART- 2: SECTION VI C – EMPLOYER’S REQUIREMENTS TECHNICAL SPECIFICATIONS (ERTS) - COMPREHENSIVE MAINTENANCE CONTRACT (CMC) OF ROLLING STOCK AND DEPOT MACHINERY & PLANT**

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## **REVISION HISTORY**

<b>R. No</b>	<b>Section</b>	<b>Description</b>
1	1, 2, 3	As per Addendum (01) Clause: 1.1.9, 1.1.10, 1.1.15, 1.1.16, 1.1.17, 1.1.18, 1.5.12,1.10.2, 1.15.8, 1.15.9, 3.2.1, 4.5.1 & 4.5.2
2	1, 2	As per Addendum (02) Clause 1.1.19 and 2.4.1
3	-	- NIL -
4	1 & 3	As per Corrigendum (10) Clause 1.16, 1.17, 1.18, 1.19, 1.20, Table 3-4 and Table 3-6.

## 1. COMPREHENSIVE MAINTENANCE CONTRACT (CMC) REQUIREMENTS

### 1.1 MAINTENANCE REQUIREMENTS OF ROLLING STOCK (RS) AND DEPOT MACHINERY & PLANT (DM&P)

- 1.1.1 The Contractor shall at all times throughout the Comprehensive Maintenance Contract (CMC) period, maintain all assets (herein referred to as CMC Assets) falling under the categories of Rolling Stock, Depot Machinery and Plant, Spares and Tools in accordance with the provisions of the Contract, Applicable Laws, Applicable Permits and Good Industry Practices.
- 1.1.2 Asset categories "Spares" and "Tools" shall include all types of Spares and Consumables, Special Tools, Jigs, Fixtures, Gauges, Testing and Diagnostic Equipment, Mechanical & Electrical Measuring and Testing Equipment, Mechanical, Pneumatic and Electric Tools, test benches and any other items required for all types of maintenance activities carried out on Rolling Stock and Depot Machinery & Plant.
- 1.1.3 The Contractor shall perform and conform to the full scope of Maintenance Requirements for CMC Assets; including the cleaning of Rolling Stock and Depot Machinery and Plant. All reference to Depot Machinery and Plant shall be deemed to include the Catenary Maintenance Vehicles (CMV).
- 1.1.4 The Contractor shall repair or rectify any defect or deficiency set forth in clause 1.2 of this Chapter.
- 1.1.5 Payments for undertaking the CMC obligations described in this Contract shall be made solely in accordance with the Price Schedules mentioned for Price Center "RS-CMC" & Price Center "DM&P-CMC" of Part-1, Section – IV Bidding Forms; subject to any deductions for Penalties defined elsewhere in the CMC Contract.
- 1.1.6 Except for the specific provisions defined in Clause 1.7, there shall be no other payments owed to the Contractor for undertaking of CMC Works.
- 1.1.7 Assets having an OEM rated design-life (an information deliverable described in Part 2 Section VIA Clause 2.3) that will lapse during the course of the CMC period shall be replaced by the Contractor (on or before expiry) as part of the obligations of this CMC Contract at no additional cost to CMRL.
- 1.1.8 In the event that CMRL chooses to exercise the Option Quantity Variation (as defined in Clause 3.3 of Part 1 – Section IV Bidding Forms), the CMC requirements and pricing structures applicable for the Base order quantity shall also be applicable to the Option order quantity. All the conditions in this chapter shall also apply to assets procured under that Option.
- 1.1.9 Designated Depot(s) refers to (i) Madhavaram Depot, which is the principal site for all heavy maintenance AND (ii) ~~further~~ One Satellite Depot(s) ~~for light maintenance~~ (mostly for inspection, cleaning activities and Corrective Maintenance).
- 1.1.10 The location of the Satellite Depot(s) shall be designated by CMRL. However, CMRL may at its sole discretion instruct the Contractor (by giving 60 days' notice) to ~~deploy~~ move their light maintenance operations ~~(only) at further to an alternative~~ Satellite Depot ~~facilities facility~~. The Contractor shall comply with the deployment request without any cost implications to CMRL.
- 1.1.11 Throughout the CMC Period, the Contractor shall remain custodian of all the deliverables for Rolling Stock (described in the Sub-Clauses of Part 2 Section VIA Chapter 15) and for Depot Machinery and Plant (described in the Part 2 Section VIB Clause 1.3). This shall include Operating Procedures and Manuals, Operating and Maintenance Manuals, Maintenance Work Instructions, Training Documentation, Equipment Illustrated Parts Catalogue and Software System Manuals.
- 1.1.12 The Contractor shall be responsible for the accuracy of the documents referred to in Clause 1.1.11 and shall apply all necessary updates when required. Document control and storage is facilitated by the Asset Maintenance Management System (AMMS) described in Chapter-5.

- 1.1.13 The Contractor's Engineering Change and Configuration Management processes that are established for the DLP shall remain in place throughout the CMC Period as well. The processes shall identify any impact to maintenance procedures or documentation.
- 1.1.14 Before start of CMC Works, the Contractor shall prepare and submit detailed CMC procedures for approval by CMRL.
- 1.1.15 In the event that lines are extended, ARE02A Rolling Stock may be deployed in revenue service within the newly added lines / extensions. Such deployment shall not relinquish the Contractor of any existing maintenance and/or asset performance obligations defined in this Contract.
- 1.1.16 In addition to being the principal depot for ARE02A Rolling Stock, Madhavaram Depot has also been classified as a Heavy Maintenance Hub and is therefore expected to serve other Chennai Phase-II Metro Fleets. A Standard Operating Procedure (SOP) shall be established by CMRL in order to provide governance that will fairly and reasonably determine how the allocation of depot facilities will be apportioned between the respective fleets and their Contractors'; without unreasonable hinderance to the ARE02A Contractor's ability to deliver the deliverables required under the scope of this Contract.
- 1.1.17 Operation of Depot Machinery and Plant for all rolling stock maintenance needed to be carried out at Madhavaram Depot shall be solely under the scope of the ARE02A Contractor. The Contractor is required to provide the resource necessary to fulfil this obligation; regardless of fleet type or underlying maintenance schedule.
- 1.1.18 If at anytime during the course of the CMC Period, CMRL purchases additional Rolling Stock for Chennai Metro Phase-II (or extension thereof) the Contractor shall at no additional cost to CMRL provide all necessary resource to support the required interface activities that involve CMC Assets (E.g. sharing of technical information and answering technical queries by other Contractors). It is clarified that the scope of this requirement does not include the cost of any hardware modifications to CMC Assets.
- 1.1.19 Where it is the case that a DLP / DNP extension had arisen on account of non-fulfilment of the Reliability Demonstration Targets for Rolling Stock (as defined in Part 2, Section VI A, ERTS-RS clause 18.6) then the penalty regime detailed in Clause numbers 1.16 & 3.3 shall not come in to force until DLP / DNP period of extension ends. This provision is made to ensure that the Contractor is not exposed to double penalties.

## 1.2 REPAIR / RECTIFICATION OF DEFECTS AND DEFICIENCIES

- 1.2.1 The scope of the CMC works is "comprehensive" in nature. This means the Contractor is required to undertake all remedial Works necessary to repair and fully rectify defects and deficiencies arising on all CMC Assets as defined by the CMC scope.
- 1.2.2 In the event that defects and/or damage cannot be expeditiously remedied at the maintenance depot facility; CMRL consent shall be sought for the Contractor to remove the asset(s) from the maintenance depot for the purposes of undertaking such repairs.
- 1.2.3 The Contractor accepts that granting of consent to remove assets from the depot may be contingent on the Contractor increasing the Performance Security amount (equal to the full replacement value) or otherwise providing an alternative form of security as agreed by CMRL.

## 1.3 OTHER DEFECTS AND DEFICIENCIES

- 1.3.1 For any defect or deficiency not specified in this document, CMRL may, in conformity with Good Industry Practice, specify the permissible limit of tolerance with reference to applicable Specifications and Standards. Any non-conformance beyond the permissible limit shall be repaired or rectified by the Contractor in accordance with Good Industry Practice.

## 1.4 EMERGENCY REPAIRS/RESTORATION

- 1.4.1 In the event that any such defect, deficiency, or deterioration of an asset(s) poses a safety hazard, or risk of damage to property, the Contractor shall promptly take all reasonable

measures to eliminate the risk.

- 1.4.2 Where total risk elimination is not reasonably practicable, the Contractor shall undertake a quantified risk assessment to identify the effectiveness of proposed risk mitigation measures and ensure that their effectiveness is to the extent that the risk is minimised and/or contained to an acceptable level.

## **1.5 SPARES AND CONSUMABLES**

- 1.5.1 Throughout the CMC period, the Contractor shall always maintain sufficient stock of all Spares and Consumables to the full extent necessary to fulfil all the obligations of the CMC scope and in compliance with the inventory requirements defined in Clause 1.5.12.
- 1.5.2 Spares and Consumables (herein referred to only as Spares) shall include but shall not be limited to the following subcategories, as applicable to both Rolling Stock and Depot Machinery & Plant (including CMV) assets,
- a) Unit exchange spares
  - b) Mandatory spares
  - c) Recommended spares;
  - d) Consumable spares;
  - e) Special Tools, Jig, Fixtures, Gauges, Testing and Diagnostic Equipment
  - f) Overhauling Spares;
  - g) Any other items required for maintenance (identified by the Contractor / CMRL / OEM).
- 1.5.3 The cost of all Spares (regardless of category) is deemed to have been included in the CMC price centres of the quoted Contract Price. Nevertheless, the Contractor shall also provide a Price List for the complete range of spares to allow the parties to administrate any chargeable costs which may arise from the provisions set forth in Clause 1.7.
- 1.5.4 The Price List shall remain applicable for the full duration of the CMC Period; in accordance with price adjustment provisions defined in Clause 3.2.7, Part 1 – Section IV Bidding Forms. The Contractor shall also ensure that all items remain available for purchase by CMRL throughout the CMC Period.
- 1.5.5 The Price List along with a schedule of supply shall be finalized during design stage in consultation with CMRL and shall form part of the CMC Spares documents for Rolling Stock and for Depot M&P respectively.
- 1.5.6 The Contractor may propose changes and amendments to the CMC Spares documents once per year during CMC period to adjust for changes in consumption rates as well as predicted failure rates. Acceptance of any changes proposed by the Contractor shall be at the sole discretion of CMRL.
- 1.5.7 The Contractor shall deliver to and store the Spares at the Designated Depot(s) and shall perform all necessary preventative maintenance to preserve their condition and integrity. The Spares shall be audited by CMRL on a quarterly basis until completion of the CMC period.
- 1.5.8 At least three (3) months prior to the end (or early termination) of the CMC period the Contractor shall restore inventory levels to the quantities defined in the approved lists. The Contractor shall also ensure that the entire inventory is in full working / serviceable condition before handing all the Spares assets back to CMRL.
- 1.5.9 Hand back of the complete inventory of Spares (in accordance with Chapter 4 -Handover Requirements of Section VI C CMC) shall be at no additional cost to CMRL and is deemed to have been included in the CMC price centers of the Contract price.
- 1.5.10 The Contractor shall (during detailed design stage) provide a comprehensive breakdown of data and information for the full inventory of Spares. This shall include, but not limited to:
- a) Names, addresses, telephone numbers and other particulars of manufacturers and their local representatives;
  - b) Models and part numbers;

- c) 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;
  - d) Quantity installed in the system;
  - e) Overall dimensions & weight including minimum packing (if any) for shelf space purposes;
  - f) OEM rated Design life and shelf life;
  - g) Interchangeability or otherwise with similar parts;
  - h) Normal manufacturing and shipment lead times;
  - i) Purchase Technical Specification with relevant drawings
- 1.5.11 The requirement defined in Clause 1.5.9 shall prevail throughout the CMC period, for any Spares (including child parts and sub-assemblies) which deviated from the original configuration (E.g. due to substitution cause by remedy of obsolescence) or any other reason.
- 1.5.12 The Contractor shall ensure that Spares are replaced at intervals that are set in accordance with the OEM's recommendations for time, distance, wear limits etc as the case may be. 1 During the CMC Period only, CMRL will use its fair and reasonable discretion to decide whether extended maintenance intervals can be accepted based on justifications submitted by the Contractor. CMRL's decision shall be final and binding on the Contractor. The Contractor shall ensure the maintenance regime has an optimized schedule, such that inspections are frequent enough to avoid components wearing beyond serviceable limits during the normal course of operation of CMC Assets.
- 1.5.13 The respective CMC Spares documents for Rolling Stock and for Depot M&P shall include an "Obsolescence Management Plan" chapter, which shall set out the Contractor's philosophy for how it will undertake surveillance to identify emerging obsolescence risks as early as possible. The minimum target which should always be achievable is 12 months' prior to the Spares, Parts, sub-assemblies or components being rendered as unavailable for purchase.
- 1.5.14 The Contractor is responsible for all remedial action required to remedy obsolescence throughout the full duration of the CMC period. Obsolescence remedy shall follow the Contractor's change control process, which shall require CMRL's prior authorisation for the remedial action to proceed.
- 1.5.15 If a proposed obsolescence remedy involves substitution of any Spares, Parts, sub-assemblies or components for an alternative; then the Contractor shall so far as is reasonably practicable ensure that the proposed substitute is of the same "form, fit and function" as its predecessor and is of equal or better quality and grade material etc.
- 1.5.16 Where it is the case the Contractor is unable to maintain the same "form, fit and function" and the need arises for a configuration change of any interfacing CMC Asset, then the Contractor shall be entirely responsible to design a modification and propose it for approval by CMRL through the change control process. The Contractor shall undertake this obligation as part of the CMC Scope at no additional cost to CMRL. This obligation is limited to CMC Assets only and does not include other railway assets / integrated systems.
- 1.5.17 Inventory Management:
- a) The inventory of Spares shall be according to target levels of stock holding quantity. The target level shall be proposed by the Contractor as part of the CMC Spares documents which shall include a breakdown of inventory allocation for each of the Designated Depot(s).
  - b) The Contractor's proposal for target inventory levels shall also include Spares needed to perform any unscheduled maintenance tasks (as described in Clause 1.7) that are reasonably foreseeable.
  - c) The Contractor's proposal for target inventory levels shall be supported by data calculations that are undertaken using rail industry recognized "Spares optimization Tool" proposed by the Contractor but subject to CMRL approval.
  - d) The Contractor shall demonstrate that the proposed quantities of Spares shall be sufficient to ensure that the Contractor is always able to perform timely repair and maintenance of the assets in conformity with the Reliability, Availability and Maintainability targets defined in



Chapter-3 of Section VIC CMC RS & DM&P.

- e) The Contractor shall continuously replenish/replace Spares and Consumables in order to sustain the target inventory levels that were proposed in the CMC Spares documents have subsequently been agreed by CMRL.
  - f) The physical inventory shall be held in the Contractor's own custody at the Designated Depot(s) under the Contractor's sole supervision and responsibility.
  - g) CMRL shall provide a provision of space for the custody stores at the Designated Depot(s) for the Contractor's use during the CMC Period. The Contractor shall be responsible to build the structure and equip the stores at the Designated Depot(s) at no additional cost.
  - h) 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 storage / handling requirements.
  - i) The "Inventory Management System" module within the "Asset Maintenance Management System" (AMMS) (defined in Chapter-5 of the Part 2 - Section 6C) shall be interfaced with the "Spares optimization Tool" (Clause 1.5.17c) in order to enhance the continuous assessment of consumption trends needed to review the target inventory levels. Both systems shall be transparent and accessible to CMRL.
  - j) Notwithstanding Clause 1.5.12 (i) the Contractor shall maintain a minimum of one (01) month consumables spares for entire fleet throughout the CMC period.
- 1.5.18 The Contractor shall also be responsible for the initial provisioning, maintenance and replenishment of any tools and/or tackles required its workforce to undertake any part of the works during the CMC Period.

## 1.6 SCHEDULED MAINTENANCE

- 1.6.1 Scheduled Maintenance refers to all forms of Preventive Maintenance (PM) including inspection overhaul and cleaning.
- 1.6.2 Throughout the CMC Period, the Contractor shall be responsible to ensure that the full suite of documents and procedures (defined in Sub-Clauses of Part 2 Section VIA Clause 15) that are relevant to matters of Scheduled Maintenance are frequently reviewed and updated to optimise and improve the methodologies for planning and execution of the Works.
- 1.6.3 The Contractor shall ensure that the Scheduled Maintenance Works attain levels of Reliability and Availability for all CMC Assets; without compromise to the safety and reliability.
- 1.6.4 The Contractor shall perform Scheduled Maintenance tasks at the periodic intervals defined by Maintenance Schedule and in accordance with the Maintenance Work Instructions and other relevant procedures defined in Part 2 Section VIA Clause 15.
- 1.6.5 Maintenance Intervals (as defined in the Maintenance Schedule) shall begin counting distance and time from the date of Taking Over Certificate for each respect CMC Asset.
- 1.6.6 Throughout the CMC Period, the Contractor shall monitor the rate of human error / maintainer error events and provide a KPI within the Monthly Report (Clause 1.11.4).
- 1.6.7 Maintenance errors shall be properly investigated by the Contractor and a report shall be submitted to CMRL; including the course of remedial action(s) taken. (E.g. staff re-training, staff briefing or update to Maintenance Work Instructions etc.)
- 1.6.8 Planning of Scheduled Maintenance works shall be compiled by the Contractor's personnel located at the Designated Depot(s). They shall work in consultation with PPIO, to prepare a schedule of Rolling Stock to be recalled for maintenance in accordance with the requirements of CMC Chapter 3 "Train Operation Plan".
- 1.6.9 The Contractor's staff shall consult PPIO on a daily basis to seek opportunities to minimize downtime hours by resequencing Preventive Maintenance to better synergize with trains that will be recalled for Unscheduled Maintenance.
- 1.6.10 The Contractor shall also be obliged to synergize their planning of Scheduled Maintenance for



CMC Assets, with other Assets such as mainline or depot infrastructure. For avoidance of doubt, it is clarified that the scheduling of Scheduled Maintenance activities shall not impede CMRL (or its representatives) from undertaking the scheduled maintenance of any other assets and/or infrastructure which comprise the Depot Premises and Line.

- 1.6.11 The Contractor acknowledges that maintenance activities on the Line shall be undertaken by the Contractor in a planned manner, except in cases of any unsafe or emergency condition which may result in an accident and/or damage to life or property. If the Scheduled Maintenance to be carried out by the Contractor on the Rolling Stock is interrupted or delayed on account of such conditions and the Contractor is unable to meet the Required Availability of the Rolling Stock under such Scheduled Maintenance, then the Contractor shall not be liable for any Damages in accordance with Clause-3.3 of Part 2 Section VIC.
- 1.6.12 The Contractor proposes a cleaning regime to ensure the cleanliness of both the interior and exterior of the trains. It shall be subject to CMRL review and acceptance.
- 1.6.13 Light cleaning of trains shall be planned for all trains inducted into revenue service on a daily basis; regardless of stabling location. The Contractor shall mobilise staff accordingly.
- 1.6.14 Heavy cleaning of trains interior and exterior shall be undertaken at a suitable interval as proposed by the Contractor but shall be subject to the approval of CMRL.
- 1.6.15 The Contractor is required to perform the following services in rolling stock metro cars (but not limited to),
- a) Internal Cleaning
    - 1. Interior Glass Cleaning (including Door glass, draught glasses and Window glass)
    - 2. All FRP Cleaning (Ceilings, Panels and Cubicles)
    - 3. Floor Cleaning
    - 4. Air Conditioner - Louvers assembly Cleaning
    - 5. Passenger Stainless Steel Doors Cleaning
    - 6. Gang-way Cleaning
    - 7. -
    - 8. Driver Cab Cleaning
    - 9. Saloon Light Cleaning
    - 10. Maps Cleaning
    - 11. Door Thresh hold Plate Cleaning
    - 12. Emergency Ramp Cleaning
    - 13. Passenger Seat Cleaning
    - 14. Cab – Adjustable Air condition Louvers
    - 15. Hand strip
    - 16. Window glasses and Rubber Beading/gasket
    - 17. Cab access door and Partition door
    - 18. Vertical and Horizontal handrail
  - b) Front and rear cab masks, windshield glass and External Glass Wiping
    - 1. Both Cab mask wiping
    - 2. Both Cab mask Windshield wiping
    - 3. External Saloon Glass wiping
    - 4. External Door Glass Wiping
  - c) Front and rear cab masks and windshield glass cleaning
    - 1. Both Cab mask Cleaning
    - 2. Both Cab mask Windshield Cleaning

d) Internal intensive cleaning

1. Interior Glass Cleaning (including Door glass, draught glasses and Window glass).
2. All FRP Cleaning (Ceilings, Panels and Cubicles)
3. Floor heavy Cleaning/ mechanized cleaning
4. Air Conditioner - Louvers assembly Cleaning
5. Passenger Stainless Steel Doors Cleaning
6. Gang-way Cleaning
7. 1st Class Foam Seat Cleaning
8. Driver Cab Cleaning
9. Saloon Light Cleaning
10. Maps Cleaning
11. Door Thresh hold Plate Cleaning
12. Emergency Ramp Cleaning
13. Passenger Seat Cleaning
14. Passenger Seat frames Cleaning
15. Hand strip
16. Window glasses and Rubber Beading/gasket
17. Cab access door and Partition door
18. Vertical and Horizontal handrail
19. Driver desk and FRP
20. Cab – Adjustable Air condition Louvers
21. All Cubical cleaning
22. Heavy Cleaning of Door Threshold
23. Gangway Bridge plate opened and cleaned
24. Complete stain mark removal in the saloon and cab floors

e) External Intensive cleaning

1. Removal of Stains & Roof Cleaning (Including HVAC Panels & Pantograph area)
2. Removal of Stains & car Body Cleaning (including rain gutters)
3. Gangway Rubber Cleaning and Polishing
4. Front Mask including windshield Cleaning.
5. All Cab Pedestrian Steps Cleaning
6. Bogie cleaning
7. Underframe Equipment and panels cleaning
8. Exterior Window Glass Cleaning
9. Doors and windows rubber beading polishing

f) Underframe Cleaning

1. Bogie frame and Parts cleaning
2. Traction convertor, Auxiliary converter, main transformer, and battery boxes and covers cleaning.
3. Car body and end under frame cleaning
4. All other under frame covers and parts cleaning.

g) Protective floor coating

1. Intensive Floor cleaning in saloon and Cab

2. Removal of stains in saloon floor and Cab floor
  3. Shine coating of Saloon and Drivers cab – 1st coat
  4. Shine coating of Saloon and Drivers cab – 2nd coat
- h) Roof cleaning
1. HVAC Cover cleaning
  2. Corrugated sheets cleaning
  3. Pantograph area mat cleaning
- i) Fumigation and Disinfection
1. Fumigation and Disinfection Saloon area
  2. Fumigation and Disinfection cab area
  3. Residual chemicals/agents cleaning

1.6.16 The periodicity of train cleaning services are shown below (the details are indicative and is subject to modification and approval of CMRL)

Type of cleaning service	Periodicity	Max time allowed for completion of activities (min)
Internal Cleaning	Daily	30
Front & rear cab masks, windshield glass and External door and window Glass Wiping	Once in 2days	30
Front and rear cab masks and windshield glass cleaning	Weekly	60
Internal intensive Cleaning	Monthly	360
Fumigation & Disinfection	Monthly	10
Seat Fabric shampooing for cushion seats	Monthly	60
External Intensive cleaning	Monthly	360
Underframe Cleaning	Quarterly	240
Protective floor coating	Half-Yearly	460
Roof Cleaning	Half-yearly	360

1.6.17 Planning

- a) The Contractor shall prepare and submit a detailed monthly housekeeping plan to CMRL for approval.
- b) All cleaning services shall be carried out as per the approved monthly plan.
- c) Any cleaning services shall not affect the movement of trains, nor cause any accident to the personnel or affect the normal working.
- d) Weekly Pep talk shall be given to all cleaning/housekeeping staff before dispersing them into the work by the housekeeping supervisors, to create awareness on safety procedures to be followed while working.

1.6.18 Cleaning Methodology

The Contractor shall submit detailed housekeeping procedures for all surfaces of metro cars for CMRL's approval. The Contractor shall ensure that these details are submitted minimum 2 months before Prototype train arrival to Depot. The proposal shall include details of Chemicals required, Equipment required, Safety precaution & PPE required, Detailed methodology, Consumables required, etc.,

1.6.19 Consumables and cleaning chemicals:

- a) Environment friendly consumables and chemicals to the extent possible shall be used. It shall be free from harmful chemical reactions, odour and shall not affect the passengers/employees,

material, and equipment etc.

- b) The consolidated list of consumables and chemicals proposed to be used shall be submitted to CMRL for approval along with the cleaning methodology.
- c) The Contractor shall store and maintain at least one month inventory of CMRL approved quantity in store at designated depots during the period of contract. The stock will be audited by the CMRL at least once in 3 months.
- d) The contractor shall make necessary arrangements such as racks, hangers, stackers, holders etc., to properly stack the cleaning implements, at his own cost.
- e) The Contractor can alter the approved quantity & type of chemical for better results after approval of CMRL, at no additional cost.
- f) Any additional type or quantity of consumables & chemicals as required during the execution period shall be mobilized by the contractor within the current scope of the contract without extra cost, with prior approval of CMRL.
- g) Relevant records on daily consumption & material inventory shall be maintained by the contractor by best industry practices.
- h) Insulated Mop sticks should only be used for the cab mask, Windshield cleaning and other exterior cleaning particularly when the activity is taken place in the lines where OHE is installed.

#### 1.6.20 Equipment

- i) The Contractor shall propose deployment of adequate number of proven latest equipment along with technical details like make, type, capacity, etc., for CMRL approval for meeting day to day metro cars cleaning.
- j) The Contractor shall deploy only newly purchased equipment & shall not use any second hand / already used equipment for housekeeping services.
- k) The upkeep and maintenance of such equipment shall be the sole responsibility of the contractor.
- l) All cleaning equipment shall be silent in operation and preferably be battery operated.

### 1.7 UNSCHEDULED MAINTENANCE

- 1.7.1 Unscheduled Maintenance refers to any maintenance or repair activity required to be undertaken on a CMC Asset which would not ordinarily be scheduled in accordance with Scheduled Maintenance Programme.
- 1.7.2 Reasons which may give rise to a requirement for “Unscheduled Maintenance” includes, but is not limited to a Fault, unsatisfactory performance, defects, deficiencies, accident, vandalism, natural calamity, fire, riots, arson or negligence.
- 1.7.3 Throughout the CMC Period, the Contractor shall be responsible to ensure that the full suite of documents and procedures (defined in Sub-Clauses of Part 2 Section VIA Chapter 15) that are relevant to matters of Unscheduled Maintenance are frequently reviewed and updated to optimise and improve the methodologies for planning and execution of the Works.
- 1.7.4 The Contractor shall ensure that repair procedures / work instructions for all foreseeable Unscheduled Maintenance tasks are included as part of the deliverables described in the Sub-Clauses of Part 2 Section VIA Chapter 15. Where a repair procedure has not been created for an Unscheduled Maintenance task, the Contractor shall create an appropriate method statement / work instruction and publish the same in the AMMS document library.
- 1.7.5 Lessons learned from technical investigation on CMC Assets shall be applied to fault finding guides to ensure the highest standards are achieved by staff undertaking Corrective Maintenance (CM) as well as PREB Team interventions (refer to Clause 1.8).
- 1.7.6 Deliverables defined in part of Part 2 Section VIA Chapter 15 shall include a procedure detailing how structural integrity assessments will be undertaken in the event of crash damage.
- 1.7.7 The Contractor expressly agrees to promptly attend to any CMC Assets requiring an “Unscheduled Maintenance” intervention and to as far as it is reasonably practical swiftly rectify

- and/or remedy the CMC Asset, without pause or delay for reasons such as apportioning attribution for cause, liability or cost.
- 1.7.8 CMRL shall establish a fair and reasonable attribution process that is unified across all assets areas and also serving the respective Contractors which may be responsible for maintenance of other railway systems. The Contractor shall in good faith agree to perform joint investigations together with other parties whenever it is the case that a Fault(s) has arisen on an integrated system (such as Signalling, PSD or Telecoms).
- 1.7.9 The attribution process shall overseen by CMRL, who will take the final decision on the outcome. The outcome shall be final and binding on the Contractor.
- 1.7.10 The Contractor shall as far as reasonably practicable minimize the downtime for Unscheduled Maintenance to avoid any adverse effect on the overall Train Operation Plan.
- 1.7.11 “Fault” refers to any CMC Asset suffering a defect, faulty design, faulty materials, bad workmanship, improper operation or maintenance which was attributable to matters for which the Contractor is responsible under Sub-Clauses 5.5 to 5.7 of GCC or failure by the Contractor to comply with any other obligation or negligence of, or for any other reason which is not solely and directly attributable to CMRL or occurrence of a Force Majeure Event.”
- 1.7.12 Any and all Unscheduled Maintenance shall form part of the Contractor’s Maintenance Obligations and shall be performed under the scope of CMC. 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) Where Unscheduled Maintenance is found to be solely and directly attributable to CMRL; the Contractor shall determine the cost & time required to carry out the necessary repair works. The basis of that assessment including all calculations used to determine the repair cost & time shall be submitted to CMRL in support of any claim by the Contractor. CMRL can however ask the 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. The Contractor shall unconditionally accept its obligation to reveal all internal costing and pricing details in order to substantiate any such claim(s).
  - (c) Unscheduled Maintenance due to the occurrence of a Force Majeure event: the cost shall be borne by the Parties in accordance with Clause 19 of Section VII GCC 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 CMRL.
- 1.7.13 Notwithstanding anything to the contrary contained in this Contract, the Contractor shall, upon arrival of Rolling Stock at the Designated Depot(s) for carrying out Unscheduled Maintenance, commence the repair thereof as soon as may be possible; except where the Trainset is determined to be fit for condemnation, as the case may be.
- 1.7.14 The Contractor shall, within 12 (twelve) hours of the arrival of Rolling Stock, for any Unscheduled Maintenance, furnish to CMRL in reasonable detail the particulars of defects, deficiencies or damages and the estimated time of repair thereof.
- 1.7.15 CMRL at its sole discretion may at any time inspect the Rolling Stock to verify the defect, deficiency or damage rectified by the Contractor in a Trainset during an Unscheduled Maintenance.
- 1.7.16 Condemnation of Rolling Stock:
- 1.7.16.1 The Parties agree that in the event of the cost of repair of Rolling Stock 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 Rolling Stock or Car from the Fleet.
- 1.7.16.2 Termination of Maintenance Obligations : The Parties expressly agree that the obligations of the Parties with respect to Rolling Stock or Car thereof which is withdrawn or condemned, as the case may be, in accordance with the provisions as above shall be deemed to be terminated and the obligations of the Parties including the obligations of Contractor to meet the Required



Availability and CMRL's obligation to make payment under Price 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 CMRL to the Contractor with respect to such condemned or permanently withdrawn Rolling Stock or Cars thereof, under this clause.

- 1.7.17 The Contractor shall perform maintenance works as per the maintenance procedure and issue a fitness certificate. PPIO shall at its sole discretion shall undertake audits on a randomly selected basis to verify the work carried out by the Contractor on the CMC Asset which the certificate was issued against.
- 1.7.18 **OBLIGATIONS REGARDING RISK OF LOSS OR DAMAGE:** 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 CMRL, then CMRL shall at its own cost and expense engage an independent third party to conduct a root cause analysis of the damage. If the root cause analysis report identifies the damage is attributable to solely any act or omission of CMRL, the amount claimed towards the loss shall be assessed by CMRL and borne by CMRL, only upon submission of relevant documents in support of the Contractor's claim to the satisfaction of CMRL. However, any findings of the investigations conducted by the Railway Statutory Authority for analysing the cause of the failure/Accident resulting into loss shall be binding on both the Parties. If the root cause analysis report identifies the damage is solely attributable to any act or omission by the Contractor, then any cost or expense incurred by CMRL in engaging an independent third-party assessor shall be deducted from the Contractor's payment. The findings of the report submitted by an independent third party shall be final and binding to both parties.

## **1.8 PROMPT RESPONSE AND EMERGENCY BREAKDOWN (PREB)**

- 1.8.1 The Contractor is required to form a PREB team, who shall be deployed to the mainline to attend emergencies, breakdowns or any other form of Unscheduled Maintenance which may arise on Rolling Stock.
- 1.8.2 The PREB team shall consist of fully trained staff per shift who shall be strategically located throughout the network, so as to always ensure that incidents will be attended by PREB staff within 30 mins of receiving a request to attend an incident.
- 1.8.3 The Contractor shall propose a deployment plan to CMRL for review and acceptance. The plan will provide details of manpower, resources, deployment locations and a procedure for effectively managing matters such as callout and logistics to mobilise staff.
- 1.8.4 PREB Team personnel shall also be trained in the use of the Relief and Rescue Vehicle (RRV) and it's onboard Re-railing & Rescue Equipment (RRE). They shall be appropriately trained and also be equipped with any other maintenance tools, special tools required to facilitate recovery of failed trainsets.
- 1.8.5 The PREB Team shall apply all reasonable effort to rectify, reset, or make temporary repairs to defects and deficiencies they attend to on the mainline.
- 1.8.6 The PREB Team shall liaise with OCC / CMRL to ensure they are adequately informed in advance about the status of trainsets they will attend. They shall follow instructions provided and assist with train rescue or recovery if required.
- 1.8.7 The emergency response and breakdown procedures followed by CMRL shall be provided after the award of the Contract. The Contractor shall ensure that all PREB Team staff are well versed on the correct procedures and will carry out period assessments to uphold a high level of competency.

## **1.9 ENDEMIC FAILURES AND DEFECTS**

- 1.9.1 An "Endemic Failure or Defect" shall be deemed to have arisen when during the evaluation period defined in Clause 1.9.2; the number of failures of a common root cause has occurred on at least 10% of the installed assets of the same component AND the respective component and/or parent subsystem does not achieve the predicted reliability/failure rate specified during



the design phase (ref. Clause 18.6.3 Part 2 Section VIA).

- 1.9.2 The failure rate shall be assessed over any rolling 60-month period from start of CMC Works. The evaluation shall consider any root cause that has arisen as a result of defects in material, workmanship, manufacturing process, design deficiencies (including but not limited to components with inherent or latent defects) or repeated maladjustment during maintenance or manufacture.
- 1.9.3 If during the Contract Period, CMRL notifies the Contractor that an Endemic Failure or Defect has occurred, the Contractor shall undertake remedial action on all CMC Assets which may be affected, so as to provide a final containment measure that will prevent such Endemic Failure or Defect arising on other CMC Assets.
- 1.9.4 The Contractor shall propose a rectification programme for a modification campaign or other appropriate final resolution within 30 (thirty) days of notification. CMRL shall review the programme and provide a decision on its acceptability within a period of 30 (thirty) days.
- 1.9.5 In the event that the Contractor fails to provide a credible rectification programme, CMRL reserves the right to employ a third party or embark on its own investigation / rectification programme; the costs for which shall be borne by the Contractor.

## 1.10 OPERATIONS MANAGEMENT BY CMRL

- 1.10.1 CMRL shall, at all times, operate the Rolling Stock in accordance with CMRL's Operation plan. The Contractor through its Maintenance Personnel at the Depot shall closely liaise with PPIO for all the operational aspects of the Rolling Stock for example its induction, scheduled / unscheduled withdrawal, Line Failures, Train Operators (TO) reports etc.
- 1.10.2 ~~For guidance of the operating staff of CMRL, the Contractor shall provide an Operations and Maintenance Manuals to CMRL. The Contractor shall be also responsible for the training of TO's, Instructors, Supervisors and CMRL's other officers and staff associated with the Trains operational management including but not limited to controllers (herein after referred as Rolling Stock Controllers or RSC), nominated officers and staff deployed by CMRL in the Depot for assessment/reconciliation of the Maintenance work etc.~~

## 1.11 MAINTENANCE REPORT / MONITORING OF MAINTENANCE

- 1.11.1 An initial Failure Analysis Report (FAR) shall be submitted to CMRL within 24 hrs of notification of any incident or failure.
- 1.11.2 A Daily Fleet Status Report shall be submitted to CMRL. The report shall cover the health of Rolling Stock and shall also include a statistical summary detailing the number of available trains, number of trains inducted in to service, number of unavailable trains, brief details of any trains held on depot as well as target dates for the release of unavailable trains.
- 1.11.3 No later than 7 (seven) days after completion of maintenance (regardless of category) the Contractor shall prepare a detailed report, which shall minimally contain the following info:
- a) an analysis of the defects and deficiencies affecting the performance or safe operation of each Trainset;
  - b) time of arrival of Rolling Stock in the Maintenance Depot or the arrival of the PREB Team at the site of the failure and/or emergency breakdown,
  - c) time of departure of Rolling Stock from the Maintenance Depot or the time of rectification of malfunction by the PREB Team at the site of failure and/or emergency breakdown
- The above details shall be verified with CMRL and may be referenced for the calculation of Availability of Rolling Stock.
- 1.11.4 Monthly Report
- a) During the CMC Period, the Contractor shall, no later than 7 (seven) days after the end of each month submit the monthly report.
  - b) The format / content of the monthly report shall align with, but not be limited to the requirements

defined in this Chapter. The same shall be proposed by the Contractor for review and acceptance by CMRL.

- c) This report shall state in reasonable detail a summary of all maintenance services performed by the Contractor on CMC Assets.
- d) The report shall also include Key Performance Indicators to measures relevant success factors for CMC Assets, such as; compliance to Maintenance Requirements, Operational Performance, asset condition and OHSE metrics.
- e) A summary of the key operational hurdles, including, but not limited to a running count of own goals / maintenance errors, 'no-fault found' outcomes, repeated defects etc.
- f) The report shall mostly cover the period of the preceding month, except for tracking of trend metrics in which case a suitable time period (E.g. 6 – 48 months') shall be mutually agreed between the Contractor and CMRL.
- g) The report shall include full details of the Contractor's corrective and/or mitigating strategies for addressing problem areas and to improve all aspects of performance.
- h) Five (5) days after submission of monthly report, a Monthly Maintenance Review meeting shall be convened at CMRL's premises.

1.11.5 Not Used

1.11.6 The Inspection

- a) CMRL shall be entitled to inspect the Rolling Stock after any Scheduled Maintenance or Unscheduled Maintenance, as the case may be, for evaluating the compliance of Rolling Stock versus the Maintenance Obligations. CMRL shall produce a report of such inspections (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 Contract.

1.11.7 Tests

- a) For determining that the maintenance of Rolling Stock conforms to the Maintenance Obligations, CMRL may require the Contractor to carry out, or cause to be carried out, the Tests specified by it in accordance with standards specified in this Contract. The Contractor shall, with due diligence, carry out or cause to be carried out all such tests in accordance with the instructions of CMRL and furnish the results of such tests to CMRL within 15 (fifteen) days of such tests being conducted.

1.11.8 Remedial measures

- a) The Contractor shall repair / rectify all defects or deficiencies and record the full details of the intervention as per the requirements set forth in the Maintenance Inspection Report or in the Test results referred to in Clause 1.11.3.
- b) Post intervention, the Contractor shall also carry out a sufficient level of testing to ensure the CMC Assets are safe to resume operational service and compliant with the Maintenance Requirements and all relevant Safety Requirements.
- c) In the event that remedial measures result in CMC Assets being rendered non-compliant with the requirements under this Contract, CMRL shall be entitled to recover Damages from the Contractor under and in accordance with the provisions of GCC.

1.11.9 Responsibility of the Contractor

- a) It is expressly agreed between the Parties that any inspection carried out by CMRL or the submission of any Maintenance Inspection Report by CMRL as per these provisions shall not relieve or absolve the Contractor of its obligations and liabilities hereunder in any manner whatsoever.
- b) It is further agreed that the Contractor shall be solely responsible for adherence to the Key Performance Indicators specified in Chapter-3 of Section VI C CMC RS & DMP.

1.11.10 Technical Records

- a) The Contractor shall maintain records of the maintenance and repairs it carries out using the

Asset Maintenance Management System (which is covered in detail in chapter 5 of Section VI C AMMS).

- b) The Contractor shall provide for CMRL, on request with such access it reasonably requires including inputs, outputs, downloads, print outs and analysis and any other information from the AMMS, TCMS or any other relevant management information system deployed by the Contractor for management of CMC Assets.
- c) The Contractor shall keep and maintain clear, adequate and accurate records and documentation on a per Trainset basis to show to CMRL's reasonable satisfaction that the Maintenance Obligations have been and are being carried out in accordance with the Maintenance Programme, Maintenance Requirements of Rolling Stock, 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 CMRL. The Contractor will maintain records of the maintenance and repairs it carries out in accordance with this chapter.

### **1.12 SUPPLY OF DIAGNOSTIC MAINTENANCE LAPTOPS**

- 1.12.1 At the start of the CMC Period, the Contractor shall supply twenty (20) diagnostic maintenance laptops of the same specification that is defined in Part 2 Section VIA Chapter 15.6 which will be handed over to CMRL.
- 1.12.2 The full quantity of laptops shall be replaced every five (5) years, throughout the CMC Period.

### **1.13 ACCESS AND QUARTERLY AUDIT**

- 1.13.1 To verify performance of and compliance with this Contract, CMRL shall be entitled, to inspect or witness at 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.
- 1.13.2 The Spares shall be held and maintained in the Designated Depot(s) stores by the Contractor and the same shall be audited by CMRL on a quarterly basis. If an audit reveals that stock levels are non-compliant with the approved list, then notification will be issued to the Contractor.

### **1.14 PERSONNEL**

- 1.14.1 The Contractor shall be fully responsible to ensure the availability of adequately competent manpower for carrying out all maintenance and overhauling activities during the CMC period to meet the Availability targets specified in Chapter 3.
- 1.14.2 The Contractor shall follow CMRL's competency procedure, which will be updated from time to time. The Contractor shall undertake training of their manpower and undertake routine assessment of their staff to ensure their competency is upheld at all times.

The Contractor shall submit the deployed staffs CV, local Police Verification report and competency certificate to CMRL for approval. Evidence of staff training, competency assessment and valid certification shall be periodically submitted to CMRL for endorsement.

Only personnel who hold all the requisite approvals shall be allowed to work in the Designated Depot(s) to undertake train maintenance. The Contractor shall deploy a tracking system to ensure that no staff shall undertake any Works once their certified competency has lapsed. The tracking system shall automatically issue reminders / warnings to ensure effective management.
- 1.14.3 The Contractor shall submit for CMRL approval - The CMC Management Plan that explicitly defines the Contractor's maintenance organization, project Controls and planning / scheduling methodologies. The CMC Management Plan shall include:
  - a) An organization chart that clearly identifies the lines of authority of all departmental managers and of the following key staff for this contract:

No.	Position	Total Work Experience (Minimum number of years)	Experience in Similar Works * (Minimum number of years)
1	Chief Maintenance Manager	15	10
2	CMC Co-Ordinator	12	7
3	Failure Investigation Specialist	12	7
4	AMMS Specialist	10	5
5	Inventory Planning & Procurement Manager	10	5

\* Only time served in a role / designation which has direct involvement in similar responsibilities, duties and industrial sector will be counted as experience in similar Works

- b) Resumes for each of the key staff members identified above.
- c) A description of the duties and responsibilities of each key staff member. The scope of responsibilities for those staff and the reporting lines between individual staff. The documents which each senior staff member is authorized to sign on behalf of the Contractor shall also be defined.
- d) A resource plan for the CMC Period shall be submitted 180 days prior to arrival of the prototype train and shall cover the full CMC period until its completion. The plan shall show levels of staffing to be provided at each phase for each discipline and functional area.
- e) Each member in the Contractor's Staffing Proposal, including the Key Personnel shall be proposed to CMRL. They shall be allocated to this Contract on a full-time basis, until the activities that he is responsible for have already been completed or have to be carried out off-site. Should it be necessary to replace any staff before the activities he is responsible for have been carried out, the Contractor shall submit the CV of the proposed substitute to CMRL Notice of No Objection, at least 30 days before the proposed change. The substitute shall not be less qualified or experienced than the person he is replacing.
- f) A description of the methodology to be used to track and control program progress against the program schedule.
- g) The following functional positions shall be filled on a full-time basis till closure of CMC of last train:-
  - i) **Chief Maintenance Manager** – with complete responsibility but not limited to delivering of all aspects of the work. Individual (must be minimum engineering graduate in Electrical/ Electronics/ Mechanical) shall have at least 15 years' experience in Rolling Stock and spent at least 10 years holding a position which substantially included management of all types of Maintenance of Metro Rolling Stock, including major overhaul.
  - ii) This person will represent the Contractor (as CMC Project Manager) and be able to make binding decisions on all aspects of the work. This person shall be mobilized to CMRL depot premises 180 days prior to arrival of prototype train until completion of CMC period.
  - iii) **CMC Maintenance Manager** – with responsibility not limited to developing maintenance strategy, co-ordination with planning, scheduling with OCC for Operations and DCC for Maintenance activity including preventive and corrective maintenance until the completion of CMC period. Individual (must be minimum engineering graduate in Electrical/ Electronics/ Mechanical) shall have at least 12 years' experience in Rolling Stock. Out of which at least 7 years he shall worked in Maintenance of Metro Rolling Stock. This person shall be mobilized to CMRL depot premises 180 days prior to arrival of proto train until completion of CMC period.
  - iv) **Failure Investigation Specialist** – with responsibility but not limited to of all the Failure investigation reports, root cause analysis of faults, etc. Individual (must be minimum engineering graduate in Electrical/ Electronics/ Mechanical) shall have at least 12 years'

experience in Railway Rolling Stock. Out of which at least 7 years he shall worked in Maintenance of Metro Rolling Stock. This person shall be mobilized to CMRL depot premises 180 days prior to arrival of prototype train until completion of CMC period.

- v) **Asset Maintenance Management System (AMMS) Specialist** - with the responsibility but not limited to configuration of Rolling Stock assets, maintaining warranty information, tracking the maintenance campaigns, Job card creations, etc. Individual (must be an engineering graduate in Computer science /Information technology) shall have at least 10 year experience in information management system in large infrastructure projects. Out of which at least 5 years shall be in implementation of AMMS of the metro Rolling stock or Computer maintenance management system like Maximo, SAP, Trimble E2M / R2M or others. This person shall be mobilized to CMRL depot premises 180 days prior to commencement of CMC works until completion of CMC period.
- vi) **Inventory Planning and Procurement Manager** - with the responsibility but not limited to of Planning and Procuring the required spares, consumables, etc. Individual (must be a science graduate with post-graduation in Inventory planning & management) shall have at least 10 years' experience in large infrastructure projects in the domain of Inventory planning and procurement. Out of which at least 5 years shall be in planning, coordination, and execution of Metro Rolling Stock Maintenance. This person shall be mobilized to CMRL depot premises 180 days prior to commencement of CMC works until completion of CMC period.

### 1.15 CMC SCOPE FOR DEPOT MACHINERY & PLANT:

- 1.15.1 This chapter defines requirements that are specific to DM&P Assets. Wherever earlier Chapters have already defined requirements for “CMC Assets” or their Spares etc. that shall be understood to have included Depot M&P Assets as well.
- 1.15.2 Additional maintenance scope which applies to DM&P assets includes (but shall not limited),
- Preventive / periodic / Schedule Maintenance,
  - Unscheduled Maintenance, Corrective Maintenance
  - Providing Emergency support during Operational failures.
  - Software upgradation
  - Documentation upgradation
  - Remote diagnosis (where applicable)
  - And other as applicable
- 1.15.3 The Contractor shall retain at site all necessary Tools and Test Equipment required to maintain Depot Machinery and Plant throughout the entire CMC period.
- 1.15.4 The Contractor shall provide comprehensive maintenance services at CMRL's depot in-person without any pre-condition, such as exclusion of weekends, unless otherwise agreed by CMRL.
- 1.15.5 The Contractor shall be available to attend to breakdowns affecting machine performance / availability on 24 X 7 basis. The Contractor shall respond within 12 hrs for all Vital DM&Ps as referred under clause 3.3.6.2. For all other categories, the Contractor shall respond within 24 hrs as referred under clause 3.3.6.3 and 3.3.6.4.
- 1.15.6 Notwithstanding the above, the total downtime including response time, preventive maintenance time and corrective maintenance time shall not exceed the allowed time of 4 days / quarter for every machinery and plant to achieve the Guaranteed Availability target of 95%.
- 1.15.7 CMRL may, at any time, undertake a full audit of the Services provided by the Contractor. The Contractor shall render all reasonable assistance to CMRL in undertaking such audit.
- 1.15.8 DM&P assets supplied under this Contract, may be required to be utilised by other Contractor(s) for their undertaking of maintenance on other Chennai Metro Phase-II Fleet(s) at the same depot. Such utilization of CMC Assets shall be at no additional cost to CMRL.
- 1.15.9 It is clarified that a Standard Operating Procedure (SOP) shall be established by CMRL in order to provide governance that will fairly and reasonably determine how the allocation of Depot M&P



facilities will be apportioned between the respective fleets; without unreasonable hinderance to the ARE02A Contractor's ability to deliver the deliverables required under the scope of this Contract.

#### 4 1.16 KEY PERFORMANCE INDICATORS (KPI) – ~~ROLLING STOCK PASSENGER SAFETY & COMFORT.~~

1.16.1 Performance of ~~Maintenance Services rendered by the Contractor~~ Rolling Stock sub-system related to Passenger Safety & Comfort shall be evaluated against a range of Key Performance Indicators (KPI).

1.16.2 ~~KPI's for Rolling Stock are subdivided into Primary, Secondary and Mandatory categories. Primary KPIs are related to Preventive Maintenance, Secondary KPIs monitor performance as perceived by passengers (in terms of information, satisfaction & comfort) and Mandatory KPIs are related to train presentation.~~

Evaluation of the Contractor's performance against the KPIs will be carried out on a monthly basis in accordance with the provisions set out in this chapter. Penalties (if any) will also be calculated on monthly basis and the total Penalties accumulated over three months will be deducted from the Quarterly payment.

1.16.3 ~~Evaluation of the Contractor's performance against the KPIs will be carried out on a monthly basis in accordance with the provisions set out in this chapter.~~

A Performance KPI Report shall be submitted by the Contractor every month starting from the commencement of the DLP period for Rolling Stock. However, payments and penalties shall only be calculated and applied during the CMC Period. In accordance with Clause 1.18.4(v) the reports shall be App generated from the start of the CMC Period.

1.16.4 ~~A Performance KPI report shall be submitted by the Contractor every month starting from the commencement of the DLP period for Rolling Stock. However, payments and penalties shall only be calculated and applied during the CMC period.~~

Passenger Safety & Comfort KPI Calculation

Only the below mentioned subsystems will be considered for this KPI calculation. Failure scenarios identified (after Train fitness) through physical inspection or OCC workstation or were recorded by the TCMS logs shall be considered. If any of the Failure scenarios listed in below table are accounted for and penalized under clause 3.3.5, then such incidents will not be considered for Penalty calculations under this clause.

Deduction shall be calculated on the respective Quarter Price Centre RS-CMC apportioned amount. The stated deduction % shall only be applied one time per month for each respective KPI.

Table 1-2: KPI Points and Weightage – ~~Rolling Stock~~

Item	Min Points	Max Points
<b>Primary KPI</b>		
<del>• Preventive maintenance for Rolling Stock</del>	0	2000
<b>Secondary KPI</b>		
<del>• Functioning of Passenger Announcement &amp; Passenger Information System (PA/PIS) in Train</del>	0	500
<del>• Functioning of CCTV in Train</del>	0	500
<del>• Functioning of Saloon Door in Train</del>	0	500
<del>• Functioning of VAC in Train</del>	0	500
<b>Mandatory KPI</b>		
<del>• Train Presentation (cleanliness)</del>	N/A	N/A



Table 1-2 : KPI Passenger Safety & Comfort

KPI	Sub-system	Failure Scenarios	No of incidents allowed in the fleet per month	Deduction per month beyond allowed No. of Incidents
1	PAPIS System	a) Non-functioning / broadcasting of any passenger announcement in a car. b) Non-functioning / broadcasting of any display (DRM, FD, ID, advertisement etc) in a car. c) Non-functioning of PEI in a car. d) Non-functioning of any internal and external door indicator in a car.	4	0.20 %
2	CCTV System	a) Any non- functioning of CCTV in a car.	8	0.20 %
3	Saloon / Detrainment Door	a) Failure of train door opening automatically. b) Failure of door closing in a car. c) Isolation of any door in a car. d) Emergency Door opening and closing failure.	2	0.20 %
4	VAC System	a) Temperature and Humidity are not maintained as defined in VAC chapter in a car. b) Nonfunctioning of Emergency Inverter in a car. c) Non-functioning of a VAC in a car.	4	0.20 %

1.16.5 ~~The total number of available performance points for Rolling Stock across the complete range of KPIs is four thousand (4,000). Theoretically, the Contractor can earn anywhere between zero (0) and four thousand (4,000) points in a month depending on applicable performance scores.~~

1.16.6 ~~Assessment periods taken for payment / penalty calculations shall be monthly. The aggregate of the three respective months within a quarter shall then be applied over the payments due for price centers RS-CMC.~~

KPI Performance Points	Payment adjustment <del>(applied over the respective month)</del>
3700 ~ 4000	Full Payment
3600 ~ 3699	<del>0.5% Penalty on the respective quarter Price Center RS-CMC apportioned amount.</del>
3500 ~ 3599	<del>1% Penalty on the respective quarter Price Center RS-CMC apportioned amount.</del>
0000 ~ 3499	<del>2% Penalty on the respective quarter Price Center RS-CMC apportioned amount.</del>

1.16.7 ~~Whenever, the Contractor successfully earns 4,000 points throughout three (3) consecutive~~

months', it will be entitled to receive an incentive payment of INR 1,00,000 (One Lakh Rupees).

**Note:** Accrued incentive months will always reset to zero at the end of any period following which the Contractor claims the incentive payment. Hence, the maximum incentive payable within a 12 month period shall be INR 4,00,000 (Four Lakh Rupees).

1.16.8 Persistently poor KPI performance is not acceptable to CMRL. To discourage lapses in maintenance standards, CMRL reserves the right to impose an additional penalty of 5% of the quarterly payment if the Contractor scores below 3,500 points for three (3) consecutive months.

#### 1.16.9 Primary KPI Performance Calculation

- a) Preventive Maintenance (PM) of Rolling Stock shall be carried out in accordance with the applicable manuals and in alignment with the maintenance schedule. PM activities shall be planned in advance by the Contractor.

The number of scheduled PM activities verses the actual number of activities carried out during each month shall be recorded in a report, which shall be submitted to CMRL and may subject to audit. This record shall be used to calculate a percentage score for the primary KPI as follows:-

$$\text{PM Completion (\%)} = (\text{PM Carried out} / \text{PM Planned}) \times 100$$

The number of points for respective percentage scores shall be as follows:-

Primary KPI Percentage Score	Primary KPI Points Awarded
100%	2,500
98%	2,300
95%	2,000
93%	1,800
90%	1,500
<90%	NIL

**Note :** In the event that CMRL fails to provide Rolling Stock for planned maintenance activities, such activity shall not be deemed as incomplete for the purposes of KPI calculations.

#### 1.16.10 Secondary KPI Calculation

Secondary KPIs adopt a points deduction methodology for each instance of for non-conformance against the five categories (a) through to (d) listed below,

**Note:** Each category is equally weighted and may earn up to 200 points, meaning 1,000 points are available in total (as shown earlier in Table 1-2). Score can be depleted to zero (0), after which there will be no further deductions which cause the score to become negative.

- a) Functioning of PA/PIS in Train

1 (one) point shall be deducted for each individual item of the PA/PIS system found to be non-functioning after the train is inducted to the main line. Defects identified through physical inspection or were recorded by the TCMS logs shall be counted.

- b) Functioning of CCTV System in Train

1 (one) point shall be deducted for each individual item of the CCTV system found to be non-functioning after the train is inducted to the main line. Defects identified through physical inspection on the train, OCC workstation or recorded by the TCMS logs shall be counted. Failures of a redundant or standby equipment which do not directly affect the performance of the CCTV system will not be counted.

- c) Functioning of Saloon Door in Train

5 (five) points shall be deducted for each non-functioning Saloon Door or Emergency Detrainment door. Defects identified through physical inspection, were identified via CCTV or were recorded by the TCMS logs shall be counted.

- d) Functioning of VAC in Train

~~5 (five) points shall be deducted for each incident involving a non-functioning of VAC systems to the extent that there is a failure to maintain the temperature & humidity (as per Chapter 7 Part 2 Section VIA requirements). Defects identified through physical inspection or were recorded by the TCMS logs shall be counted.~~

#### 1.16.11 **Mandatory KPI / Train Presentation**

~~CMRL expects the highest standards of train presentation for the travelling public and will enforce the levels of cleanliness through an inspection audit regime. This KPI has been categorised as mandatory, meaning a penalty amount of 0.01% for the respective payment month shall immediately apply whenever the non-compliance threshold is breached and shall be applicable on each NCR. The number of permissible non-conformance report (NCR) events per trainset per month are defined as follows~~

Area	Post Daily Cleaning Audit Inspection per trainset		Post Heavy Cleaning Audit Inspection per trainset	
	Minor NCR	Major NCR	Minor NCR	Major NCR
Saloon Interior	5	3	3	NIL
Exterior / Train Wash	5	4	3	NIL

~~Note : The compliance and closure of NCR shall be done within 24 hours of date of issue.~~

~~The decision to raise NCRs and the awarded level of severity, shall be decided by CMRL in its reasonable opinion based on a pre-determined audit criteria. A copy of the audit process document shall be shared with the Contractor for an aligned understanding.~~

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### 1.17 **KEY PERFORMANCE INDICATORS (KPI) – ~~DEPOT MACHINERY & PLANT MAINTENANCE.~~**

1.17.1 Performance of Maintenance Services rendered by the Contractor shall be evaluated against a range of Key Performance Indicators (KPI) as mentioned in this section. It covers for Rolling Stock, Depot Machinery & Plant and the RS Maintenance Depot.

1.17.2 ~~KPI's are subdivided into Primary and Mandatory categories. Primary KPIs are related to Preventive Maintenance and Mandatory KPIs are related to Depot Machinery & Plant cleaning.~~

Evaluation of the Contractor's performance against the KPIs will be carried out on a monthly basis in accordance with the provisions set out in this chapter. Penalties (if any) will also be calculated on monthly basis and the total Penalties accumulated over three months will be deducted from the Quarterly payment.

1.17.3 ~~Evaluation of the Contractor's performance against the KPIs will be carried out on a monthly basis in accordance with the provisions set out in this chapter.~~

A Performance KPI report shall be submitted by the Contractor every month starting from the commencement of the DLP period for Rolling Stock. However, payments and penalties shall only be calculated and applied during the CMC Period. In accordance with Clause 1.18.4(v) the reports shall be App generated from the start of the CMC Period.

1.17.4 ~~A Performance KPI report shall be submitted by the Contractor every month starting from the commencement of the DLP period for Depot Machinery & Plant. However, payments and penalties shall only be calculated and applied during the CMC period.~~

Rolling Stock – Maintenance KPI :

Preventive Maintenance (PM) of Rolling Stock shall be carried out in accordance with the applicable manuals and in alignment with the maintenance schedule. PM activities shall be planned in advance by the Contractor.

The number of scheduled PM activities verses the actual number of activities carried out during each month shall be available in real-time via the Software Application Tool (detailed in Clause 1.18) and shall be summaries in the App generated reports and penalty calculations. The same may subject to audit.

Note : In the event that CMRL fails to provide Rolling Stock for planned maintenance activities, such activity shall not be deemed as incomplete for the purposes of KPI calculations.

~~Table 1-3: KPI Points and Weightage—Depot Machinery & Plant~~

<b>MACHINE / EQUIPMENT</b>	<b>Points</b>
Automatic Train Wash Plant	600
Under Floor Wheel Lathe	600
Synchronised Mobile Lifting Jacks for 3 car length & car body stands for 3 car length	200
Diesel Operated Rail Cum Road Rescue Vehicle With Rerailing Rescue Equipment & Auxiliary Truck	200
Battery Operated Rail Cum Road Shunter	280
Bogie Wash Plant	200
Pit Jacks	400
Bogie Testing Unit / Bogie Test Stand	200
Bogie Frame Manipulator / Rotator	80
EOT Crane	400
Bogie Turn Table	80
Wheel Profile Measuring System (way side)	160
Catenary Maintenance Vehicle	400
DM&P R-given list (All Machine)	200
Total	4000

- 1.17.5 ~~The total number of available performance points for Depot Machinery & Plant across the complete range of KPIs is four thousand (4,000). Theoretically, the Contractor can earn anywhere between zero (0) and four thousand (4,000) points in a month depending on applicable performance scores.~~

Rolling Stock – Cleaning Schedule :

Rolling Stock Cleaning Schedule shall be carried out in accordance with applicable manuals and in alignment with the maintenance schedule. Cleaning activities shall be planned in advance by the Contractor.

The number of Cleaning schedule activities verses the actual number of activities carried out during each month shall be available in real-time via the Software Application Tool (detailed in Clause 1.18) and shall be summaries in the App generated reports and penalty calculations. The same may subject to audit.

Note : In the event that CMRL fails to provide Rolling Stock for planned maintenance activities, such activity shall not be deemed as incomplete for the purposes of KPI calculations.

- 1.17.6 ~~Assessment periods taken for payment / penalty calculations shall be monthly. The aggregate of the three respective months within a quarter shall then be applied over the payments due for price centers DM&P-CMC.~~

Depot Machinery & Plant – Maintenance KPI :

Preventive Maintenance (PM) of Depot Machinery & Plant shall be carried out in accordance with the applicable manuals and in alignment with the maintenance schedule. PM activities shall be planned in advance by the Contractor.

The number of scheduled PM activities verses the actual number of activities carried out during each month shall be available in real-time via the Software Application Tool (detailed in Clause

1.18) and shall be summaries in the App generated reports and penalty calculations. The same may subject to audit.

Note : In the event that CMRL fails to provide DM&P for planned maintenance activities, such activity shall not be deemed as incomplete for the purposes of KPI calculations.

Primary KPI Points Awarded	% of Penalty for DM&P CMC Price centre
3800 to 4000	No Penalty(Full payment)
3600 to 3799	2% Penalty of monthly value
3400 to 3599	6% Penalty of monthly value
3200 to 3399	10% Penalty of monthly value
3000 to 3199	15% Penalty of monthly value
0 to 2999	25% Penalty of monthly value

1.17.7 Persistently poor KPI performance is not acceptable to CMRL. To discourage lapses in maintenance standards, CMRL reserves the right to impose an additional penalty of 5% of the quarterly payment if the Contractor scores below 3,000 points for three (3) consecutive months.

Table – Maintenance KPI

Deductions (as applicable) will be calculated as below,

Table 1-3 : KPI Maintenance

KPI	Attributes		Critical Attributes	Measurement Frequency	Deduction rate
KPI 1	<b>KPI 1 – Rolling Stock Preventive Maintenance Schedule</b>			Records will be taken directly from AMMS for each train every Month.	1.00 %
	1	Preventive activities achieved vs planned activities for Rolling Stock (according to the approved maintenance plan)	Y		
KPI 2	<b>KPI 2 – Depot M&amp;P Preventive Maintenance Schedule</b>			Records will be taken directly from AMMS for each train every Month.	1.00 %
	1	Preventive activities achieved vs planned activities for Automatic Train Wash Plant	Y		
	2	Preventive activities achieved vs planned activities for Under Floor Wheel Lathe	Y		
	3	Preventive activities achieved vs planned activities for Synchronised Mobile Lifting Jacks for 3 car length & car body stands for 3 car length			
	4	Preventive activities achieved vs planned activities for Diesel Operated Rail Cum Road Rescue Vehicle With Rerailing Rescue Equipment & Auxiliary Truck	Y		
	5	Preventive activities achieved vs planned activities for Battery Operated Rail Cum Road Shunter			
	6	Preventive activities achieved vs planned			

KPI	Attributes		Critical Attributes	Measurement Frequency	Deduction rate
		activities for Bogie Wash Plant			
	7	Preventive activities achieved vs planned activities for Pit Jacks	Y		
	8	Preventive activities achieved vs planned activities for Bogie Testing Unit / Bogie Test Stand			
	9	Preventive activities achieved vs planned activities for Bogie Frame Manipulator / Rotator			
	10	Preventive activities achieved vs planned activities for EOT Crane	Y		
	11	Preventive activities achieved vs planned activities for Bogie Turn Table			
	13	Preventive activities achieved vs planned activities for Wheel Profile Measuring System (way side)			
	14	Preventive activities achieved vs planned activities for Catenary Maintenance Vehicle	Y		
	15	Preventive activities achieved vs planned activities for DM&P-R given list (All Machine)			
KPI 3	<b>KPI 3 – Rolling Stock Cleaning Schedule</b>			Score will be taken directly from AMMS for each train every Month.	0.10 %
	1	Cleaning activities achieved vs planned activities (according to the requirements specified in Clause 1.6.16)	Y		
KPI 4	<b>KPI 4 – Rolling Stock Internal Cleaning</b>			Once in a month for 20 Rakes randomly.	0.30 %
	1	Noticeable dust / dirt / stain / improper cleaning on Floor or Seat.	Y		
	2	Noticeable dust / dirt / stain / improper cleaning on Glass surface like Window, Draught, Door.	Y		
	3	Noticeable dust / dirt / stain / improper cleaning on Interior Panel, Gangway panel, Emergency operator desk.			
	4	Noticeable dust / dirt / stain / improper cleaning on VAC grill, Saloon Light.			
KPI 5	<b>KPI 5 – Rolling Stock External Cleaning</b>			Once in a month for 20 Rakes randomly.	0.20 %
	1	Noticeable dust / dirt / stain / improper cleaning on cab masks.	Y		
	2	Noticeable dust / dirt / stain / improper cleaning on Rake Side walls.	Y		
	3	Noticeable dust / dirt / stain / improper cleaning on Rake Underframe.			



KPI	Attributes		Critical Attributes	Measurement Frequency	Deduction rate
	4	Noticeable dust / dirt / stain / improper cleaning on Rake Roof.			
KPI 6	<b>KPI 6 – Depot M&amp;P Cleaning</b>			Five (5) inspections in a month	0.60 %
	1	Planned Cleaning activity of Depot M&P as approved by CMRL is not fulfilled.	Y		
	2	UFWL : Not removing Metal chips after work completion.	Y		
	3	Water stagnation, improper cleaning of ATWP / BWP zone.			
KPI 7	<b>KPI 7 – RS Maintenance Depot (Premises Areas Allocated to the Contractor)</b>			Five (5) inspections in a month	1.20 %
	1	Noticeable dust / dirt / stain / improper cleaning of floor in IBL or SBL or RBL.	Y		
	2	Non removal of garbage / debris / cotton waste in RS Maintenance Depot.	Y		
	3	Evidence of Cobweb / Termite nest / Pigeon dropping / animal dropping in RS Maintenance Depot.			
	4	Any area has a prolonged / lingering bad smell (which is not perceived to be temporary).			
KPI 8	<b>KPI 8 – Safety and Work ethics</b>			Any time during the assessment period.	1.00 %
	1	Safety incident occurred in Employer's premises for the reasons attributable to the Contractor	Y		
	2	Contractor's Staff not following Safety Practice			
	3	Evidence of creating unsafe conditions.			

#### 1.17.8 ~~KPI Performance Calculation for Depot Machinery & Plant~~

- a) ~~Preventive Maintenance (PM) of Depot Machinery & Plant shall be carried out in accordance with the applicable manuals and in alignment with the maintenance schedule. PM activities shall be planned in advance by the Contractor.~~

~~The number of scheduled PM activities verses the actual number of activities carried out during each month shall be recorded in a report, which shall be submitted to CMRL and may subject to audit. This record shall be used to calculate a percentage score for the primary KPI as follows;~~

$$\text{PM Completion (\%)} \text{ against each DM\&P} = (\text{PM Carried out} / \text{PM Planned}) \times 100$$

~~**Note :** In the event that CMRL fails to provide DM&P for planned maintenance activities, such activity shall not be deemed as incomplete for the purposes of KPI calculations.~~

- b) ~~Mandatory KPI~~

~~CMRL expects the highest standards of DM&P area and will enforce the levels of cleanliness through an inspection audit regime. This KPI has been categorised as mandatory, meaning a penalty amount of 0.05% for the respective payment month shall immediately apply whenever the non-compliance threshold is breached and shall be applicable on each NCR. The number of~~

~~permissible non-conformance report (NCR) events are defined as follows:~~

Area	Post Daily Cleaning Audit inspection	
	Minor NCR	Major NCR
<del>Underfloor wheel lathe area (Removable of Metal Chips)</del>	<del>5</del>	<del>2</del>
<del>Automatic Train Wash plant Area</del>	<del>5</del>	<del>2</del>
<del>Any other Depot Machinery Area</del>	<del>5</del>	<del>2</del>

~~Note : The compliance and closure of NCR shall be done within 24 hours of date of issue.~~

~~The decision to raise NCRs and the awarded level of severity, shall be decided by CMRL in its reasonable opinion based on a pre-determined audit criteria. A copy of the audit process document shall be shared with the Contractor for an aligned understanding.~~

~~Conditions For Calculating Penalties based on CMRL Inspection KPI Score.~~

- ~~i) The applicable deductions for each month shall be calculated based on CMRL KPI Inspection score obtained from minimum 5 times / month conducted randomly.~~
- ~~ii) The Plan for all scheduled activities for Train Cleanliness, Depot Machinery & Plant cleanliness and Depot Premises Cleanliness shall be submitted CMRL before start of CMC works and approved by CMRL. During execution of the works, in case of any changes to the schedules prior approval from CMRL is mandatory.~~
- ~~iii) Conditions for calculating monthly deductions on such Inspection KPI score is as follows:
 
  - ~~a) Each KPI is categorised into one or more attributes as listed in above table.~~
  - ~~b) Each attribute under a KPI category shall be Inspected.~~
  - ~~c) Scores for all attributes from will be taken directly from Application, for the purposes of calculation.~~
  - ~~d) A minimum of five (5) Inspections would be conducted by CMRL in each month.~~
  - ~~e) Pass percentage for each KPI category for each inspection shall be calculated separately as below~~~~

$$\text{Pass \% of each KPI} = \frac{\text{Total number of attributes passed under a KPI category}}{\text{Total number of attributes under the KPI category}} \times 100$$

- ~~f) The average pass percentage for that month for each KPI category shall be calculated as per the formula below~~

$$\text{Average Pass \% for KPI Category} = \frac{\text{Sum of the lowest five pass percentages calculated at (d) above}}{5}$$

- ~~iv) If average pass percentage calculated at (f) is  $\geq 90\%$  in a monthly cycle, no deduction shall be made for that KPI.~~
- ~~v) If average pass percentage calculated at (f) is  $< 90\%$  in a monthly cycle, a commensurate deduction shall be made for that KPI from the amounts payable to the Contractor, as per the following formula~~

$$\text{Deduction amount for each KPI category} = \frac{\begin{matrix} (100\% - \text{average pass \% of that KPI}) \\ \times \\ \text{Deduction Rate in \% of that KPI} \\ \times \\ \text{Quarterly payment value as per contract*} \end{matrix}}$$

~~\* for KPI 1, KPI 3, KPI 4, KPI 5 & KPI 8 the "Quarterly payment value as per contract" shall be the Price Centre RS-CMC apportioned amount the for respective quarter.~~

~~\* for KPI 2, KPI 6 & KPI 7 "Quarterly payment value as per contract" shall be respective quarter Price Centre DM&P-CMC apportioned amount.~~

- vi) If any critical attribute under a KPI category fails in an Inspection, the pass percentage of that specific KPI category shall be zero for that Inspection in that month.
- vii) Nature of CMRL Inspection shall be by way of Periodic and/or High-Level surprise Inspection, for which the Contractor shall ensure absolute coordination and facilitation.

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#### **1.18 SOFTWARE APPLICATION TOOL FOR CMC PAYMENTS, KPI & PENALTY REGIME**

- 1.18.1 Prior to commencement of the CMC Period, the Contractor shall develop a fully functional, App based Software Application Tool that will be integrated with the AMMS System and will be used to provide governance for the performance of the CMC Works.
- 1.18.2 The App shall be developed by the Contractor in accordance with the requirements in this Chapter and shall be subject to prior approval by CMRL. Development and any reoccurring costs for the application are deemed to be included in the Quoted Price.
- 1.18.3 The App shall be used by both the Contractor and CMRL. User privileges shall be securely demarcated and the role of the user categories shall be broadly as follows:
  - i) Contractor's App Users: shall enter data related to planning and execution of the KPI dependant Works.
  - ii) CMRL's App Users: shall enter details of the inspection / audits.
- 1.18.4 The App shall facilitate the following, but shall not be limited to:-
  - i) Recording of entered data (as well as data fetched from AMMS) in relation to the KPI and Penalty regime.
  - ii) Tracking of scheduled KPI dependant Works vs. Actual Works achieved.
  - iii) Recording of data entered by CMRL during inspection done as part of the audit regime (including image / video capture).
  - iv) Calculation of billing for all CMC Price Centers (including deduction of any penalties).
  - v) Report generation.
- 1.18.5 The Contractor shall not be entitled to submit penalty calculations performed outside of application environment; thus the full rate of penalties shall apply if the Contractor fails to develop the App to produce the requisite calculations once the CMC Period commences.
- 1.18.6 CMRL performance and acceptance parameters shall be incorporated in the App in a checklist format to facilitate CMRL's audits and performance evaluation.
- 1.18.7 All data available in this system is confidential and shall be the property of CMRL. The Contractor shall ensure that the data is also stored in the AMMS system.
- 1.18.8 The Contractor shall ensure that there is a facility to apply changes to the App (if required) to evaluation check sheets and other documents as per the discretion of CMRL, without any additional cost.

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#### **1.19 CMC PAYMENTS**

- 1.19.1 ~~Payments will be made on a quarterly basis subject to the submission of valid invoice / IPA by the Contractor and approval of CMRL.~~  
Whenever, the Contractor successfully completes the works without any Deductions / Penalties based on KPI for three (3) consecutive months' an incentive payment of INR 1,00,000 (One Lakh Rupees) shall be awarded.  
Note: Accrued incentive months will always reset to zero at the end of any period following which the Contractor claims the incentive payment. Hence, the maximum incentive payable within a 12 month period shall be INR 4,00,000 (Four Lakh Rupees).
- 1.19.2 ~~The quarterly payment amounts shall be calculated based on the Price Centre 'RS-CMC' & 'DM&P-CMC' apportionments duly applying the penalties / incentives (available in Part 2-Section 6C) as applicable during the quarter.~~

Whenever, the Contractor gets any Deductions / Penalties of >8% of Quarterly CMC payments for TWO (2) consecutive quarters, then CMRL reserves the right to Terminate the Works in accordance with GCC.

- 1.19.3 ~~Price adjustment as per clause 2 (Table D) & clause 3.2.7 of Part 1, Section IV-Bidding Forms, shall be calculated on the amount arrived at 1.18.2 above (i.e. after application of penalties / incentives as applicable).~~

Payments will be made on a quarterly basis subject to the submission of valid invoice / IPA by the Contractor and approval of CMRL.

- 1.19.4 The quarterly payment amounts shall be calculated based on the Price Centre 'RS-CMC' & 'DM&P-CMC' apportionments duly applying the penalties / incentives (available in Part 2-Section 6C) as applicable during the quarter.

- 1.19.5 ~~Price adjustment as per clause 2 (Table D) & clause 3.2.7 of Part-1, Section IV-Bidding Forms, shall be calculated on the amount arrived at 1.19.4 above (i.e. after application of penalties / incentives as applicable).~~

- 1.19.6 Taxes shall be calculated on ~~1.18.1 & 1.18.2~~ 1.19.4 & 1.19.5 and paid to the authorities by the Contractor.

- 1.19.7 IPA / Invoice shall be raised only for the amount payable considering the above.

- 1.19.8 Taxes will be reimbursed by CMRL to the Contractor subject to the conditions of Contract.

## 1.20 DELIVERABLES

1. Submission of Compliance matrix for entire works (NTP + ~~35~~ 63 days)
2. Submission of Design Submission Programme with all activities for all works (NTP + ~~42~~ 70days)
3. Submission of Master Schedule Programme with all activities for entire works (120 days before Completion of DLP).
4. Submission of a Price List covering all categories of Spares for all categories of CMC Assets shall be submitted during Design Phase. The Key Dates for Final Design Documents (Part-3, Section - VIII Particular Conditions (Part A: Contract Data) shall be considered as final deadline for submission.

## 2. MANAGEMENT OF MAINTENANCE DEPOT

### 2.1 GENERAL

- 2.1.1 Designated Depot(s) were already defined in CMC Chapter-1. This chapter describes the management, safety and handover requirements.
- 2.1.2 All references to “RS Maintenance Depot” within this Chapter refer to the requirements for “Madhavaram Depot” which is the Contractor’s principal site for all maintenance activities.
- 2.1.3 Whereas, references to Designated Depot(s) shall be taken to mean both Madhavaram Depot as well as Satellite Depot(s).
- 2.1.4 A tentative layout of Madhavaram Depot is attached in Part 2 Section VIA – Appendix D. Demarcations of jurisdiction within the depot site shall be finalized during the Joint Survey to be conducted as specified in clause 2.2.1 below.
- 2.1.5 CMRL shall handover the RS Maintenance Depot to the Contractor in order to fulfil its contractual obligations throughout the DLP and CMC Periods of the Works.
- 2.1.6 Upon Termination or expiry of Contract period, the Contractor shall hand back the RS Maintenance Depot according to the terms of the Contract.
- 2.1.7 Broadly the RS Maintenance Depot shall include Stabling Bay Lines (SBL), Inspection Bay Line (IBL), Cleaning Sheds and Repair Bay Lines (RBL) for heavy repairs and overhaul as illustrated in Part 2 Section VIA – Appendix D
- 2.1.8 Depot Machinery & Plant facilities are deliverables of the Contractor and are already specified in Part-2 Section VI B ERTS-DM&P However, for avoidance of any doubt, any additional machinery or plant facilities required to perform maintenance of CMC Assets shall be provided by the Contractor at his own cost.

### 2.2 HANDING OVER OF RS MAINTENANCE DEPOT (CMRL TO THE CONTRACTOR)

- 2.2.1 Handover Date and Joint Survey
  - i) The RS Maintenance Depot shall be handed over to the Contractor no later than 30 Days prior to delivery of the Prototype Trainset, subject to satisfactory completion of the formalities set out in the CMC Contract.
  - ii) CMRL 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. The joint survey inspection shall be carried out at least 60 days prior to delivery of the Prototype Trainset.
  - iii) The format of the Joint Survey report shall be prepared by the Contractor and submitted for CMRL’s review at least 30 days prior to the agreed date for the joint survey inspection.
  - iv) During the Joint Survey, the Contractor shall undertake a complete assessment of the RS Maintenance Depot. Any observations/remarks shall be discussed and recorded in a Joint Survey Report, a copy of which shall be provided to both Parties.
  - v) Within 7 (seven) days of receipt, both parties shall acknowledge and sign the Joint Survey Report. If either Party fails to acknowledge the findings within the time specified period, the Joint Survey Report shall be deemed to have been accepted and will be final and binding on the Parties.
  - vi) Utility 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.
- 2.2.2 Provision of Office Accommodation
  - i) In accordance with Part 2 Section VIA Clause 18.13.2 the Contractor shall be responsible for construction of site offices and stores.
  - ii) The Contractor shall ensure that the facilities constructed are of a sufficient size to provide office desks for 15 CMRL staff within the RS Maintenance Depot.

### 2.2.3 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 2.2.1 above and in accordance with the conditions of this Chapter and the terms of the Contract.
- ii) The Contractor shall have the right to use the RS Maintenance Depot in accordance with the provisions of this Contract.
- iii) The Contractor shall not use the RS Maintenance Depot for purposes other than the Works specified in the Contract.

## 2.3 MAINTENANCE OF RS MAINTENANCE DEPOT

### 2.3.1 Maintenance obligations of the Contractor

- i) The Contractor shall provide trained personnel that are competent to maintain the CMC Assets as well as the working environment of the Designated Depot(s). Refer to clauses 2.5 and 2.6 of this Chapter regarding day-to-day work management.
- ii) At all Designated Depot(s), the Contractor shall be solely responsible for all day-to-day operations in the performing the maintenance of CMC Assets and shall be responsible to ensure that safe systems of work for the whole of the Works. All staff shall duly observe the Safety Health & Environmental Manual of CMRL.
- iii) At the RS Maintenance Depot only, the Contractor shall be responsible for the complete cleaning of all areas of the facility (including deep cleaning) that are handed over to the Contractor during the Contract Period. This scope shall include waste management.
- iv) It is clarified that all other scope (besides cleaning) of building maintenance and facilities management required at the RS Maintenance Depot shall be undertaken by CMRL.
- v) The Contractor shall also be responsible for general housekeeping / cleanliness following any undertaking of Works at other Designated Depot(s) besides the RS Maintenance Depot.
- vi) The Contractor shall provide Blocks in the RS Maintenance Depot as requested by CMRL in a planned manner by giving a notice to the Contractor in accordance with clause 2.3.2.(v) below, without affecting the Required Availability of the Available Trainset.
- vii) The Contractor shall optimize the consumption of the water required for maintenance and other Project activities. Considering the scarcity of the water resources at present & in future, the Contractor by all innovative means shall progressively make efforts to limit the water consumption.
- viii) The Contractor, in order to optimize available resources and maximize reliability and Availability of CMC Assets, shall install a proven web-based Asset Management System (which is covered in detail in chapter 5 of Section VI C AMMS), e.g. SAP, Maximo, Trimble E2M / R2M, etc. for comprehensive management of all physical assets on a common platform with key features mentioned below but not limited to:
  - 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 the Contractor's personnel. However, CMRL 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 / BCC / OCC / PPIO and at any other CMRL offices through the internet.

- ix) The Contractor shall provide access to Rolling Stock and the RS Maintenance Depot to CMRL's representatives and any other person authorized by CMRL for undertaking cab foot plating,



conducting periodical current collection tests and any other activities of CMRL in the line and on the depot assets that are in control of CMRL and have not been handed over to the Contractor.

- x) The Contractor acknowledges that CMRL shall provide the security for the entire perimeter and at the entry / exit points of the Designated Depot(s). CMRL will also provide security at various locations within designated Depot premises based on any additional requirements which may arise. The Contractor shall liaise with CMRL security for providing access/entry pass for the Designated Depot(s).
- xi) Notwithstanding Clause 2.3.1 ix, CMRL accepts no liability for loss, theft or damage of the Contractor's assets stored at the Designated Depot(s). The Contractor shall make its own determination as to the extent of any additional security personnel which may be needed and procure the services at its own cost.
- xii) The Contractor shall comply with the Safety requirements as set out in 2.7 of this chapter.
- xiii) The Contractor shall ensure coordination with CMRL's Representative (PPIO) 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 CMRL at depot. The Contractor shall be responsible for deployment of competent personnel for:
  - (a) Safe operation of the traction and auxiliary power supply system.
  - (b) Safety of all persons including CMRL personnel and any 3<sup>rd</sup> party at RS Maintenance Depot.

#### 2.3.2 Maintenance obligations of CMRL

- i) 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 CMRL.
- ii) CMRL 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 CMRL before handing over to RS Maintenance Depot.
- iii) CMRL from Operational Control Centre (OCC) and through its personnel(s) at Depot Control Centre (DCC) shall coordinate the movement of Rolling Stock as part of the overall operational management.
- iv) The head of CMRL's team at DCC shall be the overall in charge for coordination between the Contractor's staff and OCC for finalizing the return of Rolling Stock to Designated Depot(s) as well as matters such as timetabling and planning of maintenance Blocks.
- v) CMRL shall make efforts to ensure that maintenance Blocks taken at Designated Depot(s) do not cause hindrance in the Availability of Trainsets by the Contractor.
- vi) All maintenance works related to Traction, S&T installations and Track Installation including all its fittings shall be undertaken by CMRL in a planned manner with intimation to the Contractor being provided in advance; so far as it is reasonably practicable. The Contractor shall ensure required Availability of Rolling Stock is not affected by CMRL's maintenance activities; except for when extenuating circumstances arise such as unplanned maintenance outages at short notice to resolve unsafe or emergency conditions. In such a scenario no Damages shall be levied on the Contractor if the Required Availability of Rolling Stock is not met.
- vii) CMRL 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.
- viii) CMRL shall, as far as is reasonably practicable, allow preference to Rolling Stock maintenance activities; to the extent required to ensure the availability of Rolling Stock for revenue service shall be met.
- ix) CMRL 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 Designated Depot(s). CMRL shall make efforts that any unscheduled maintenance activities, if taken, should be limited to at most one line/bay.

- x) CMRL shall undertake the civil and electrical maintenance in the ETU building.
- xi) In case of any maintenance related dispute, the Parties shall refer such dispute to CMRL 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 20.

## 2.4 HAND BACK OF RS MAINTENANCE DEPOT

### 2.4.1 General

- i) Not less than 3 (three) months prior to the expiry of the CMC 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 CMRL shall conduct a joint inspection of the Depot premises before the hand back of Maintenance Depot and facilities from the Contractor to CMRL.
- ii) 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. CMRL shall review the joint inspection report in line with the Joint Survey Report and the Contractor shall remove any discrepancy noted by CMRL upon review.
- iii) 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 prior to the date of Termination or expiry of the Contract Period:
  - 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 spares as per the latest approved list under shall be replenished by the Contractor and handed back to CMRL in working condition at least three (3) months prior to termination or expiry of the CMC Period at no cost to CMRL; in accordance with Chapter 4 -Handover Requirements of Section VI C CMC.
  - 2

 c) ~~A Minimum of 25% maintenance staff and supervisor of the Contractor shall be transferred to CMRL payroll after expiry of Comprehensive maintenance contract to ensure continuity and quality of maintenance of the train till alternative arrangements are made by CMRL. The selection procedure shall be finalized jointly by CMRL and Rolling stock Contractor.~~  
~~To safeguard its succession plan for maintenance; CMRL reserves the right to offer of employment to any of the Contractor's maintenance workforce (regardless of their level of seniority) prior to cessation of the CMC Period. The Contractor shall not impede CMRL's selection process or object to the transfer of any staff willing to join CMRL and/or Subcontracted organization.~~
  - d) All information technology (IT) systems and equipment shall be in working condition.
  - e) The Contractor shall deliver to CMRL 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 favor of CMRL have been thus novated.
  - g) The Contractor executes such deeds of conveyance, documents and other writings as CMRL 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 CMRL or its nominee; and
  - h) The Contractor shall submit the Hand back Package to CMRL, as specified in sub-clause 2.4.2 below.

### 2.4.2 Hand back Package

- i) The Contractor, at the time of Termination or expiry of the CMC Period, shall ensure that the Hand back Package contains, at a minimum, the following information:
  - 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, formats to be agreed mutually between Contractor and CMRL.
  - 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:
    - 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
    - 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.

## 2.5 MAINTENANCE DEPOT

### 2.5.1 Maintenance Depot

- i) 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.
- ii) The RS Maintenance Depot part of the Depot Site shall be handed over by CMRL to the Contractor in accordance with this chapter.
- iii) The Contractor shall be responsible, at its own cost (inclusive of manpower and any other expenses), for any upgradation (if required), operation and maintenance of all infrastructure in its custody at 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 CMRL.

### 2.5.2 Maintenance and upkeep of RS Maintenance depot

- 1 i) During its period of custody, 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 ~~area allocated to the Contractor in the RS Maintenance Depot.~~

- ii) The Contractor shall operate the maintenance facilities and install and maintain any equipment necessary for performing its maintenance obligations required by this Contract.

#### 2.5.3 Inspection of Maintenance depot

- i) The Contractor shall acknowledge that CMRL and/or Railway Statutory Authority may at any time during the Contract Period inspect:
  - a) Designated Depot(s).
  - b) conduct safety inspection at Designated Depot(s).
  - c) competency of staff employed by the Contractor for the maintenance of Rolling Stock and
- ii) 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 CMRL or Railway Statutory Authority.

### 2.6 PROGRESS PLANNING & INVESTIGATION OFFICE (PPIO) AND ROLLING STOCK CONTROLLER (RSC)

#### 2.6.1 Coordination between the Contractor, PPIO and RSC is outlined as follows: -

- i) 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.
- ii) PPIO shall be manned by CMRL's staff. However, CMRL shall monitor this Contract, for availability reconciliation and other co-ordination activities.
- iii) All maintenance work on CMC Assets including testing, trial & modifications shall only be carried out after a job card has been issued by PPIO. Thus, PPIO shall act as a single point of contact within CMRL for all Depot and Train operational matters.
- iv) The Contractor shall plan well in advance for planned maintenance, cleaning, inspection, Modifications etc. of trainsets and coordinate with PPIO / DDC as required. The Contractor shall be informed if trains are not returning back to depot as per the scheduled time.
- v) The Contractor shall certify the fitness of trains being offered as available for revenue service through PPIO / DDC.
- vi) Operational Control Centre (OCC) staff are responsible for train operations on the mainline, whereas Depot Control Centre (DCC) staff are responsible for train operations at the Depot. Both shall be manned by CMRL staff (or its Operations Contractor) who shall be responsible for all movement of trains to & from depot.
- vii) Shunting within RS Maintenance Depot shall be the responsibility of the Contractor in coordination with DCC. The Contractor's shunter shall be used for this purpose.
- viii) Rolling Stock Controller (RSC) as a part of OCC shall be deployed by CMRL round the clock at OCC for managing the rolling stock operations online including line failures.
- ix) 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 revenue service, scheduled maintenance planning and line failures of train.
- x) RSC shall inform PPIO of any failures arising on the mainline and may request deployment of PREB teams to attend defects in person, or otherwise provide advice to operations staff.
- xi) Response to failures attended on the mainline (including emergencies and/or train rescue), shall be coordinated under the guidance of the RSC. The Contractor is therefore obliged to follow all reasonable instructions given by RSC during deployment to the mainline.

#### 2.6.2 Information available at PPIO

- i) PPIO shall collate (and display) all relevant and up to date information about the status of trainsets held on the Depot.
- ii) 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.

- iii) PPIO shall seek updates from the RSC at regular intervals regarding mainline failures, train arrival / departure particularly during off peak hours for fault rectification, minor maintenance, modification etc.
- iv) PPIO shall obtain and record details of any action taken by RSC staff when attending incidents on the main line.
- v) PPIO shall have the list of personnel (with mobile / contact no) in hierarchy order of CMRL Land Contractor staff to be contacted during any emergency situation.
- vi) PPIO shall maintain train logbook register, communication register, (communication with RSC / DCC / Supervisors / Departments / Officers), Instruction register (from Officers / Failure Management / Depot Management / Procedure / Material Management), shift diary, shunting Register (from- to with reason, train, time, shunting request to DCC) etc.
- vii) A Maintenance schedule, train withdrawal plan, job cards etc. will be generated by PPIO through the AMMS system supplied and installed by the Contractor. The Contractor shall provide all necessary AMMS competency training for PPIO staff.

## 2.7 SAFETY REQUIREMENTS

### 2.7.1 Safety Requirements

- i) The Contractor shall develop, implement and administer a safety program for providing a safe environment on or about the Rolling Stock, 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'.
- ii) Safety Requirements shall apply during all phases of Works including delivery and DLP periods.

### 2.7.2 Obligations of the Contractor

- i) The Contractor shall abide by the following to ensure safety of the Rolling Stock 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 CMRL and Railway Statutory Authority from time to time.
  - d) provisions of this Contract.
  - e) relevant safety standards/guidelines contained in internationally accepted codes; and
  - f) Good Industry Practice.
- ii) 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.
- iii) The Contractor shall be responsible for undertaking all the measures under its control to ensure the safe operation of Trainsets and safety of all its personnel.
- iv) The Contractor agrees that CMRL or CMRL'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.
- v) 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 an 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 CMRL or any third party for any losses incurred as may be determined by the Railway



Statutory Authority.

- vi) If the Railway Statutory Authority enquiry, in case of an Accident found to be occurred on account of any Fault, CMRL 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.
- vii) The Contractor shall extend all necessary data, information and cooperation to the Railway Statutory Authority at the time of enquiry about an Accident. If the Contractor does not cooperate with the Railway Statutory Authority, then CMRL 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 CMRL shall be entitled to terminate the Contract forthwith.

#### 2.7.3 Safety Requirements for the Trainsets

- i) 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.
- ii) The Contractor shall ensure that any interruption of operations of the Trainsets is remedied promptly without undue delay.
- iii) The Contractor shall ensure that all the safety obligations at 2.1, are strictly complied with. Compliance shall also be monitored by CMRL and a breach by the Contractor of its obligations in respect of this Chapter identified by CMRL 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.

#### 2.7.4 Safety measures during upgradation

- i) 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 relevant safety standards as mentioned in the contract.

#### 2.7.5 Annual Safety Report

- i) The Contractor shall submit to CMRL before the 31st (thirty first) May of each Accounting Year, an annual report in containing, without limitation, a detailed listing and analysis of all Accidents occurring on account of Rolling Stock and/or in the Deposit 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").
- ii) Once in every Accounting Year, a safety audit shall be carried out by CMRL. It shall review and analyze the Annual Safety Report and Accident data of the preceding Accounting Year and undertake an inspection of Rolling Stock and Project Assets. CMRL shall provide a safety report recommending specific improvements, if any, required to be made in Rolling Stock and Project Assets. Such recommendations shall be implemented by the Contractor in accordance with Safety Requirements, Specifications and Standards and Applicable Laws.

#### 2.7.6 Accident

- i) 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 CMRL during any enquiry conducted by CMRL and shall follow the Accident reporting requirements.

#### 2.7.7 Relief and Rescue Vehicle (RRV) with Re-railing & Rescue Equipment (RRE)

- i) The Contractor shall maintain appropriate Re-railing and Rescue Equipment (RRE) at the Designated Depot(s) in a box container that is loaded on a Relief and Rescue Vehicle ("RRV").
- ii) The RRV / RRE is intended to attend any eventuality of accident, unusual occurrence or any other incident requiring the lifting of one or more trainset axles to clear the Mainline (or Tracks within a designated Depot) and to facilitate a prompt rescue of stranded passengers.
- iii) CMRL and/or the Railway Statutory Authority may, at its sole discretion, inspect the RRV / RRE



and their associated procedures to assess its suitability and effectiveness to respond to any foreseeable mainline incidents. Any improvement notices issued following an inspection shall be binding on the Contractor.

- iv) The RRV / RRE shall be maintained by the Contractor such that it is always available and ready to deploy.
- v) The Contractor shall ensure a sufficient number of RRV / RRE trained personnel are always available, on all shifts for prompt attendance of any incident.

### 3. OPERATION PLAN

#### 3.1 MASTER TRAIN OPERATION PLAN

- 3.1.1 CMRL 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).
- 3.1.2 The Contractor shall offer trains for revenue service as per the details of the Master Train Operation Plan. Train fitness management and induction from depot to main line is briefly explained as follows:
- a) The Contractor shall declare the fitness of the trains to DCC at least 30 minutes before departure of first train induction on main line as per time table.
  - b) No train shall be offered as “ready” by the Contractor for revenue Service unless it has been tested and checked for all safety and functional aspects and the same has been duly documented. CMRL reserves the right to randomly spot check all types of documents related to the activities involved in declaration of fitness.
  - c) On receipt of train fitness, DCC shall allow train for induction to revenue service on main line. In case of UTO operation, the Contractor shall finalize the train withdrawal and induction plan in consultation with OCC / DCC.
  - d) At the time of declaring the fitness, the Contractor shall advise PPIO / DCC of any pending maintenance requirements to maximize the opportunity of planning the return of trains during off-peak hours with minimal timetable changes.
  - e) No maintenance activity is permitted on train, after train fitness is conveyed to DCC.
  - f) No train shall be allowed into revenue service with a pending defect; except where it is already agreed in accordance with Clause 3.3.3, Availability Requirements or where PPIO has granted permission in advance due to special circumstances.
  - g) Shunting Operations within depot (all vehicle types excluding CMV) shall be undertaken by the Contractor in coordination with DCC. The Contractor shall ensure that an adequate number of trained staff are always available for shunting requirements.
  - h) Trainset induction to and/or reception from the mainline shall be performed by CMRL's Train Operator; within the confines of the UTO controlled sections of Designated Depot(s).
  - i) Mainline train operations of trainsets shall be performed by CMRL's train operator, however, in cases where trainsets are under dynamic test, the Contractor shall provide technical support as requested by CMRL.
  - j) A sample Train Operation Plan is shown in Table 3-1 of this chapter.
  - k) A sample Timetable of train induction and revenue service is shown in Table 3-2.
  - l) Detailed joint procedure order(s) for train operational interface between CMRL and the Contractor shall be made after award of Contract.
- 3.1.3 The Contractor shall not deviate from the Master Train Operation Plan in providing the Available Trainsets during the relevant week.
- 3.1.4 In the event that a Replacement Trainset is provided by the Contractor to CMRL in accordance with Chapter-3 of Section VI C RS-DMP the Contractor shall promptly but no later than providing such Replacement Trainset, notify CMRL of the Trainset identification number of such Replacement Trainset.
- 3.1.5 The entire process pertaining to monitoring of Train Operation Plans shall be administered.

**Table 3-1 : Train Operation Plan**

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
4am to 5am			
5am to 6am			
-----			
10pm to 11pm			
11pm to 12am			
Total No. of train trips per direction per day			

**Table 3-2 : Metro Time Table**

Metro Time Table ( From -To )												
Train no	Depot departure	Service starts from		Service last from		Depot arrival	Remarks	No. Of trips as per time-table				Notes
		Station name with up/dn	Time	Station name with up/dn	Time			Section (from- to)	Length (in kms)	Trips	Total kms	
												1. AVERAGE SPEED  KMPH. 2. Other Details, if any
								TOTAL		0	0	

REVERSAL TIME AT TERMINALS	STATION	MORNING	OFF PEAK	EVENING	STEPBACK
SECTION with UP/DN RUN TIME					
RUN TIME INCLUDING DWELL TIME	From - To	DN LINE			
		UP LINE			

NO. OF RAKES IN REVENUE SERVICES				__Morning/ __Afternoon/ __ Evening			STABLING TRAIN ID		
HEADWAY	SECTION	TIME SLOT		HEADWAY			TRAIN NO	LOCATION	TIME
				AVERAGE	MINIMUM	MAXIMUM			
	From - To	PEAK HOUR							
		OFF PEAK							

### 3.2 FAILURE CLASSIFICATION

3.2.1 Failures that require subsequent verification or maintenance or corrective action shall be as below:

- 1 a) **Type 1 / Service Failure:** Failures that result in a service operational delay of a specific train for more than 2 minutes at any location of the mainline or during induction from depot to the mainline of CMRL Phase 2 Network. This category of failures also includes an unscheduled withdrawal of a trainset from revenue service.

A list of anticipated scenarios which may lead to an unscheduled withdrawal is provided in Appendix I of Part 2 Section VIA). ~~When such failures occur, it shall be considered as a Type 1 failure event even if CMRL was unable to successfully withdraw the train from service due to operational constraints.~~ It is clarified that when such failures occur, the incident will not be categorised as a Type-1 / Service Failure if the train had continued running until the end of service without affecting punctuality.

- b) **Relevant Failure:** A relevant failure of an item is an independent failure which results in a loss of function of that item as a result of a fault/defect in an equipment or sub-system of the train while operating within its design and environmental specification limits or a maintenance error by the Contractor in undertaking its obligations during CMC period. Improper operation, maintenance, or testing of the item as a result of erroneous documentation supplied by the Contractor or Failures of transient nature (including those with post investigation status as 'No fault found'), shall be considered as a relevant failure if in the opinion of CMRL these are attributable to rolling stock. The decision of CMRL shall be final.
- c) **Non-relevant Failure:** Any failure of an item not included in the definition of relevant failure such as, a failure caused by malfunction of any other equipment or subsystem not supplied by the Contractor or a failure caused by human error which was not the fault of the Contractor (as defined by the criteria for a Relevant Failure), a failure caused by accidents not associated with the normal operation of the item (E.g. a collision or striking a foreign object on the right of way) or a failure caused by operating the equipment or sub-system outside of design or environmental specification limits.

3.2.2 Definitions:

- a) **Withdrawal Scenario:** The train withdrawal scenario described in Appendices I of Section VI A Part 2 and includes possible anticipated failure scenarios which can affect safety, punctuality and passenger comfort. Reasonable changes to the list can be proposed by the Contractor for CMRL's consideration.
- b) **Pattern Failure:** Repeated occurrence of three or more relevant failures of the same replaceable part, item or equipment in same manner in identical or equivalent applications when they occur at a rate which is inconsistent with the predicted failure rate of the part, item or equipment. The detailed methodology for identification of pattern failures shall be finalized during the design stage. The decision of the CMRL shall be final.
- c) **Deboarding:** Any failure attributable to the Contractor resulting in passenger de-boarding in mid-section or any station.

- d) Train Operation Plan (TOP): Operation plan for train placement and withdrawal from the mainline in planned manner to meet the traffic requirements.
- e) Train Running Timetable: Timetable for the running of trains based on the TOP.
- f) Depot Control Center (DCC): The organization in overall charge of controlling the movements of trains inside the depot as well as controlling the movements of trains coming inside or going outside the depot from the main-line
- g) Operation Control Center (OCC): The organization manned by CMRL and overall responsible for controlling the movements of trains on the main-line
- h) Depot PPIO: A centralized cell to be manned by CMRL, responsible for overall co-ordination with respect to train maintenance, arrival, departure, power block co-ordination and single point contact with CMRL for day to day working of depot.
- i) Train Handover Point: Refer Procedure in chapter 4.
- j) Available Trainset: Refer clause 3.3.4 (a) of this chapter
- k) Non-Available Trainset: Refer clause 3.3.5.3 of this chapter
- l) Revenue Service: Passenger services on the main line
- m) Penalty / damages shall be imposed on the Contractor in line with the scenarios defined in Tables 3-4 and 3-5. Penalties for non-achieving of availability targets and penalties for service affecting failures may be simultaneously imposed if both arise within the same quarterly payment period.

### 3.3 AVAILABILITY DURING CMC PERIOD

#### 3.3.1 RS Availability Requirements

Definitions:

- a) Commercial / Revenue Hours of Operation: This defines the period when trains are expected to run according to a timetable to convey passengers. It is expected that this shall ordinarily be between 04:00 hrs - 00:00 hrs However, CMRL may at its sole discretion apply minor changes to the start / end times to allow for flexibility in the timetable. The Contractor shall be notified of such change with at least 24 hours of advance notice.
- b) Non-Revenue Hours: Defines the period when trains are not required to convey passengers and is expected to be between 00:00 hrs - 04:00 hrs.
- c) Morning Peak Hours: Defines the anticipated morning rush hours, during which shorter headways will be planned. It shall ordinarily be between 08:00 hrs - 11:00 hrs on Weekdays.
- d) Evening Peak Hours: Defines the anticipated evening rush hours, during which shorter headways will be planned. It shall ordinarily be between 17:00 hrs - 20:00 hrs on Weekdays.
- e) Peak Hours: Shall be taken to mean either Morning Peak Hours, Evening Peak Hours or the combination of both as the case may be. CMRL may at its sole discretion apply minor changes to the nominal Peak Hours to respond to changes in passenger demand. The Contractor shall be notified of such change with at least 24 hours of advance notice.
- f) Availability shall be assessed by the following measure:

$$\% \text{Availability} = \left( 1 - \left( \frac{\text{DT(SC)} + \text{DT(OPM)} + \text{DT(CM)}}{\text{Total Time}} \right) \right) \times 100$$

Total Time Where:

- i) Total Time is the time in hours during the assessment period multiplied by the total number of trains of the fleet.
- ii) DT (SC), or Down Time due to service checks, is the total down time in hours due to service checks summed over all the trains during the assessment period.
- iii) DT(OPM), or Down Time due to Other Preventive Maintenance, is the total down time in hours due to Preventive Maintenance other than service checks, summed over all sessions

carried out on all trains during the assessment period.

- iv) DT (CM), or Down Time due to Corrective Maintenance, is the total down time in hours due to corrective maintenance or retrofit modifications in trains, summed over all sessions carried out on the trains in revenue operation during the assessment period. Any unreasonable delay in handing over the train for repairs for reasons not attributable to the Contractor shall be excluded. Time spent on train integrity inspections after train reformations arising from corrective maintenance work shall be included.
- v) Not used.
- vi) DT(CM) shall be counted starting from the moment when the defective train is handed over to the Contractor and shall end when the train is restored to service condition.
- vii) The down times DT (SC), DT (OPM) and DT (CM) shall also cover the full content of the maintenance work concerned, including safety precautions, inspections, servicing, replacement of equipment, defect detection and rectification, testing and restoration to service condition.

### 3.3.2 RS Availability Targets

- a) The Contractor shall ensure that Trains are offered and made available for operation at the respective Depot as per the Train Operation Plan and in accordance with the procedures agreed upon during execution phase. The entire process pertaining to monitoring of Train Operation Plans shall be administered through DCC / PPIO. Detailed procedures for placement and withdrawal of the Trains, daily availability monitoring of trains and anything necessary to apply the above-mentioned requirements shall be finalized and agreed during the execution phase.
- b) CMRL shall prepare the monthly Train Operation Plan (TOP) indicating the scheduled placement and withdrawal timings of Trains from the train handover point and inform the same to the Contractor at least 7 (seven) days before start of each month.
- c) In some emergency / festive scenarios, TOP can be changed subject to condition that it will be informed to the Contractor at least 24 hours in advance and for not more than 15 days in a calendar year.
- d) At the time of major maintenance such as major overhaul of trains, the availability targets as applicable will be revised by CMRL, decision of CMRL shall be final and binding.
- e) The fleet of trains supplied shall achieve a minimum average availability target of 95.0% overall for the assessment durations mentioned in clause 3.3.3 in this chapter.

### 3.3.3 RS Availability Demonstration during CMC period

- a) The availability of trains shall generally be more than 95% during CMC period.
- b) The average availability of the trains shall be assessed during CMC period under the Contract. The total down times for all trains shall be collected by the CMRL on monthly basis, and the average availability during the preceding three (3) months (assessed quarterly of respective year) shall be worked out from the above-mentioned formula in clause 3.3.1 (f) of this chapter.
- c) The assessment period for the availability calculation shall be scheduled from the actual date of start of CMC Works and assessed separately for each quarter of respective year for the entire duration of CMC period. The Contractor shall submit monthly reports and the calculation of availability demonstration as below,

$$AD_Q = (AD_1 + AD_2 + AD_3) / 3$$

Where  $AD_Q$  is the average availability demonstration of the monthly score  $AD_1$ ,  $AD_2$ ,  $AD_3$ .

- d) If the availability target mentioned in clause 3.3.2 (e) is not achieved for any assessment period duration, availability penalty/damages is applicable as per clause 3.3.4 of this chapter.

### 3.3.4 RS Availability Damages:

- a) Trainsets shall be considered as 'Available' provided they are offered for revenue service at least 30 minutes prior to the scheduled departure time as per the Train Operation Plan.



As far as reasonably practicable, no trainset shall be inducted on mainline with a defect, the Contractor may however, prepare and submit the list based on previous experience for CMRL review and acceptance.

b) Penalty / Damages on not meeting Availability targets:

Penalties for not meeting Availability targets shall be imposed on the Contractor through a reduction of the certified payment for Price Center RS-CMC. Availability performance shall be calculated on a Monthly basis. The assessment period against the targets defined in Table 3-4 shall be on a quarterly basis throughout the entire CMC period.

**Table 3-4: RS Availability target penalty/damages**

SL No.	Availability target	Penalty / Damages
1	> 95%	No penalty shall be imposed during the respective quarter when this target is met.
2	> 93% to ≤ 95%	0.5% Penalty on the respective quarter Price Center RS-CMC apportioned amount.
3	> 90% to ≤ 93%	1% Penalty on the respective quarter Price Center RS-CMC apportioned amount.
4	≤ 90%	2% Penalty on the respective quarter Price Center RS-CMC apportioned amount. If availability AD <sub>Q</sub> is ≤ 90% consecutively for 3 (three) times, the CMC Works is liable for termination as per the provisions of GCC.

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**3.3.5 RS Penalties on Service Failures**

3.3.5.1 Penalties on account of service failures: If train is withdrawn from service as per withdrawal scenario present in Appendices I of Section VI A Part 2 then penalty shall be imposed as per Table 3-5.

3.3.5.2 Trainset available with delay: A Trainset shall be considered as available with delay if such Trainset is offered with a delay such that it affects its scheduled departure time as per the Train Operation Plan. Availability damages in such cases shall be as per the Number of trip(s) delayed / cancelled as defined in Table-3-5 below. CMRL shall return the trains as per TOP ordinarily.

3.3.5.3 Non-Available Trainset: A trainset can be classified as non-available if the Contractor is already accruing penalties outlined in SL No. 3 of Table-3-5 or is attending to a fault/defect (service failure/relevant failure) in the train(s) that are attributable to the RS Contractor.

3.3.5.4 Detailed list of different conditions and corresponding penalty / damages which shall be levied on the Contractor are outlined below.

**Table 3-5: RS Service Affecting Failure**

SL No.	Conditions	Penalty / Damages per incident (Figures in INR)
1	Passenger De-boarding & Train withdraw in mid-section due to train immobilization	20,00,000
2	Passenger De-boarding & Train withdrawn at station due to train immobilization	15,00,000
3	Passenger De-boarding at any Station, but train not immobilized	1,00,000
4	Train withdrawn at terminal Station during Peak Hour	20,000
5	Train withdrawn at terminal Station during Non-	10,000

SL No.	Conditions	Penalty / Damages per incident (Figures in INR)
	Peak Hour	
6	>2 minutes ≤5 minutes (Trip Delay)	10,000 per trip delay
7	>5 minutes	20,000 per trip delay
8	Trip Cancellation	75,000 per trip cancellation

**Note:**

1. Penalty / Damage figures shall prevail for the entire CMC Period.
2. Where a failure arising on a single trainset causes scenarios 1 – 5 to occur on multiple Trainsets; only one penalty shall be imposed on the Contractor derived by the scenario attracting the highest penalty amount.
3. Delays shall be calculated according to the time deviation from Timetable recorded at the destination station (one-way trip). CMRL judgement shall be final and binding on the RS Contractor.
4. In case of partial trip cancellation, penalty corresponding to 8 of table 3-5 shall be applicable on pro-rata basis.
5. The damages mentioned above are calculated on a per train incident basis and shall be recovered by deduction from the certified payment amount for Price Center RS-CMC.
6. Escalation of 5% compounded annually shall be applicable for the figures mentioned under Penalty / Damages from the Commencement date of the Contract.

3.3.5.5 Penalties as defined in Table 3-5 shall not be applicable to the RS Contractor for delay / withdrawal / de-boarding due to faults in equipment which are maintained by CMRL or other designated Contractors viz. Signalling, Telecom etc.

3.3.5.6 Incorrect troubleshooting by Train Operators / Attender / Station Controller shall not relinquish the Contractor from failure attribution.

**3.3.6 DM&P Availability Target**

3.3.6.1 Penalties for not achieving availability target:

For cases where the Availability of a machine falls short of the Minimum Guaranteed Availability target, the following Penalties shall be levied as calculated over each quarterly payment period

Table 3-6: DM&P Availability Penalty calculation

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Sl. No	Availability Slab	Applicable Penalty % for each category ( <del>as % of the quarterly contract price against Apportionment for calculating Penalty table</del> )
1	> 95%	No penalty shall be imposed during the respective quarter when this target is met.
2	> 95% to ≤ 85%	<del>0.5% for every 1% (or part thereof) reduction in availability of machine below 95%</del> 0.50% Penalty on the respective quarter Price Center RS-DM&P apportioned amount
3	> 85% to ≤ 75%	<del>0.75% for every 1% (or part thereof) reduction in availability of machine below 85% + Amount calculated as in Sr No 1 for availability of machine up to 85%.</del> 0.75% Penalty on the respective quarter Price Center RS-DM&P apportioned amount
4	≤ 75%	<del>1% for every 1% (or part thereof) reduction in availability of machine below 75% + Amount calculated as in Sr No 1 and 2 for</del>

		availability of machine up to 75%. 1% Penalty on the respective quarter Price Center RS-DM&P apportioned amount
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**Minimum Guaranteed Availability target calculation**

- A. Total days in the Quarter:  
 B. Standard down days for preventive maintenance (in days/quarter):  
 C. Total Plant Down Time due to Breakdown including response time for break down (in days):  
 D. Guaranteed Availability for the quarter (in days) : (A - (B+C))

Actual availability in %age = (D / A) x 100:

Note : Availability of the DM&Ps shall be calculated against each quantity of each machine.

3.3.6.2 Category (VITAL- DM&P-Q&R)

- Automatic Train Wash Plant,
- EOT Crane,
- Under Floor Wheel Lathe
- Battery Operated Rail Cum Road Shunter
- CMV
- Pit Jacks for 3 car length
- Diesel Operated Rail Cum Road Rescue Vehicle
- Vertical Storage System

Note : For this category, the Penalty shall be calculated on 60% of DM&P-CMC Price Centre from Quarterly amount.

3.3.6.3 Category (ESSENTIAL – DM&P-Q & R)

- SYNCHRONISED MOBILE LIFTING JACKS FOR 3 CAR LENGTH
- CAR BODY STANDS FOR 3 CAR LENGTH
- BOGIE WASH PLANT
- BOGIE TESTING UNIT / BOGIE TEST STAND
- Pallet truck

Note : For this category, the Penalty shall be calculated on 40% of DM&P-CMC Price Centre from Quarterly amount.

3.3.6.4 Category (DESIRABLE – DM&P-Q)

- BOGIE FRAME MANIPULATOR/ROTATOR
- BOGIE TURN TABLE
- WHEEL PROFILE MEASURING SYSTEM-WPMS (WAY SIDE)

Note : For this category, the Penalty shall be calculated on 20% of DM&P-CMC Price Centre from Quarterly amount.

3.3.6.5 Category (TYPE 2 – DM&P: R)

Complete list of items under Table 1-2 of Part 2 – Section VIB (Chapter 1).

Excluding Vertical storage system and pallet truck

Note : For this category, the Penalty shall be calculated on 10% of DM&P-CMC Price Centre from Quarterly amount.

3.3.6.6 Category (TYPE 3 – DM&P-T)

Complete list given under Table 1-2 of Part 2 – Section VIB (Chapter 1).

Note : For this category, the Penalty shall be calculated on 5% of DM&P-CMC Price Centre from Quarterly amount.

### **3.4 OPERATION OF DEPOT MACHINERY & PLANT:**

- 3.4.1 Operation of the Depot Machinery & Plant (excluding CMVs operation) shall be under the Contractor's scope throughout DLP and the CMC period. The Contractor's Operational staff shall be available at the premises of the designated Depot(s) round the clock. The price towards the operation of Depot Machinery & Plant is deemed to have been included in quoted price.
- 3.4.2 In addition to the above, the Contractor shall also be responsible for the operation of Depot Machinery & Plant during testing, trials, Integrated testing etc.
- 3.4.3 The number of Contractor's Staff that will be provided for Operation of Depot Machinery & Plant shall be adequate to provide continuous seamless operations. All expenses of Staff shall be borne by the Contractor.
- 3.4.4 Staff deployed to the designated Depot(s) shall be competent and trained to handle the operations of Depot Machinery & Plant etc. The staff shall be trained by the Contractor to effectively operate the machine.
- 3.4.5 Non-Availability operation staff of depot machinery and plant during Testing, Commissioning, DLP and CMC period shall attract penalty of Rs.10,000 per day per staff.
- 3.4.6 All deployed staff for Depot Machinery & Plant operation shall report to PPIO for day-to-day activities.

## 4. HANDOVER REQUIREMENTS

### 4.1 HANDOVER REQUIREMENTS

- 4.1.1 The terms defined in this Chapter set out the Contractor's obligations to ensure there is a smooth handover of maintenance operations and to ensure the condition of CMC Assets meets the Maintenance Requirements of the Contract.
- 4.1.2 The intent of the requirements herein are intended to deal with both possible scenarios of the cessation of this Contract; whether through Expiry of the CMC Period or an early Termination of the Contract under the terms set out in Section - VII. General Conditions of Contract (GCC) Chapters 15 and 16.
- 4.1.3 Except where it is otherwise specifically provisioned, the Contractor shall in all cases be obliged fulfill all the obligations of Handover Requirements, regardless of the scenario leading to cessation of this Contract.
- 4.1.4 The Contractor shall comply with and conform to the following Handover requirements at the stated times prior to Expiry / Termination of the CMC Contract Period. Wherever no specific deadline is mentioned, the respective handover requirement shall be completed at least fifteen (15) days prior to the date of Expiry / Termination of the CMC Contract Period:
- a) Submit a Certificate of Completion to certify that the Contractor has ensured that all CMC Assets have been cured of all defects and deficiencies and that all due maintenance has been completed.
  - b) The Certificate of Completion shall certify that completed maintenance is sufficient to have complied with all Maintenance Obligations; with the exception of any Unscheduled Maintenance works which arose on account of Accident, vandalism, arson, riot or natural calamity and had occurred no earlier than one hundred and twenty (120) days prior to such Expiry / Termination of the Contract Period.
  - c) Notify to CMRL forthwith the location and particulars of all CMC Assets as well as Civil Infrastructure, building etc. under the Contractor's possession regardless of whether those assets were handed over by CMRL or installed, deployed and/or commissioned by the Contractor for the purpose of undertaking maintenance.
  - d) Deliver forthwith the actual or constructive possession of the CMC Assets, along with the infrastructure therein, free and clear of all Encumbrances.
  - e) All spares as per the latest approved list shall be replenished by the Contractor and handed back to CMRL in a serviceable and good working condition at least three (3) months prior to Expiry / Termination of the Contract Period at no cost to CMRL; in accordance with this Chapter.
  - f) Deliver and transfer relevant records, reports and Intellectual Property pertaining to the Rolling Stock, Depot M&P and Maintenance Depot including all perpetual software and manuals pertaining thereto, and complete "as built" Drawings as on the Termination Date so as to enable CMRL to operate and maintain the Rolling Stock and Maintenance Depot and execute such deeds of conveyance, documents and other writings as CMRL 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 Rolling Stock and shall be assigned or licensed to CMRL free of any Encumbrance.
  - g) Transfer and/or deliver all Applicable Permits in respect of the CMC Assets to the extent permissible under Applicable Laws.
  - h) Execute such deeds of conveyance, documents and other writings as CMRL 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 CMRL.
  - i) Execute such deeds of conveyance, documents and other writings as CMRL may reasonably require for conveying, divesting and assigning all the rights, title and interest which the Contractor has over CMC Assets to CMRL or its representative(s).

- j) 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 Rolling Stock, Maintenance Depot and Insurance Cover, free from all Encumbrances, absolutely unto CMRL or to its nominee; and
- k) Pay all dues pending towards its staff and/or the Contractors etc. and any other amounts due and payable under this Contract.

4.1.5 Subject to the exercise by CMRL 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.

4.1.6 In order to assist CMRL, the Contractor shall be responsible for preparing and updating a Hand-back Package. The Hand-back Package must include details of all the matters listed in Chapter 2 of this document. The Contractor must update the Hand-back 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 Hand back Package to CMRL. For each version of the Hand-back Package provided to CMRL, the Contractor must provide written confirmation to CMRL that the Hand back Packages contain the information required under Chapter 2 of this document.

4.1.7 Where the Contractor decides that the Hand-back 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 CMRL in writing within 20 (twenty) days after the end of each 6 (six) month period that the Hand-back Package is up to date. The Contractor must also retain copies of the most recent version of the Hand back Package and provide these to CMRL.

## **4.2 ISSUANCE OF PERFORMANCE CERTIFICATE**

4.2.1 CMRL shall issue of the Performance Certificate to the Contractor within 30 days of satisfactory completion of an “Asset Condition Monitoring Period (ACMP).

4.2.2 The ACMP shall be for a duration of 180 days and shall commence on the date of expiry of the CMC Period (or termination date in event of an early termination of the CMC Contract).

4.2.3 The purpose of the ACMP is to provide a buffer of time for CMRL to ensure that the status and integrity of all CMC Assets is satisfactory and to also to ensure there are no unreported threats to the continued operation of the CMC Assets, such as emerging obsolescence, latent defects or lapses in supply chain agreements etc. in addition to verification that all of the handover requirements set for in this Chapter have been met.

## **4.3 COOPERATION & ASSISTANCE ON TRANSFER OF MAINTENANCE DEPOT**

4.3.1 The Parties shall cooperate on a best effort basis and take all necessary measures, in good faith, to achieve a smooth transfer of the assets specified in Chapter 4.1 in accordance with the provisions of this Contract so as to protect the safety of and avoid undue delay or inconvenience to the users, other members of the public or the lawful occupiers of any part of the Designated Depot(s).

4.3.2 The Parties shall provide to each other, nine (9) months prior to the end of the CMC Period (or immediately in the event that either Party conveys to the other Party its intent to issue a Termination Notice) as much information and advice as is reasonably practicable regarding the proposed arrangements for continuation of maintenance operations beyond the CMC Period or Termination Date. The Contractor shall further provide such reasonable advice and assistance as CMRL, its nominee or agent may reasonably require for operation of the CMC Assets until 6 (six) months after the CMC Period or earlier Termination Date.



#### 4.4 JOINT INSPECTION / DISPUTE RESOLUTION

- 4.4.1 Not less than thirty (30) months nor more than thirty-six (36) months prior to expiry of the Contract Period, the Contractor and CMRL shall conduct a joint inspection (the "Initial Inspection") of the CMC Assets.
- 4.4.2 In the event that an early Termination of this Contract prevents the undertaking of a joint inspection at least thirty (30) months prior to the date of Termination, the Contractor shall remain responsible for all defects and deficiencies arising on CMC Assets for a period of one hundred and eighty (180) days beyond the date of Termination. The Contractor's obligation to repair or rectify the same at its own cost shall prevail throughout.
- 4.4.3 Within ninety (90) days after the completion of the Initial Inspection, the Contractor shall provide to CMRL a report on the condition of the CMC Assets and a notice setting out the Contractor's proposals as to the works required to comply with the Handover Requirements as stated in this chapter.
- 4.4.4 CMRL may, within ninety (90) days after receipt of the notice from the Contractor in accordance with clause 4.4.3, by notice to the Contractor object to the proposals giving details of the grounds for such objection.
- 4.4.5 If no resolution agreement is reached between the Contractor and CMRL within thirty (30) days of receipt of such notice, then either the Contractor or CMRL may refer the matter to the Disputes Resolution Procedure.
- 4.4.6 Upon determination by 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.
- 4.4.7 Not less than nine (9) months nor more than twelve (12) months prior to the Expiry / Termination of the Contract Period, the Contractor and CMRL shall conduct a joint inspection (the "Second Inspection") of all elements of the Project (whether or not the Renewal Works have been carried out).
- 4.4.8 Within thirty (30) days after the completion of the Second Inspection, the Contractor shall provide to CMRL 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.
- 4.4.9 CMRL may, within thirty (30) days after receipt of the notice from the Contractor in accordance with Clause 4.4.8, by notice to the Contractor object to the proposed revisions giving details of the grounds for such objection.
- 4.4.10 If no resolution agreement is reached between the Contractor and CMRL within thirty (30) days of receipt of such notice, then either the Contractor or CMRL may refer the matter to the Dispute Resolution Procedure.
- 4.4.11 Upon determination by 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.

#### ~~4.5 RETENTION OF PAYMENTS DUE~~

- ~~4.5.1 Arrangements for Retention of Payments, release of Retention Money against a Bank Guarantee as well as the final release of Retention Money or Bank Guarantee is defined in Part 3: Section VIII Particular Conditions Clause 50 which is to be read in conjunction with Part 3: Section VII General Conditions of Contract Clause 14.9.~~
- ~~4.5.2 Pursuant to Part 3: Section VIII Particular Conditions Clause 50, the Contractor shall accept that the CMC Period shall only be deemed to have completed, following the Contractor's fulfillment of all the Handover Obligations defined in the Clause 4.1, 4.3 and 4.4.~~

## 5. ASSET MAINTENANCE MANAGEMENT SYSTEM (AMMS)

### 5.1 GENERAL

- 5.1.1 The purpose of the AMMS solution is to provide effective Asset Management capabilities for CMC Assets. The system shall aid in reduction of maintenance down time and optimize capacity utilization of the Designated Depot(s).
- 5.1.2 The Contractor shall ensure that the proposed AMMS complies with and supports the concepts of ISO 55000 and has been proven for metro rolling stock application (e.g., IBM Maximo, SAP, Trimble R2M / E2M etc.) during at least two similar projects during the last 10 years.
- 5.1.3 The Contractor shall ensure that the proposed AMMS system is fully installed, tested & commissioned before delivery of the Prototype Trainset. The primary objectives are as follows but not limited to:
- i) Storage of fault data from CMC Assets (including wayside Hot Axle measuring system data) for at least 35 years.
  - ii) To eliminate the need for human intervention / manual download of fault data recorded by CMC Assets through automated data transfer with interfaced systems.
  - iii) To provide early identification of emerging failure trends.
  - iv) To predict operational failures through aggregation of TCMS fault data with historic / emerging failure trends. The system shall generate service and/or maintenance work orders on an automated basis, without user intervention.
  - v) To automate decision making process in job card or work order creation through implementation of rules that can generate Job cards and work orders automatically for most tasks, semi-automatic with approval in exceptional cases and occasional manual job card creation for rare conditions.
  - vi) Full access to display, analyze and generate reports from remotely acquired data in real-time and also on demand of the maintenance, faults and condition of rolling stock assets, work orders or stock status.
  - vii) Streamline Maintenance process at Depot by seamless integration of remote data acquisition, creation of job cards, processing of work orders, tracking of all assets of depot, inventory and material data management at stores automatically and without human intervention.
  - viii) Reduce downtime of trains at depot by automatically processing rules for optimizing the duration of stoppage at depot by diagnosing and recommending repairs, replacements and other service requirements while the train is running and keep resources such as maintainers and spare parts ready well ahead of train reaching the depot for Corrective or Scheduled maintenance.
  - ix) Optimize the number of maintenance interventions at the depot by synchronizing the Corrective, scheduled / preventive maintenance based on the severity, urgency and availability of train based on automated diagnostic rules engine with minimal human intervention.
  - x) Record all requests from the Operations Control Centre, stations, trackside and depot sources for non-scheduled maintenance work;
  - xi) Produce on request a current list of items outstanding and work in progress;
  - xii) Record materials and spares withdrawn from stores for each maintenance activity;
  - xiii) Output on a daily basis to maintenance supervisory and management personnel as required a list of outstanding maintenance items by engineering discipline and length of time outstanding.
  - xiv) Record the time a maintenance item is completed; record the cause or circumstances of each failure and the corrective action taken.
  - xv) AMMS shall improve the availability of assets by using predictive maintenance and the Internet of Things (IoT) to take early corrective actions.
  - xvi) AMMS server shall collect data from Rolling Stock server.

## 5.2 SCOPE OF WORK

### 5.2.1 Hardware Deployment:

- i) The Contractor shall provide all equipment hardware (including main server, backup server, desktop computer and laptops for user interface etc)

### 5.2.2 Interfaces:

- i) The Contractor shall interface with other designated Contractors for matters including, but not limited to Space, Power, UPS, Data communication, etc.
- ii) The Contractor shall also interface with the Signaling and Telecoms Contractors for transfer of TCMS and wayside Hot Axle measuring system data through their network to the AMMS server.

### 5.2.3 Maintenance Management Module:

- i) Automatic work order / Job card creation based on the fault data acquired from the train sets and Depot M&P's.
- ii) Automatic work order / Job card creation for the Preventive maintenance activities of the Rolling stock assets based on the mileage / running hours / time period and Depot M&P.
- iii) Maintaining the configuration (Up to each Line Replaceable Unit level) of all the Rolling stock assets and Depot M&P.
- iv) Maintaining warranty information for all Rolling stock Assets and Depot M&P
- v) Tracking the maintenance campaigns (Software / Hardware Changes).

### 5.2.4 Material Management Module:

- i) Tracking inventory including repair and return items.
- ii) Tracking material inside the stores by barcoding and its location.
- iii) Generating Pos

### 5.2.5 The Contractor shall procure / provide sufficient number of licenses to operate, manage & monitor the AMMS. The Contractor shall transfer the licenses to CMRL at the end of the CMC period which shall be further valid for the period of at least one year after completion of CMC. In addition, the Contractor shall also provide TWO fully functional AMMS terminals (Latest version laptop) to CMRL maintenance personnel to access the real time information of maintenance and enable CMRL for the generation of reports. CMRL shall also be able to generate service requests from their terminals. The Contractor shall make suitable arrangement to securely store the database of AMMS system.

### 5.2.6 The Contractor shall provide all complete Hardware and Software equipment's enabling the system to download all the stored TCMS data and its linked files if any through from Rolling Stock and Fault data from Depot M&P's to AMMS server through the Signalling Contractor provided network. The Signalling Contractor will provide network for data transfer. The downloading shall be real time / time interval actuated / fault actuated / manual triggered and shall be stored on a central server.

### 5.2.7 The Contractor shall be responsible for the complete set up and commissioning and satisfactory working of the system till the expiry of CMC. The integrity of the data shall not be affected during remote download and in case of any interruption or otherwise the data shall be suitably secured and retrievable. Apart from normal downloading the system should also have intentional / forced download by authorized CMRL personnel.

### 5.2.8 The Contractor shall provide logbook for each Rolling Stock and Depot M&P's which shall be progressively updated to record details of the status of the Vehicle at all stages of production and testing up to the point at which routine maintenance is commenced and subsequent modifications and maintenance actions are recorded by the Maintenance Management System.

### 5.3 MAINTENANCE MANAGEMENT SYSTEM

- 5.3.1 The core functionality of the Maintenance Management system is to automatically capture all information from TCMS system in real-time, process it through a Diagnostics Rule engine and seamlessly integrate to the Maintenance system for Job Cards / Work order creation without the need of human intervention.
- 5.3.2 Job card / Work Order: All maintenance activities shall be organized, planned, and reported through job cards / work orders. A work order refers to the maintenance tasks and creates a link between:
- i) A basic action or group of basic actions
  - ii) A subsystem function or component.
  - iii) According to maintenance task nature, the work order shall have different consequences.
  - iv) Equipment unavailability, needing immediate intervention.
  - v) Equipment dysfunction, needing a planned intervention.
- 5.3.3 Work Order Triggering, Planning and Closure
- i) Both preventive and corrective maintenance activities shall be managed through work orders.
  - ii) Preventive work orders shall be automatically generated according to:
    - a) Technical Maintenance Plans (TMP) milestones (related to counters)
    - b) Pre-defined allocation by an entity in charge of it (internal or external)
    - c) Pre-defined resources engagement according to standards (Human Resources, major maintenance equipment, spare parts, etc.).
  - iii) Maintenance Department ability regarding the workload and resources to be engaged.
  - iv) Different timescales shall be visualized based on the planning horizon.
  - v) Corrective work orders shall also be created by either Operations or Maintenance stakeholders, according to operational disfunction or technical report needing maintenance intervention, if required.
  - vi) Whatever the trigger is, Work Order description shall be based on:
    - a) Automatically generated Work Order number.
    - b) Asset assignation according to asset register files.
    - c) Event context (date, hour, location, operator details etc.).
    - d) Codified Work Order origin (maintenance regime, TMP reference if preventive maintenance, etc.).
    - e) Entity assignation according to the process described previously.
    - f) Expected duration of the maintenance task (related to preventive standards or failure codes).
  - vii) Whatever the WO is, the system shall support the following information size but not limited to allow the WO closure:
    - a) Identification of the entity (division, shift, etc.)
    - b) Intervention beginning/end.
    - c) Description of the technical intervention
    - d) Selection of the sub system (and breakdown level) subject of the WO
    - e) Selection of the intervention cause related to the sub system according to a pre-defined terminology (worn, broken, fouled, ...)
    - f) Selection of the intervention nature according to a pre-defined terminology (check, measurement, exchange, cleaning, ...)
    - g) Selection of the failure code in case of corrective action

- h) Measurements registration (according to “online templates”)
- i) Resources engagement (human resources, spare parts, third party, tools, and equipment)
- j) Considering technical, organizational or workload issues, a WO shall be transmitted from one entity to another one.
- viii) If, during a maintenance intervention, several elementary actions are conducted, the initial work orders (“parent work orders”) shall be broken down in several ones (“child work orders”).
- ix) AMMS shall allow the complete maintenance process (planning, initiation, execution, and closure) to be implemented without the use of any paper form or print out. Thus, all steps of the process must be tracked within the system for records and reporting purposes.

#### 5.3.4 Specific Follow Up and Investigations

- i) For any technical issue or need to monitor a specific sub system population, etc, the process to collect and register information will be based on the Rolling stock Remote Diagnostics and Maintenance Management System.
- ii) The initiative shall be backed by specific WO generation allowing:
  - a) Pre-defined equipment/sub systems samples (asset specific designations)
  - b) Pre-defined timescales (beginning/end of the follow up)
  - c) Intervention triggering “rule,” eventually diverging from the generic TMP.
  - d) Specific reports
- iii) As this type of work order is close to the preventive one’s concept, the planning process will be the same, dedicated to the Maintenance Planner.
- iv) AMMS shall be fitted with functionalities to send specific alert/warning messages to defined persons based on adjustable parameters (i.e. based on MTBF levels, failures rates...)

#### 5.3.5 Maintenance Documentation

- i) Updated maintenance documentation shall be accessible from AMMS. Two types of documentation shall be available and displayed:
  - a) Relating to elementary maintenance actions
    - CMRL Maintenance procedures and manuals
    - Reports and forms to be filled in, etc.
  - b) Relating to functions and components technical documentation
    - Technical notes
    - Charts, pictures, and drawings
    - Assembly / removal process, etc.
- ii) As maintenance operations shall be executed mostly on the field (track, stations...), access and viewing of this documentation via handheld devices shall be possible.

#### 5.3.6 Operations / Maintenance Integration

- i) Equipment Operational Engagement and State: From Real Time to Forecast
- ii) The system will collect in real time from Remote Diagnostics system and transfer the specific usage data, especially distance running, usage period, energy consumption and operation cycles for equipment and sub systems equipped with counters. This data shall be allocated individually to the different assets and related sub systems.
- iii) Maintenance planning (short and long term) will be based on extrapolation of this data (according to individual or grouped trends) and shared (via pre-defined reports) by Maintenance Planner with Operations employees enabling them operations planning.
- iv) Concerning the Rolling Stock, the AMMS will enable, through real-time collection of data, short- & long-term planning, the definition of the daily mileage target per train to ensure that maintenance activities are evenly spread in time.



- v) In case of an equipment failure, AMMS Remote Diagnostics system shall be the interface between Operations and Maintenance to raise the malfunction, generate and send necessary reports and thus enable corrective action to be undertaken.

#### 5.3.7 Joint Maintenance Effort

- i) The maintenance staff shall be able to raise requests for maintenance to the operating staff such as requests to get a train set in a particular depot at a particular time etc.
- ii) Maintenance activities that are to be done, such as internal train cleaning etc., during non-revenue hours shall be planned and tracked using AMMS. The Maintenance requests shall be represented in a user-friendly form to ease usability. AMMS shall be capable of storing these requests and activities and analyzing the data for different performance parameters.

#### 5.3.8 Safety

- i) The system shall raise pre-alerts and alerts to maintenance planning in case of an impending maintenance milestone or expired milestone. In case of an alert, the situation shall be considered according to two modes:
  - a) Standard situation: work order requiring an immediate intervention (and consequently the equipment unavailability) is initiated,
  - b) Derogation implementation: planned work order requiring a specific survey is put in place with the approval of the safety department, no immediate intervention is planned.

#### 5.3.9 Not used.

5.3.10 AMMS shall provide a comprehensive view of any specific vehicle faults and identify any potential faults that may arise through color codes that are configurable. For example, critical faults shall be highlighted in Red, Medium in Orange, Less critical in Yellow etc. and shall be dynamic with a real time refresh of live train data.

5.3.11 AMMS shall also have the capability to analyze and detect anomalies in specific on-vehicle component behavior and use this information to identify the health and status of both the individual component and the possible impact that this behavior may have on the vehicle and to the overall fleet.

5.3.12 AMMS shall also have the capability to retrieve reports after an incident or fault has occurred to replay the history of events and the condition and behavior of the vehicle that led to the fault or incident, with the user's capability to visualize time, distance, location etc. on a graphical / map based system.

5.3.13 Addimap-based display of real time diagnostic data in the display unit of maintenance control center.

5.3.14 TCMS data of all trains in operation or in depot shall be made visible in a single dynamic view that is constantly refreshed within 5 second intervals to display each train, its cars, Location, Speed, List of faults with color coding configurable by user, Live Events window of every fault captured in real-time from every running train on the system.

5.3.15 The system shall also have the capability to decipher the TCMS codes and protocols to correctly display the relevant system detail, state and values.

5.3.16 The system shall have the capability to allow the user to have a detailed train level, subsystem level, component level data, Channel data, Location data and TCMS display values along with meter and counter values in real-time.

5.3.17 The Live display window shall also allow users to select, query and drill down to individual train sub systems in real-time to monitor and analyze current condition of individual equipment, signal values, events etc. continuously.

5.3.18 All the display dashboards, values, tables and meters on the live view shall have clear color coding based on criticality and condition that is configurable by the users.

5.3.19 The display and views shall also have the capability to do a time-based study and analysis as and when required without affecting live data acquisition.



- 5.3.20 The system shall have the capabilities for role-based and user-based access and display for the following functionalities, as a minimum requirement but not limited to:
- i) Interactive and predictive fault detection with configurable coding and alerts from Diagnostics rule engine.
  - ii) Interface where new alerts and rules can be defined and added to the system without affecting the vehicles in service.
  - iii) Real-time cross fleet performance monitoring identifying trends as they occur within the fleet.
  - iv) Real-time schematic view of key subsystems as the train is in service.
  - v) The system shall be capable of real-time vehicle and fleet location tracking through mapping software, with the option for the user to select and view individual fleet and condition data.
  - vi) Replay fault events to accurately diagnose root cause and repair actions during maintenance with rule-based diagnostics enabling automation.
  - vii) Rule engine for diagnosis shall recommend maintenance repair actions to the fleet maintainer, based on the data received from the on-board systems.
- 5.3.21 The rule-based diagnostics and alerts trigger system shall allow the user to define, modify and configure rules at any point of time without the need to approach the solution provider.
- 5.3.22 The rule editor interface shall be intuitive and user friendly, allowing any authorized user to quickly modify rules by adding any remote diagnostic data, train alerts, channel data, meter values and condition data in any combination with logical / Boolean operators to define further actions, alerts, messages, trigger other activities or reports.
- 5.3.23 The result of the Remote diagnostics Rule engine shall be capable of enabling the following functions, as a minimum requirement but not limited to:
- i) Job card / Work order creation
  - ii) Events and Alerts with color coding and prioritization
  - iii) Reports and messages
  - iv) Email / SMS alerts
  - v) Sub system events for further rule processes
  - vi) Alert Escalation process
- 5.3.24 Based on predefined / configurable rules, from a rule-based diagnostics engine, the maintenance alerts are triggered, and an interactive maintenance scheduling is enabled based on the availability of workshop, machinery, skillsets and existing plan schedules.
- 5.3.25 Not Used
- 5.3.26 A job card is created and shared automatically to the designated maintenance teams based on the maintenance scheduling on a maintenance planner's approval window.
- 5.3.27 The job card / work order is circulated to related maintenance stake holders based on activity, workflow, and roles.
- 5.3.28 Not used
- 5.3.29 Not used
- 5.3.30 Solution provider shall take necessary precautions for not deleting the data from the original fault logger in rolling stock, at any point of time.
- 5.3.31 All the logs shall be stored in a server, hereinafter referred to as data server, to be installed in Madhavaram depot by the Contractor. The maintenance management solution shall be capable of fetching respective asset maintenance manuals for a specific maintenance intervention.
- 5.3.32 Configuration Management
- i) The solution will be a full-featured asset configuration management system for all equipment in metro rolling stock and depot M&P's.
  - ii) The configuration management solution shall consist of a tool for managing engineering rules

and physical build and provide a tool for managing operational status.

- iii) The configuration management tool shall provide conflict detection and resolution, unlimited backdated changes to Install / Remove and Usage records, and on-the-fly historical at-the-time asset build and component life views.
- iv) The system will include a rule engine to support true alphanumeric serial effectivity and system-on-system functionality.
- v) The system will be able to define all maintenance programs as part of the configuration management capability as master data that is utilized by all applicable assets (based on the rules)
  - a) Create a network of maintenance requirements that links maintenance requirements to one or more related maintenance items that are triggered on related actions (completion, install, remove etc.).
  - b) Link maintenance resources to the Maintenance items (bill of materials, labor, tools and services).
- vi) The system will provide for the ability to view an audit trail, since asset creation on the system, and to view and status changes, including life usage, components fitted and maintenance program status.
- vii) The system will support Technical Records with the ability to define all technical record types, such as Engineering Orders, Service Bulletins, Modifications and Service Instructions, service Technical Instruction etc. within a single application that enables both technical records effectively and embodiment to be effectively managed.
- viii) The Technical Record capability shall dynamically link to the maintenance program (preventive maintenance) and work order applications.
- ix) The system will support Fleet Management definition, such as a fleet of metro rolling stock and depot M&P's, based on attribute values that may change over time.
- x) The system will support Work Packaging requirements for maintenance inputs based on planned maintenance activities.
- xi) The system will support configuration management attributes throughout the logistics applications.
- xii) The system will provide in service 'Event Management' capability to record all in service events based on retrospective recording / configuration validation of all associated actions to provide robust 'Service Lifecycle Management'.

## 5.4 OTHER REQUIREMENTS OF AMMS

- 5.4.1 The AMMS is expected at the minimum to allow seamless, unattended and automated flow of diagnostics, condition and channel data from rolling stock and Depot M&P to Remote diagnostic system, Diagnostics Rule Engine, Maintenance management system, Display and reporting systems, Job card / Work order systems, Maintenance Rule Engine, Maintenance planning system and individual/common display devices in real-time with a refresh rate of not exceeding 5 seconds under ideal connectivity condition.
- 5.4.2 The system shall also have options on demand for Manual intervention, manual approvals and manual data entry as and when required.
- 5.4.3 The AMMS solution shall allow for multiple repairs to be recorded for each component.
- 5.4.4 The AMMS solution shall be capable of using metro railway industry standard codes.
- 5.4.5 The AMMS solution shall be capable of recording industry standard codes for labor and materials on job card / work orders and purchase order.
- 5.4.6 The AMMS solution shall be able to create and track OEM, Extended and aftermarket warranties by Item, Industry Code, and Manufacturer.
- 5.4.7 The AMMS solution shall be capable of processing warranty claims based on tracked warranty

items.

- 5.4.8 The AMMS solution shall generate a warranty items report identifying items that were replaced under warranty by a given period.
- 5.4.9 The equipment or asset record in the AMMS system shall display warranty information.
- 5.4.10 The AMMS solution shall generate claims against warranty items.
- 5.4.11 The AMMS solution will provide a warranty system to manage reimbursement in money, replacement parts, credits and other conditions.
- 5.4.12 The AMMS solution shall be capable of generating a warranty alert prior to the end of the asset's warranty period.
- 5.4.13 The AMMS solution will provide a template for assigning warranties to multiple assets within a group or fleet.
- 5.4.14 The AMMS solution shall provide a capability that allows defined work types to be excluded from warranty validation, eliminating additional alerts when a work type is not eligible for warranty recovery.
- 5.4.15 The AMMS solution shall have a tracking system to track s for manufacturer recalls, changes in government regulations and internal engineering orders and changes.
- 5.4.16 The AMMS solution's tracking system shall be capable of defining a as a set of job or task plans for one or more assets.
- 5.4.17 The AMMS solution's system shall be able to select multiple assets for the setup.
- 5.4.18 The system of the AMMS solution shall create a job card/work order hierarchy for each job or task plan for each equipment, and the ability to track the progress.
- 5.4.19 The AMMS solution shall be able to perform inspection and servicing activities, such as daily inspections, car cleaning and external washing that can be recorded for multiple assets on a single work order.
- 5.4.20 The AMMS solution shall allow for meter adjustments for broken items such as odometers and hour meters.
- 5.4.21 The AMMS solution shall have a built-in capability to import and validate multiple readings from external systems in future.
- 5.4.22 The AMMS solution shall be capable of recording meter history & allow correction of previous readings.
- 5.4.23 The AMMS solution shall have the capability of tracking an unlimited number of meters readings with history.
- 5.4.24 The AMMS solution shall have a built-in meter import capability for all continuous meters such as odometers and hour meters in future when requirement arises.
- 5.4.25 The AMMS solution shall allow users to setup rules in the rule Engine, that enable to issue work orders / Job Cards, alerts, or early preventive maintenance (PM) work orders when a meter threshold is exceeded in the Rule settings automatically.
- 5.4.26 The AMMS solution shall provide a capability to automatically capture a meter reading on the main page of a work order based on the asset's primary meter, defined by asset type (mileage, hours, cycles, etc.) that is captured live from the Running Train including timestamp, Location etc. within 5 seconds from the Remote diagnostics data.
- 5.4.27 The AMMS solution shall have a specifications capability in the Asset Management system to list a multilevel hierarchy in the asset record with attributes at various levels in the hierarchy.
- 5.4.28 The AMMS solution will support measurement points that can be defined in a new asset template that will create a measurement tab or fields in work orders for associated assets to allow for multiple measurements to be recorded on the work order.
- 5.4.29 The AMMS solution shall support serial number changes of equipment, component and parts.
- 5.4.30 The AMMS solution shall include inventory tracking and purchasing functionality as part of a

single application.

- 5.4.31 The AMMS solution will provide a capability for the setup and management of inventory and cycle counting.
- 5.4.32 The AMMS solution shall be able to make work assignments through a supervisor screen or window.
- 5.4.33 The AMMS solution shall have a screen or window to allow maintainers to see their assignments, select work orders and start, pause and stop labor hours.
- 5.4.34 The AMMS solution will have the capability to capture training and certifications, and verify technicians are qualified for safety or special training assignments within the application and alerts expiry of certifications.
- 5.4.35 The AMMS solution shall have the capability to create multiple asset and equipment records using a template.
- 5.4.36 The AMMS solution shall be able to generate multiple Preventive Maintenance schedules using a template.
- 5.4.37 The AMMS solution will have a preventive maintenance (PM) system that will provide relationships that can be used to have one PM schedule activate, inactivate, or complete another PM.
- 5.4.38 The AMMS solution will provide for a detailed view of the preventive maintenance (PM) events of the asset throughout its life.
- 5.4.39 The AMMS solution shall be able to track out of service, available and operational status of all assets.
- 5.4.40 The AMMS solution shall have the capability to define expected life, depreciation schedule, current condition & repair cost limits and manage repair or replacement decisions.
- 5.4.41 The AMMS solution shall be able to record and manage items and components by position that is captured through the Remote Diagnostics system in real-time.
- 5.4.42 The AMMS solution will be able to alert the user of recent or repeat repairs, to include the display of a user configurable recent or repeat history of the asset on the current work order.
- 5.4.43 The AMMS solution shall have the capability to manage outsourced maintenance work on components and assets through job cards.
- 5.4.44 The AMMS solution will provide detailed history of component and asset movements based on parent-child relationships.
- 5.4.45 The AMMS solution shall provide straight forward access to full work order history, including preventive maintenance history, charges for labor, material, tools, and services, warranty work history, meter readings, status, condition changes, moves, and usage history chronologically. The displayed data shall be in real-time based on changes updated from Remote Diagnostics system.
- 5.4.46 The AMMS solution shall have the capability for integration of remote data acquisition and wayside condition monitoring equipment to drive emergency work orders and preventive maintenance inspections as part of a future requirement.
- 5.4.47 The AMMS solution shall be capable of integrating to telematics systems for health or condition monitoring to track parameter information and receive diagnostic data and have seamless link to other systems down the line.
- 5.4.48 The AMMS solution will provide a capability for flexibility for asset numbering, allowing customers to define an unlimited number of different asset numbers (aliases) for each asset
- 5.4.49 The AMMS solution shall be capable of triggering alert for scheduling job cards / work order which are waiting for spare / material and train availability in depot.
- 5.4.50 If any system in AMMS fails, the restoration time shall not exceed 30 minutes under any circumstances.
- 5.4.51 The AMMS solution shall be capable of functioning with local server as well as with cloud (i.e.,-

remote server)

- 5.4.52 The AMMS solution shall not affect the existing functionality of any assets to which AMMS is incorporated.
- 5.4.53 The AMMS shall also be capable of manually raising job cards/ work orders as and when required.
- 5.4.54 The AMMS shall allow handling of additional rolling stock and depot M&P machines by CMRL.
- 5.4.55 All the hardware and software support for AMMS shall be available for 10 years post AMC.
- 5.4.56 The AMMS solution shall be capable of protecting its system from all malwares, viruses and any other potential threats throughout its service life.

## **5.5 MATERIAL MANAGEMENT SYSTEM**

- 5.5.1 The core functionality of the material management is to provide a fully integrated, comprehensive capability for requisitioning, procurement, warehousing, distributing and inventory tracking for all the spare parts, materials and components with seamless integration to the Maintenance Management of AMMS.
- 5.5.2 The material management shall be a Windows / Web application-based solution with Bar coding capability for effective material management.
- 5.5.3 The material management shall also be mobile based, compatible for viewing on tablets and smaller screen sizes.
- 5.5.4 The material management shall provide the following functionalities as minimum requirements.
- 5.5.5 Automatic identification and data capture: The system shall consist of a Barcode station which will facilitate unique identification, categorization and labeling of all the store components which shall be tracked individually at any given point in time.
- 5.5.6 Master Data Maintenance for Procurement Planning: The material management shall capture and store vendor transaction details and other purchase related information including automated vertical storage system and provide an interface to other modules with in AMMS solution enabling it to collect the necessary details that can be used to create inventory transactions and Purchase orders. The same details shall be available for tracking of warranty, service periods and related information.
- 5.5.7 Warehousing (Storekeeping): The system shall automatically determine the distribution of the store materials, including those that are available in automated vertical storage system and other locations where these stocks are maintained, stacked and handled. The material management shall define and enforce a standard procedure for receipt, inspection, issue and accounting of materials and so on.
- 5.5.8 Inventory Control: The material management shall maintain stock of materials at the correct level under all circumstances, providing automatic stock level updates and sending notifications to concerned departments when Re- Order Level (ROL) is reached. The material management shall handle Inward Material Rejection, WIP Material Status and Tracking and management of parts with defects which also encompasses warranty information tracking with scheduled synchronization to Material Management system of AMMS.
- 5.5.9 Surplus / Obsolete / Scrap Disposal: The material management shall provide the functionality to actively track, decommission and dispose of store materials and components that are either obsolete, dead surplus or scrap. The disposed materials shall not be available anywhere else in the system and the serial number management is to be handled accordingly to eliminate ambiguity.
- 5.5.10 Business Intelligence based Reporting for Value analysis and cost optimization.
  - i) The material management shall provide Insightful Business Intelligence reports that effectively cover all aspects of store management such as inventory tracking etc., The material management reports shall be visually illustrative, easy to comprehend and easy to generate.



- ii) The user shall also be able to generate custom reports based on the data available in the system.

5.5.11 The minimum requirement in terms of reports from material management are but not limited.

- i) Category Based Location Mapping
- ii) Materials at or below Reorder Level
- iii) Materials Currently within Warranty Period
- iv) Category Wise Stock availability of Components
- v) Category wise Movable Surplus quantities
- vi) Component wise useful Life
- vii) Category wise Storage Space Availability
- viii) Annual Inventory Snapshot comparison (Current and previous)
- ix) The reports shall be provided with drill-down capabilities, enabling the user to view the data at both a summarized and detailed view.

5.5.12 The material management system is expected to address the following areas:

5.5.13 Supplier contacts

- i) The system will enable direct interface between Maintenance Management/Supply Chain Management
- ii) Spare parts “pre-reservation” during the planning process
- iii) Stock levels automatic updating according to spare parts picking (cf. WO)
- iv) Purchasing proposition if minimum stock level is reached.

5.5.14 Spare-parts consumption forecast (considering preventive planning and corrective aspects). At any time, AMMS shall provide a vision of real inventory according to assets, locations, warranty duration, maintenance department and financial breakdown.

5.5.15 According to spare-parts rotation rates, the system shall be able to

- i) Propose updated stocking levels.
- ii) Control stock lifetime compliance (for goods with specified lifetime) and alert in case of risk of non-compliance.
- iii) AMMS shall be able to handle logistic processes based on bar codes.

5.5.16 Purchasing

- i) The system will enable launching, endorsement, monitoring and reporting of the purchasing process. Spare parts and services (third party) purchasing shall both be considered.
- ii) Process shall be engaged following a recommendation automatically generated or a punctual need.
- iii) Analyze Supplier performance when ordering a part.
- iv) Once validated, a purchasing proposition shall raise a purchasing order to be endorsed (endorsement rules according to the purchasing amount).

## 5.6 REPORTS, ANALYSIS AND KPIS

To ease reporting and analysis, all the configuration and recorded data shall be exportable to commonly used file format (e.g., MS Excel). A set of regular reports shall be designed considering all the aspects of maintenance activities and according to various breakdowns (equipment, sub-system, component, location, etc.,)

- Planned vs. Unplanned work.
- Detailed fault / cause analysis
- Repeat defect analysis.



- Resources (history and forecast)
- Technical (reliability and availability)
- Assets utilization (counters state)
- Costs

AMMS shall be fitted with data management tools allowing easy set-up of customized reports related to all available data. These report building facilities shall neither require IT skills nor intervention of the software provider.

5.6.1 As a minimum but not limited to, the following KPIs shall be tracked:

S. No	Area	KPI	Description
1	Inventory	% Inactive stock items	Percentage of all stock items that have had no activity in the past 12 months.
2		Total inventory value	Total dollar value of all inventory items in stock.
3		% Annual stores investment used	Percentage of the inventory value that is used annually.
4		Inventory turnover ratio	The value of total orders for inventory items annually, divided by the total value of inventory.
5		% Non-critical spares as a % of total inventory value	Percentage of all inventory items that are considered non-critical to the operation.
6		% Critical spares as a % of total inventory value	Percentage of all inventory items that are considered critical to the operation.
7	Assets	% Total downtime	Percentage of the total operating hours resulting in downtime for all causes.
8		% Maintenance downtime	Percentage of the total operating hours resulting in downtime for maintenance reasons.
9		% Unscheduled downtime	Percentage of unscheduled downtime
10		% Downtime caused by breakdowns	Percentage of downtime that was caused by breakdowns.
11		Mean Time Between Failure (MTBF)	A measure of the typical duration between any failures for a critical asset (breakdown).
12		Mean Time To Repair (MTTR)	A measure of the average time it takes to correct failure on an asset.
13		% Repetitive asset failures	Percentage of asset failures that are repeat failures.
14	Planned activities	% of Planned Maintenance Work	Percentage of work orders that were planned.
15		Weekly Plan Attainment %	Measure of the successful completion of the maintenance plan on a weekly basis
16		Unplanned %	The level of unplanned maintenance activities against available time.

17	Work order	% Work orders waiting on parts	What percentage of work orders are waiting on parts.
18		% Preventive work labor hours	What percentage of all work orders were PMs.
19		% Corrective work labor hours	What percentage of all work orders were Corrective
20	Preventive maintenance	% Corrective work orders generated from PM inspections	What percentage of all corrective work orders is generated from PM inspections annually.
21		% PM tasks audited annually	What percentage of PMs is audited!
22		% PM inspections overdue	What percentage of PMs was not completed before the due date.

5.6.2 As a minimum but not limited the following reports shall be generated:

Report	Description
Details of an Asset's Failures	Summarizes the failures, by problem code, for an asset between the specified dates. Links are available to view these failures graphically. Problem codes are linked to the Drilldown into Asset's Failures report.
Drilldown into Asset's Failures	Displays problem causes and remedies for the selected problem code.
Summary of Asset Failures by Location	Displays the total number of failures reported against the selected assets during the specified time period.
Accident/Incidents	For the staff/ Assets in depot and mainline
	For all EIR/ECP
Scheduled reports	Such as rolling stock / depot machine's daily report, weekly report, monthly reports, train running hours, train set wise / TO login details etc.,

## 5.7 USER ADMINISTRATION

- 5.7.1 Several user profiles will be implemented according to various access privileges ("user groups") defined during design stage. According to users' functions and missions, these privileges will allow them to (the following list is given for illustration purpose and will be further defined during design):
- Allocate tasks.
  - Create reports.
  - Seize data (in partly or complete AMMS access).
  - Consult data (in partly or complete AMMS access).
  - Generate purchase orders.
  - Approve purchase orders.
  - Part of these "user groups" shall be external ones, such as sub-contractors (cleaning operations, etc...) or suppliers (especially during the defect liability period).
- 5.7.2 The software user licenses shall not be restricted to the number of users of the solution.
- 5.7.3 The solution shall be capable of producing different user groups with specific privileges. There shall be flexibility to change user groups and privileges as desired by CMRL.

- 5.7.4 At any given point of time of the entire lifecycle of the solution without restrictions on number of users, profiles, user groups, roles or capabilities.

## **5.8 PROJECT MANAGEMENT**

- 5.8.1 The Solution provider shall provide on-going project management for the responsibilities, to provide a framework for project planning, communications, reporting, procedural and contractual activity. This activity is composed of the following tasks:
- i) Develop and maintain the master implementation plan and set project standards
  - ii) Report to steering committee and program management.
  - iii) Ensuring and auditing the quality, clarity and comprehensiveness of documentation of all KPIs, business process functional requirements, technical requirements, configuration setups, data migration scripts, roles & responsibilities and access rule etc.
  - iv) Control project performance
  - v) Conduct regular meetings and/or updates with other project team members
  - vi) Assist project Manager and change manager to implement organizational change management plan
  - vii) Review work products produced by project members.
  - viii) Ensure system fully tested prior to cut over to production
  - ix) Risk Management
  - x) Project status reporting
  - xi) Scope Management /Delivery of project
  - xii) Ensure external consultant's obligations on the project are completed on time
  - xiii) Co-ordinate with various IT/business groups in organization to ensure the success of implementation of project
  - xiv) Confirmation of quality server setup, start of UAT, Go-Live check and confirmation from CMRL for Go-live.

## **5.9 SYSTEM ACCEPTANCE CRITERIA**

- 5.9.1 System Integration Testing
- i) System Integration & Testing (SIT) process brings together individual elements of software under implementation and tests the system as an integrated whole. All the systems that were not available and untested during Solution Mapping, Application Development and Data Conversion are brought together at System Integration Test environment.
  - ii) This activity is composed of the following tasks:
    - a) Prepare Test Environment
    - b) Prepare Test plans.
    - c) Prepare Test Specifications
    - d) Load sample data
    - e) Execute test.
    - f) Bug fixing and Regression testing.
    - g) Document Test Results
  - iii) Deliverables:
    - a) System Integration Test Plan
    - b) System Integration Test Specification with test cases
    - c) System Integration Test Results

- iv) Completion Criteria: Upon the submission & Physical signoff of the above-mentioned deliverables.
- v) Performance Testing
- vi) Peak-Load Performance Testing needs to be carried out for all the processes below, individually as well as collectively.
  - a) Extracting Rolling stock asset logs from the DATA server manually.
  - b) Automatic Work order creation from the logs available in the DATA server.
  - c) Manual and automatic Records creation/ updates by application as well as via integration
  - d) Tasks/ Jobs assignment and notification
  - e) Work Order creation through PM schedules and manually
  - f) Work Order updating through Mobiles as well as manually
  - g) Material request and approval procedure through mobiles as well as manually.
- vii) Deliverables
  - a) System Performance Test Plan
  - b) System Performance Test Specification
  - c) System Performance Test Results
- viii) Completion Criteria: Upon the submission & Physical sign-off of the above-mentioned deliverables.

#### 5.9.2 User Acceptance Testing (UAT)

- i) This Testing will be based on Acceptance Test Plan and test specifications. CMRL will issue acceptance certificate upon completion of the testing. This activity is composed of the following tasks:
  - a) Create UAT Environment
  - b) Prepare for Acceptance Test
  - c) Prepare test plans.
  - d) Validate Test Plan and Sign Off
  - e) Prepare test specifications.
  - f) Execute test.
  - g) Bug fixing and Regression testing.
  - h) Obtain user acceptance.
- ii) Deliverables:
  - a) Acceptance Test Plan
  - b) Acceptance Test Specification
  - c) Acceptance Test Results
  - d) Acceptance Certificate (From CMRL)
- iii) Completion Criteria: Upon the submission & Physical signoff of the above-mentioned deliverables.
- iv) UAT Acceptance Criteria: The UAT Plan would clearly and unambiguously spell out the plan to test the following final acceptance criteria, the fulfillment of which would complete the implementation phase. The problems reported during the UAT would be categorized according to these severity codes.
  - a) Severity 1: Critical and high severity problems that include problems that would in a production environment, cause disruption of the work.
  - b) Severity 2: Medium severity problems that include problems such as certain functions not working as per the documented functionality, but which in a production environment would

- not cause total disruption of the operations.
- c) Severity 3: Low severity problems that include problems that have been circumvented at operational levels and/or not disrupting the normal operations.
  - d) Severity 4: Cosmetic problems and others that have no impact on the functionality of the system.
  - v) Deployment Acceptance Criteria is considered complete and accepted when it meets the following criteria:
    - a) There shall not be any failures of Severity 1 or severity 2 or severity 3 for three months (System stability period) from the date of completion of UAT test.
    - b) If the failures of Severity 1 or severity 2 or severity 3 are found during the system stability period, then solution provider shall immediately address the failures. After rectifying the failures stability period shall be started again from Day 1.
    - c) The remaining errors (Severity 4) may be addressed during the Support period (AMC). All sign-off deliverables would be treated as accepted when the system goes live. However, this does not include the deliverables, which may be open in the UAT stage before the system goes live.

## 5.10 GO-LIVE

- 5.10.1 The Go-Live process encompasses transition to deployment readiness, production planning, testing, production, and post-production support. When planning for deployment the following issues are addressed.
- i) Infrastructure readiness
  - ii) Organization (change) readiness and adoption
  - iii) CMRL Business users' readiness
  - iv) Deployment Strategy
  - v) Post Implementation support from Solution provider
  - vi) Joint post implementation review
- 5.10.2 This activity is composed of the following tasks:
- i) Prepare Production Environment
  - ii) Data Collection
  - iii) Load data (100%)
  - iv) Develop Transition Management Plan
  - v) Migrate Configurations from Test to production system.
  - vi) Go Live
- 5.10.3 Completion Criteria
- i) Upon the submission & Physical signoff of the above-mentioned deliverables
  - ii) System Go live signoff shall be taken from CMRL.

## 5.11 TRAINING

- 5.11.1 Skill transfer is critical to the implementation of the project at CMRL. The training will be carried out separately for each section's users (like Rolling stock maintainers, stores team, etc.,).
- 5.11.2 The training for various groups (maintainers and stores) shall be conducted separately. Solution provider shall provide training for four weeks to CMRL. The number of trainees will be decided by CMRL.
- 5.11.3 Three sets of training material, hard copy and soft copy shall be provided to CMRL.

5.11.4 Deliverables

- i) End user Training
- ii) Training material

5.11.5 Completion Criteria: Upon the submission & Physical signoff of the above-mentioned deliverables.