



**Bid Documents
For**

DESIGN, MANUFACTURING, SUPPLY, TESTING,
COMMISSIONING AND TRAINING OF PLANT AND
EQUIPMENT FOR RAILWAY TRACK AND ELECTRIC OVER
HEAD EQUIPMENT (OHE) ON DADRI-REWARI-JNPT
NETWORK OF WDFC

**PLANT AND EQUIPMENT WORKS
PACKAGE – 6**

Issued on: 1st Dec. 2017

ICB No. PE P-6

**VOLUME II
Employer's Requirement**

Employer:
Dedicated Freight Corridor Corporation of India Limited
(A Government of India Enterprise)
NK Consortium
NK – JARTS – PBJ – NKI
Consulting Engineers

Ministry of Railways
Government of India





**BID Documents
FOR
PLANT AND EQUIPMENT WORKS
ICB No. PE P-6**

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1. Introduction

- 1.1 Dedicated Freight Corridor Corporation of India Limited, an enterprise of the Ministry of Railways, Government of India and is building two rail networks namely the Eastern and Western Dedicated Freight Corridors. The Western Dedicated Freight Corridor is financed through a loan from the Japan International Corporation Agency. The entire project consisting of works related to construction of Civil, OHE, Track, Signaling, Telecommunication, procurement of Locomotive and procurement of P&E for maintenance of the track and OHE infrastructure is under execution in two Phases, namely Phase 1 and Phase 2. Both the phases are in different stages of execution. The entire work of different phases is divided into many packages. The other packages involved in the construction of the network are as follows:

Phase 1 Packages:

- ICB - CT P-1 & 2: Civil, Building and Track Works, Rewari – Iqbalgarh
- ICB - CT P-3 (R): Civil, Building and Track Works, Iqbalgarh – Vadodara
- ICB - CT P-3A (R): Special Steel Bridges across river Mahi and Sabarmati
- ICB - EM P-4: Electrical and Mechanical Works, Rewari – Vadodara
- ICB - ST P-5: Signaling and Telecommunication Works, Rewari – Vadodara
- ICB - ST P -5A: Train Protection and Warning System Rewari-JNPT section
- ICB- RS P-7(R): Electric Locomotive cum Maintenance and Depot Works

Phase 2 Packages:

- ICB - CT P-11: Civil, Building and Track Works (JNPT – Vaitarana)
- ICB - CT P-12: Civil, Building and Track Works (Vaitarana – Sachin)
- ICB - CT P-13: Civil, Building and Track Works (Sachin – Vadodara)
- ICB - CT P-14: Integrated Civil, E&M and S&T Works (Rewari – Dadri)
- ICB - CT P-15A: Special Steel Bridges (8 Nos.) JNPT-Vadodara
- ICB - CT P-15B: Special Steel Bridge across Narmada River
- ICB- CT P-15C: Special Steel Bridges (3 Nos.) across Yamuna and Hindon Rivers
- ICB - EM P-16: Electrical & Mechanical (E&M) Works (JNPT – Vadodara)
- ICB- ST P-17: Signal and Telecommunication (S&T) Works (JNPT – Vadodara)

- 1.2 The various packages of two phases of WDFC network of DFCCIL are under construction and it is expected to be commissioned by the year 2021.

2. Schedules of Requirements

- 2.1 There are 22 (twenty-two) types of Plant and Equipment (P&E) required for the maintenance of WDFC infrastructure. These P&E are divided in two groups, namely Key Machines (KM) and Other Machines (OM).
- a) Key Machines: Key Machines are those machines which shall be sourced from Specialist Manufacturers found eligible as per the Evaluation and Qualification Criteria given in Section 2 of VOL I and complies with the Particular Specification of the respective P&E. There are total 16 (sixteen) types of such Key Machines.
 - b) Other Machine: All other types of P&E which are not covered as Key Machines and are called Other Machines. These P&E are sourced from Other Manufacturers who complies with the General and Particular Specification of the respective P&E. There are total 6 (six) types of such Other Machines.



- c) The detailed list of P&E with quantity and identification of KM or OM is given below:

| S. No. | Descriptions | Key Machine(KM) or Other Machine (OM) | Quantity |
|--------|--|---------------------------------------|----------|
| 1 | 2 | 3 | 4 |
| 1 | Continuous Tamping Machine with integrated dynamic stabilizer | KM | 3 |
| 2 | Ballast Regulating Machine with Hopper | KM | 4 |
| 3 | Shoulder Ballast Cleaning Machine | KM | 1 |
| 4 | Points and Crossing Tamping Machine | KM | 1 |
| 5 | Dynamic Stabilizer | KM | 1 |
| 6 | Duo-matic Two Sleepers Tamping Machine | KM | 2 |
| 7 | Mobile Rail Grinding Machine | KM | 1 |
| 8 | Track Recoding Car (TRC) | KM | 1 |
| 9 | OHE Recoding Car (ORC) | KM | 1 |
| 10 | Inspection Vehicle | KM | 2 |
| 11 | Rail bound mobile Vehicle for Civil Engineering works with MMU Equipment | KM | 11 |
| 12 | Tower Wagon 8-wheeler | KM | 12 |
| 13 | Bridge Inspection Vehicle | KM | 2 |
| 14 | Rail cum Road Multi Utility Vehicle with MMU Equipment | OM | 4 |
| 15 | Rail cum Road vehicle with crane for Civil Works | OM | 3 |
| 16 | Rail cum Road vehicle with crane for OHE Works | OM | 2 |
| 17 | PSI equipment testing Van (Road only) | OM | 2 |
| 18 | Rail cum Road based vehicle with motorized elevated working platform (MEWP) | KM | 26 |
| 19 | Vehicle Condition Monitoring Equipment Base Station consisting of Wheel Impact Load Detector (WILD) & Hot Axle & Hot Wheel (HAHW) Detector | KM | 3 |
| 20 | Ballast Hopper Wagon with remote control discharge | OM | 100 |
| 21 | OHE Rehabilitation/Renewal Equipment | KM | 1 |
| 22 | Flat Wagon for carrying Rails | OM | 25 |

2.2 16 (sixteen) types of P&E out of 22 (twenty-two) are also grouped based on functionality, similarity of sub-assembly/components/manufacture, utility, technology, etc.

- Mechanized Track Maintenance Machines covering Spec. No. 9.1.1 to 9.1.6 below
- Self-Driven Measurement and Recording Car Spec No. 9.3.1 to 9.3.3 below
- Self-Driven Rail Bound Mobile Maintenance Vehicle Spec. No. 9.4.1 to 9.4.3 below
- Rail cum Road Maintenance Vehicle Spec. No. 9.5.1 to 9.5.4 below

Specification in respect of balance 6 (six) types of P&E are given separately.



The unifying specification of these groups of P&E is given in Section 9.1, 9.3, 9.4 and 9.5 and covers all the P&E in that group as given below:

| Sl. No. | Specification Section No. | Description | Qty. |
|---------|---------------------------|---|------|
| | 9.1 | Mechanized Track Maintenance Machines | |
| 1 | 9.1.1 | Continuous Tamping Machine with Integrated dynamic stabilizer | 3 |
| 2 | 9.1.2 | Ballast Regulating Machine with Hopper | 4 |
| 3 | 9.1.3 | Shoulder Ballast Cleaning Machine | 1 |
| 4 | 9.1.4 | Points and Crossing Tamping Machine | 1 |
| 5 | 9.1.5 | Dynamic Stabilizer | 1 |
| 6 | 9.1.6 | Duo-matic Two Sleepers Tamping Machine | 2 |
| 7 | 9.2 | Mobile Rail Grinding Machine | 1 |
| | 9.3 | Self-driven Measurement and Recording Cars | |
| 8 | 9.3.1 | Track Recording Car | 1 |
| 9 | 9.3.2 | OHE Recording Car | 1 |
| 10 | 9.3.3 | Inspection Vehicle | 2 |
| | 9.4 | Self-driven Rail Bound Mobile Maintenance Vehicle | |
| 11 | 9.4.1 | Rail Bound Mobile Vehicle for Civil Engineering works with MMU equipment | 11 |
| 12 | 9.4.2 | Tower Wagon 8-wheeler | 12 |
| 13 | 9.4.3 | Bridge Inspection Vehicle | 2 |
| | 9.5 | Rail cum Road Maintenance Vehicle | |
| 14 | 9.5.1 | Rail cum Road Multi Utility Vehicle with MMU equipment | 4 |
| 15 | 9.5.2 | Rail cum Road vehicle with crane for Civil works | 3 |
| 16 | 9.5.3 | Rail cum Road Vehicle with crane for OHE works | 2 |
| 17 | 9.5.4 | PSI equipment testing Van (Road only) | 2 |
| 18. | 9.6 | Rail cum Road based vehicle with motorized elevated working platform (MEWP) | 26 |
| 19 | 9.7 | Vehicle Condition Monitoring Equipment Base Station Consisting of Wheel Impact Load Detector PS 9.7.1 and Hot Axle and Hot Wheel Detection Ps 9.7.2 | 3 |
| 20 | 9.8 | Ballast Hopper Wagon with remote Control discharge | 100 |
| 21 | 9.9 | OHE Rehabilitation/Renewal Equipment | 1 |
| 22 | 9.10 | Flat wagon for carrying Rails | 25 |

2.3 The Bidders shall go through the specifications and ensure that their equipment fully comply therewith. If a Bidder feels that his equipment can substantially meet the performance and quality requirements of the equipment, but does not fully satisfy a particular clause of the specification, the Bidder may submit its request during pre-bid conference identifying without any ambiguity the clause number, which is non-compliant and giving its detailed reasoning, how the non-compliance of the said clause or revised clause does meet the Employer's Requirement substantially.

2.4 ICB – PE-P6 is meant for the procurement of Plant and Equipment for the maintenance of Track and OHE infrastructure of Western Corridor of DFCCIL but shall also comply for working over Eastern Corridor of DFCCIL and Indian Railways. In view of this, the vehicle shall comply to
a. Indian Railways Schedule of Dimensions 1676 mm Gauge (BG) Revised, 2004

- b. Standard Schedule of Dimensions 1676 mm Gauge (Broad Gauge) for Eastern and Western Dedicated Freight Corridors of Indian Railways Jan 2013.

2.5 The Technical Parameters of the WDFC Project regarding the network, track, OHE, bridges, signaling, telecommunication, buildings, SOD (Schedule of Dimensions), MMD (Maximum Moving Dimensions) importantly required for the design, manufacturing, inspection and testing are described in the following Attachments in VOL III. In case, there is any change due to ongoing Works, the same will be advised during design approval stage.

| SI No. | Description | Attachment No. |
|--------|---|----------------|
| 1 | Technical Parameters for the WDFC Project | 1 |
| 2 | Maximum Moving Dimensions of IR and WDFC | 2 |
| 3 | Worn wheel profile for adoption to the wheels provided on the rail vehicle | 3 |
| 4 | Design Report on Civil and Track Works | 4 |
| 5 | Typical cross section for straight in embankment and cutting as per LWR for track center 6M and cross slope 1 in 30 | 5A |
| | Typical cross section for curve in embankment and cutting as per LWR for track center 6M and cross slope 1 in 30 | 5B |
| 6 | Infrastructure facilities at TMD, IMD, SIMD and stations for basing P&E | 6 |
| 7 | Information on the OHE system parameters | 7 |
| 8 | Typical OHE Mast on Embankment at 3.00-meter implantation | 8 |
| 9 | Pantograph profile with 2032 mm wide bow for WDFC | 9 |
| 10 | Technical Specification & Cross Section of Contact Wire over IR and DFCCIL network) | 10 |
| 11 | Dimensions of Drum for Catenary and Contact wire | 11 |
| 12 | System Overview of the Signaling System | 12 |
| 13 | Scope and Purpose of Telecommunications System | 13 |
| 14 | Climatic Conditions | 14 |
| 15 | Layout for 1 in 12 and 1 in 8½ canted turnout | 15 |

2.6 It is mandatory on the part of the Contractor including its Specialist Manufacturer and Other Manufactures to ensure development of designs based on the parameters specified in sub-clause 2.4 and 2.5 above.

3. Definition of Section and Time for Completion

3.1 The WDFC network is scheduled for completion in different phases between 2019 to 2021. In view of this, staggered schedule of supply is given in Definition of Sections to match the supply with the likely time of the requirement of these P&E for maintenance work. There are 5 Sections named Section A, B, C, D and E and quantities of Plant and Equipment to be procured under each Section is given thereon. The supply of Plant & Equipment and Time for Completion is stipulated in the Table A “Definition of Section and Time for Completion”. (Refer Clause 1.1.3.3 of ATB to GC). The Time of Completion is given in number of months from the Commencement Date of Contract. The Time for Completion is given in a format of the range of months and the Work shall be completed in this range i.e. neither earlier nor later. Employer may agree to accept the supply of P&E earlier than the start of a Section, depending on the requirement of Works and Contractor is willing to effect supply as per rescheduled time which is earlier than the Contractual schedule of supply.



- 3.2 The term 'Section with alphabet suffix' represent part of the Works and is different as compared to 'Section with Numeric suffix' which represent the Specification.
- 3.3 The supply of one number of the first lot of Plant and Equipment of each type shall undergo Site Acceptance Test and Oscillation Test (as applicable refer Clause 25 of Vol II) and the supply of balance machines begins thereafter.



| Sl. N | Plant and Equipment with Unit | Reference Specification | Definition of Section (Quantities of Plant and Equipment to be Procured under each Section) | | | | | Total |
|--|---|-------------------------|---|-----------|-----------|-----------|-----------|-------|
| | | | Section A | Section B | Section C | Section D | Section E | |
| Time for Completion of Section (in months) | | | 21-27 M | 27-33 M | 36-42 M | 42-48 M | 48-54 M | |
| 1 | Continuous Tamping Machine with Integrated Dynamic Stabilizer Each | 9.1.1 | X | 1 | 1 | 1 | X | 3 |
| 2 | Ballast Regulation Machine with hopper Each | 9.1.2 | X | 1 | 1 | 1 | 1 | 4 |
| 3 | Shoulder Ballast Cleaning Machine | 9.1.3 | X | X | X | X | 1 | 1 |
| 4 | Points & Crossing Tamping Machine | 9.1.4 | X | 1 | X | X | X | 1 |
| 5 | Dynamic Stabilizer | 9.1.5 | X | 1 | X | X | X | 1 |
| 6 | Duomatic Two Sleepers Continuous Tamping Machine Each | 9.1.6 | 1 | 1 | X | X | X | 2 |
| 7 | Mobile Rail Grinding Machine | 9.2 | 1 | X | X | X | X | 1 |
| 8 | Track Recording Car (TRC) | 9.3.1 | 1 | X | X | X | X | 1 |
| 9 | OHE Monitoring Car (OMR) | 9.3.2 | X | 1 | X | X | X | 1 |
| 10 | Inspection Vehicle Each | 9.3.3 | 1 | X | 1 | X | X | 2 |
| 11 | Rail Bound mobile vehicle for Civil Engineering works with MMU Equipment Each | 9.4.1 | 1 | 5 | 5 | X | X | 11 |
| 12 | Tower Wagon 8-wheeler Each | 9.4.2 | 1 | 4 | 4 | 3 | X | 12 |
| 13 | Bridge Inspection Vehicle Each | 9.4.3 | 1 | X | X | 1 | X | 2 |
| 14 | Rail cum Road Multi Utility Vehicle with MMU Equipment Each | 9.5.1 | 1 | 3 | X | X | X | 4 |
| 15 | Rail cum Road vehicle with crane for Civil Works Each | 9.5.2 | 1 | 1 | 1 | X | X | 3 |
| 16 | Rail cum Road vehicle with crane for OHE works Each | 9.5.3 | 1 | X | 1 | X | X | 2 |
| 17 | PSI equipment testing Van (Road only) Each | 9.5.4 | 1 | X | 1 | X | X | 2 |
| 18 | Rail cum Road based Vehicle with Motorized Elevated Working Platform (MEWP) Each | 9.6 | 2 | 6 | 6 | 6 | 6 | 26 |
| 19 | Vehicle Condition Monitoring Equipment Base Station with Wheel Impact Load Detector (WILD) & Hot Axle & Hot Wheel (HAHW) detector Set | 9.7 | 1 | 2 | X | X | X | 3 |



| | | | | | | | | |
|----|--|------|---|----|----|----|----|-----|
| 20 | Ballast Hopper Wagon with remote control discharge | 9.8 | X | 25 | 25 | 25 | 25 | 100 |
| 21 | OHE Rehabilitation / Renewal Equipment | 9.9 | X | X | X | X | 1 | 1 |
| 22 | Flat wagon for carrying Rails | 9.10 | X | X | 8 | 8 | 9 | 25 |

3.4 The Employer's Requirement also includes provision of the following services beside the supply of listed P&E:

3.4.1 Receipt of P&E at the Employer's nominated place, on-site assembly, commissioning, Site Acceptance Test and Oscillation Test (as applicable) of the supplied P & E. Sanction of the P&E involving rail bound vehicle in pursuant to the Clause No. 25 Section 8 Vol II will also be required.

3.4.2 The Defect Notification Period of the respective P & E for a period of 24 months (104 Weeks) after the issue of the Taking Over Certificate by the Employer of the P&E listed for supply in the respective Sections. The Defect Notification Period shall include all unscheduled repairs during the period, free of cost.

3.4.3 Documents describing in detail, the various schedules required for upkeep and maintenance of P & E from the time of issue of the Taking-Over Certificate till the first major overhaul, listing the spares and consumables required for each maintenance schedule. This shall be submitted along with the Bid and to be finalized during design approval stage.

3.4.3.1 The contractor shall provide the procurement specification and his approved list of vendors of such assembly/sub-assembly/spare parts which are sourced by him from the trades before the issue of the Taking Over Certificate of the first P&E of each type.

3.4.4 Documents describing in details of the procedure, sequence of dismantling, cleaning, inspection, assembly, testing, etc. with drawings, pictures, animation as the case may be for easy understanding by the maintenance staff for taking up the periodical overhaul. The list of items in kit form and, other than the kit form to be replaced during overhauls shall be provided along with the approved vendors of the Contractor. This shall be before the issue of the Taking Over Certificate of the first P&E of each type.

3.4.5 Provide as a part of each P & E supplied, the list of tools, keys, fixtures, etc. required for the operation of the P&E in sufficient numbers, machine or operator-wise as per the norms of operation of each of the machine. The list shall be assessed by the Specialist Manufacturer as per the standard operating norms set by him and such numbers indicated and included in the Bid. It should also include all concomitant accessories necessary for the satisfactory working and interface requirement of the operator. The Contractor also shall be providing a set of test tool, diagnostic kit, maintenance tools, etc. as required for adjustment/maintenance of the P&E.

3.4.6 Training of the Employer's personnel, at manufacturers' premises and/or field in manufacturing and assembly, operation, maintenance, repairs and overhauling of the supplied P & E to the satisfaction of the Employer.

3.4.7 The confirmation along with certification from Specialist Manufacturer to support the supply of spare parts for a minimum period of 15 years and technical support to the

Employer in the maintenance and operation of the P&E and trouble-shooting of defects on cost compensation basis as and when required. The Bidder shall indicate the Indian agent if the Key and Other Machines are sourced from the manufacturer based in foreign countries.

- 3.4.8 The Bidder shall submit the probable list of any other spares which may be required to be replaced during accidents, breakdowns, or unscheduled defect arising with budgetary quote valid for two years. The Employer will buy the spare parts, as and when required.

4. Codes, Standards and Specifications

- 4.1 The Bidder should possess and submit at the Bid stage, a valid IS/ISO-9001:2008 (or latest) certificate for his and his Specialist Manufacturers/Other Manufacturers for their work addresses, covering the items for which they are participating in the Bid.
- 4.2 IEC 61508 - Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems. The Contractor shall submit the Safety Integration Level followed in the design of the P&E where applicable. All systems shall generally be fail safe.
- 4.3 The reliability of electronic components shall conform to IEC 61709 - Electric components - Reliability - Reference conditions for failure rates and stress models for conversion.
- 4.4 The welding of the vehicle and its component, inspection, testing and documentation shall conform to EN 15085/JIS Z3420, JIS Z 3211, Z3801 and Z3841.
- 4.5 The Contractor shall submit Painting Plan describing the stages of coating for anti-rust and selection of paint like Polyurethane resin heat insulating paint for the exterior body, phthalic resin enamel finish for inside cab, amino alkyd resin finish for interior lining, etc. The color scheme to be followed for each of the P&E shall be decided at the design approval stage with the objective of durability, appearance, standardization, easy recognition of ownership and base depot from distance etc. The painting plan shall be governed as per BS EN ISO 12944-2: 1998: Paints and Varnishes – Corrosion Protection of Steel Structures by protective paint systems.
- 4.6 Ingress Protection (IP) ratings developed by the European Committee for Electro Technical Standardization (CENELEC) (NEMA IEC 60529 Degrees of Protection Provided by Enclosures - IP Code), specifies the environmental protection of the enclosure. There are large many sub-assemblies, measuring and instrumentation attachments mounted on the roof or underslung or outside in the open and shall be provided with necessary standards of Ingress Protection to ensure trouble free service and not effected due to dust and water. While submitting the design and drawings, a specific attention shall be drawn of the Engineer towards compliance and included in Inspection and Test Plan (ITP) of that requirement.



- 4.7 A list of the International standards and codes such as IS, EN, UIC, IEC, BS, UL, etc. followed during procurement of material, different stages of manufacturing, procurement of assembly/sub-assembly, testing for each of P&E to demonstrate that the product will comply with the Employer's requirement shall be submitted during a design approval stage. The Contractor shall provide two copies of each of the Standards during the design approval stage to the Engineer.
- 4.8 Most of the P&E or its sub-assemblies are procured by Indian Railways on a regular basis and there exists RDSO standard specification. These drawing/specifications wherever stated are indicative for performance parameters and for guidance to the Bidder. RDSO specification in whole or part for a few of the P&E as applicable, is attached.

| Sl No. | Description | Specification No. (attached in Vol III) |
|--------|---|---|
| 1 | High Output Tamping cum Stabilising Machine capable of 3500 sleepers per hour peak output for BG (1676mm) | Specification No. 1 |
| 2 | Ballast Regulation Machine for BG (1676mm Gauge) | Specification No. 2 |
| 3 | Shoulder Ballast Cleaning Machine | Specification No. 3 |
| 4 | Heavy Duty on Track Tamper for Tamping Plain Track and Points & Crossing for BG (1676 mm) | Specification No. 4 |
| 5 | Dynamic Stabilizer | Specification No. 5 |
| 6 | High Output Tie Tamping Machine capable of 2600 sleepers per hour peak output for BG (1676mm) | Specification No. 6 |
| 7 | Mobile Rail Grinding Machine | Specification No. 7 |
| 8 | Integrated Track Monitoring System | Specification No. 8 |
| 9 | BG self-propelled OHE Recording-cum-Test Car (NETRA) for Electric Traction | Specification No. 9 |
| 10 | Self-propelled Diesel Hydraulic Rail Bound Maintenance Vehicle (RBMV) | Specification No. 10 |
| 11 | T8-wheeler diesel Electric Inspection and Maintenance OHE Car underslung type for operation on Broad Gauge (1676 mm) | Specification No. 11 |
| 12 | Self-propelled wiring train consisting of multipurpose vehicle for un-rolling/re-rolling of contact and catenary wire including adjustment of overhead lines on BG (1676 mm) routes of Indian Railways. | Specification No. 12 |
| 13 | Wheel and Axle Assembly for carriage and wagons | Specification No. 13 |
| 14 | Axles for Diesel and Electric Locomotive, EMU Motor coaches and powered axles of rail cars | Specification No. 14 |
| 15 | Tungsten Carbide Tamping Tool (TCTT) For On Track Tamping Machines Specification No. TM/HM/6/320 (Rev-2-2016) | Specification No. 15 |

- 4.9 The Bidder may develop a design to attain improved standards towards RAMS. In case, the Contractor decides to procure any of the item from RDSO approved sources, the Contractor shall ensure compliance of all standards and performance parameters and prior RDSO approval given to any firm shall not be taken as a confirmation of quality and compliance of specification. The responsibility towards any deviation or defect in the supply from RDSO approved sources shall lie with the Contractor.



- 4.10 Fire prevention shall be suitably provided as per latest UIC standard or EN 45545 or RDSO's Specification No. RDSO/PE/CP/EMU/0001 Rev.0 of Aug.'2003 (Amendment No.1 of July'2006) and with the latest revision. The standard to be followed shall be finalized during the design stage and shall be applicable for all P&E covered under this clause.
- 4.11 The Contractor shall bring to the notice of the Employer/Engineer all those materials which are prone to fire and the precautions taken for the purpose. The Contractors shall submit the list of fire retardant material used during the manufacturing along with the International standards followed to comply this clause.
- 4.12 The engine emission standards shall conform to latest Bharat Stage norms applicable for such type of engines and fuel as directed by CPCB, Ministry of Environment and Forests, Govt. of India.

5. Reliability, Availability, Maintainability and Safety (RAMS)

Besides complying with RAMS standards and procedure for compliance as detailed in Appendix No. 1 on Reliability, Availability, Maintainability and Safety (RAMS). The Employer is also looking for the following design features for a long-term benefit. The features are as follows:

- 5.1 The Reliability, Availability, Maintainability and Safety norms shall be specified, governed and conforming to EN 50126/IEC 62278 - Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS).
- 5.2 The Bidder shall identify the defects which will make the machine immobile in the section affecting train operation and will identify and list the measures, including tools and fixtures required to clear the block section within the minimum possible time.
- 5.3 The Contractor shall take steps to provide anti-theft measures for items having a high intrinsic value and vulnerable to theft.
- 5.4 Contractor shall check and comply that its design ensures following features to facilitate user friendly maintenance
- (a) Accessibility: The sub-system and components requiring maintenance shall be readily accessible for service and inspection.
 - (b) Modular: All equipment shall be designed using the principle whereby the repair of a fault merely involves the replacement of a faulty module. All models shall be labeled with description and part code as given in the maintenance manual.
 - (c) Adjustments: The need of adjustments shall be reduced as far as reasonably possible.
 - (d) Skills and Training: The maintenance and operation requirement shall be in accordance with the skills and training of the maintenance personal and easily adopted by them.
 - (e) Maintenance Cost: The design shall work for minimum maintenance cost.

- (f) Equipment Diagnostic: All significant systems and sub-systems shall incorporate a self- diagnostic function to identify faults and the likely cause. There shall be an automatic protection through audio visual aid for any wrong operation of the operator. It should be possible to investigate the damage to the machine caused due to wrong operation of the operator through data logged on the machine.
- (g) Standardization: The Bidder shall study all possibilities for standardization of assembly, sub-assembly and components in the same Section or a different Section of specification of P&E to ensure minimum inventory of parts and ease in maintenance at a later stage. The standardization plan designed by the Contractor of all P&E shall be submitted to the Engineer for approval at design stage. Few of the examples for working out the standardization proposal are as follows:
 - (i) The Contractors shall follow applicable or designed similar standard for color coding of power wiring, control cables, air pipes, conduit, etc. on all the P&E for easy identification during operation and maintenance.
 - (ii) The Contractor shall consider the following assembly/sub-assembly such as Bogie, Wheel, Suspension, Diesel Engine, Hydraulic Transmission, DG set, Battery, Electrical fittings etc. for the purpose of standardization.

6. Quality Assurance Program

The Contractor shall formulate a Quality Assurance program detailing the methodology proposed to be followed to ensure a quality product. QAP shall cover quality assurance procedures to be followed during all stages of design, manufacture, testing and commissioning of the equipment. The Employer's Requirement on Quality Assurance is detailed in Appendix No.2.

7. Environment and Climatic Conditions

The P&E is required to operate in a very harsh environment and climatic condition. The Contractor shall study the environmental and climatic conditions carefully detailed in Attachment No.14 and ensure features in its design to cater for the said environmental and climatic conditions without any deviation. No failure in service shall be attributed to the environmental and climatic conditions.

8. GPS Alpha Numeric Code

The rail bound mobile vehicle and rail cum road mobile vehicle, including track maintenance machines shall be given a GPS alpha numeric code connected to the central server located at Operation Control Center (OCC) through GSMR network of DFCCIL or internet as decided during a design approval stage. It should be possible to locate and monitor each of the vehicles either on rail, road, working or stabled, at OCC terminal. The format for vehicle monitoring data at OCC for daily report to be decided at the design stage.

9. Proven make and brands of the accessories

- 9.1 With each of the P&E, there are many accessories specified such as MMU equipment, Efficiency Multiplier, Measuring Tools, Maintenance tools, rerailling and disaster management equipment, furniture/furnishing/kitchen, etc. The make-brand of the accessories in some of the P&E is specified in the Particular Specification and the Contractor shall supply the accessories accordingly.
- 9.2 In case, the make-brand is not specified or there is difficulty in procuring the item of specified brands, the same shall be finalized during design approval stage with the following options:
- a) RDSO specification with approved source, but the Contractor to ensure compliance of the specification instead accepting the approval as a confirmation of quality product. Supply details to any unit of Indian Railways during the last five years shall be required while seeking approval from the Engineer.
 - b) Proven accessories of minimum 5 years in service based on supply documents with specification to which it is manufactured shall be submitted during a design approval stage.
 - c) Popular brands of items of furniture / furnishing / kitchen / toilets / TV / Computers / Laptop/ etc.
 - d) The Contractor shall provide for the warranty of each of such accessories, which shall not be different from what the manufacturer of accessories generally provides to other customers. However, it shall not add to Contractor responsibility exceeding the Defect Notification period and will be dealt by the Employer based on the manufacturer's warranty certificate to be issued in favour of the Employer.
 - e) In case, the options of a), b) and c) is not possible due to reasons beyond the control of the Contractor, and a new make is necessary, in such situations, the accessories shall be supported by an additional warranty of two years over and above the Defect Notification Period. It shall be applicable to the manufacture of the accessories and shall not interfere with the Defect Notification Period as per the Contract.

10. Project Programme Requirements

- 10.1 For the timely execution of the project and to identify all critical issues as per CPM network, the Contractor is required to prepare Project Programme plan as detailed in Appendix No. 3.
- 10.2 In order to accomplish the set targets and scheduling of activity in Project Programme plan, a system of Monthly Progress Meeting shall be put in place to sort out any issue of concern. The system of Monthly Meeting shall be guided by the guidelines incorporated in Monthly Progress Report. Appendix No. 4.

11. Design and Drawings

- 11.1 The Plant & Equipment shall be robust, reliable, requiring minimum maintenance and suitable for working over the DFCCIL network as well as on IR network.



- 11.2 The Contractor shall ensure that the design prepared for supply of P&E shall be better than the machine supplied for which the Specialist Manufacturer has been qualified as per sub-factor 3.2(e)(iii) Section 2 of Vol I. The Engineer may ask for design details of the previous supply during design approval stage if considered applicable.
- 11.3 The Contractor shall schedule its plan of submittal of Design and Drawings of the P&E detailing systems, sub-systems and any other related subject to the Engineer and attach QA 1 certificate given in Appendix No. 2.
- 11.4 The procedure to be followed for the purpose of standardization of submittal of Design and Drawing, the Contractor shall follow the Appendix No. 5 on CAD and DOCUMENT STANDARDS. The Contractor shall supply and install the Auto CAD software (two numbers) for study of drawings by the Engineer and the Employer. The Contractor shall also train two CAD operators each of Employer and Engineer for the purpose. It is preferable for the Specialist/Other Manufacturer to use the same software for the development of design so that multiplicity of software is avoided.
- 11.5 The Contractor shall submit within 4 weeks, a timeline of the Design and Drawings submittal and seeking approval from the Engineer/Employer. The timeline shall be prepared in a manner ensuring the Time for Completion as per Contract.
- 11.6 The Contractor, when submitting proposals or designs for approval of the Employer/Engineer, shall draw attention to any deviation or departure from the specification involved in his proposals or drawings or details submitted at the bid stage. This situation shall only arise when there is upgradation of technology, improved output and performance etc.
- 11.7 The Contractor shall develop the design based on the details given in this specification, submittal at the bid stage and sound engineering practices. In case, the procurement is similar to RDSO standard specification and the Contractor has supplied the P&E to Indian Railways, the documentary evidence of the design so approved by RDSO may be attached to accelerate the design approval process.
- 11.8 The Contractor shall submit the manufacturer's test certificate as per the relevant standard of all major assemblies proposed to be used in the manufacturing of the P&E at the design approval stage. In case, considered necessary by the Engineer, the manufacturer of sub-assemblies, accessories, etc. may also be required to attend the meeting to sort out technical issues related to Design and Drawings.
- 11.9 From the information given in this specification and bid submission, the Contractor shall prepare a full set of engineering drawings, write ups, calculations etc. and submit the same to the Engineer for approval.



- 11.10 Each set consisting of drawings, write ups, calculation, etc., shall form a complete set of documents to which the P&E is proposed to be manufactured, the first sheet being the index and the following sheets being arranged properly to show the various write ups, calculations, circuit diagram, layouts, assemblies, sub-assemblies and components of complete works in the following sequence:
- (a) Lists of all parts grouped into major assembly with details of numbers per set, weight, specification, primary material and drawing reference against each item (Bill of material).
 - (b) General arrangement drawings of the complete equipment set. Diagram of lubrication points indicating type of lubricant and sub-assembly arrangement in proper and logical sequence.
 - (c) Detailed documentation on all parts forming the assembly, sub-assembly, technical data, calculations etc. shall be submitted.
 - (d) The Contractor shall identify the Design Document/Drawings which are in the critical path of manufacturing and shall plan for submission at the earliest.
- 11.11 The Contractor shall submit the designed maintenance schedule of each machine with periodicity. Designed maintenance schedule means that the maintenance schedule is unavoidable and no quality/design improvement is possible to avoid the schedule.
- 11.12 The list of all such spares which are required to be replaced based on service or life shall be submitted with replacement schedule. The purchase specification and list of vendors for those spares which are sourced by the Specialist Manufacturer from trade shall be furnished.
- 11.13 The Contractor shall demonstrate compliance of the Quality Assurance Plan (refer Appendix 2) during the inspection of the P&E when asked by the Inspecting Officer.
- 11.14 The Contractor shall submit an Inspection and Test Plan (ITP) to the satisfaction of the Employer for Prototype, Stage Inspection, Factory Acceptance Test, Routine, Commissioning, Site Acceptance Test and Acceptance Criteria of Oscillation Trial (as applicable) for each of the P&E to assure its suitability as per the specification, applicable international quality standards and requirement of the Employer. The ITP as approved during design stage shall only be followed.
- 11.15 In some of the P&E, there are sub-assembly(ies) having critical role in its working. Such critical assemblies shall be listed while submitting the Drawing and Design along with the ITPs of such sub-assemblies. These critical assemblies are either manufactured by the Specialist/Other Manufacturers or procured from its regular vendor. The Contractor shall ensure that such sub-assemblies when procured from his vendor, shall be proven and the one from whom the sub-assemblies are procured during the last three years without any complaint/rejection.

- 11.16 The Engineer with the approval of Employer may decide to undertake Factory Acceptance Test and/or Routine Inspection of such sub-assemblies.
- 11.17 The Contractor is responsible for obtaining prior Notice of No Objection from the Engineer when Design phase is decided to be completed and before proceeding for the manufacturing of the P&E. A detailed procedure for Document Submission and Review Procedure is given in Appendix 6.
- 11.18 Notwithstanding the procedure specified above, the Contractor shall always seek advice from the Engineer in the event of any conflict, immediately for a final decision.

12. Approval of Drawings by the Employer

- 12.1 Approval of the drawing means the approval to the general adaptability of the designed features and as submitted with the bid documents, subsequent design and approval and accepted by the Engineer. The Contractor shall be wholly and completely responsible for correctness of dimension, materials, strength and performance of components.
- 12.2 The approval of the Design and Drawing, technical submissions etc. will be given as per the procedure explained in Appendix No. 6.

13. Inspection, Testing and Commissioning

- 13.1 The Contractor shall submit a ITP to the Employer/Engineer along with the design submittal for approval. The ITP shall include the scheduled dimensions and permissible tolerance, standards for consistency, repeatability, accuracy, calibration parameters in measurements, etc. The ITP shall demonstrate the compliance of the Employer's Requirement and approved design in complete, measurement of dimensions, weight, power pack capacity, fuel efficiency, productivity, redundancy, quality assurance plan, tools and spares as part of the P&E etc. The ITP proforma for inspection and testing shall be submitted during the design approval stage for the following stages of inspection. The inspection shall only start after the ITP is approved by the Employer/Engineer.
- a) Prototype testing where specified/required or considered necessary by the Engineer;
 - b) Stage Inspection during manufacturing process where applicable;
 - c) Internal Inspection Report jointly signed by the Authorised Representative of Contractor and Specialist Manufacturer;
 - d) Factory Acceptance Test/Inspection on the first machine (including major assemblies as decided by Engineer/Employer) at the manufacturer's premises;
 - e) Routine inspection on balance series production at the manufacturer's premises as decided by the Engineer;
 - f) Commissioning Test on site;
 - g) Site Acceptance Test at site; and
 - h) Oscillation trial for establishing speed of the vehicle where applicable.

- 13.2 Prototype test of the P&E or its major sub-assembly shall not be required
- a. if a design is already working over Indian Railway with a prototype test done during the last three years;



- b. if a design is already working over Indian Railway for the last three years subject to submittal of documentary evidence to support the claim and speed certificate (if applicable); and
- c. if a design exists and in use over any world Railways and the prototype test certificate not more than three (3) years old is available and submitted.

This is subject to the acceptance of the aforesaid documents by the Engineer and permits waving off the prototype testing.

- 13.2.1 In case the prototype testing of the P&E or its any of the major assembly considered necessary, the Contractor shall engage an Independent Agency and/or Independent Accessor for undertaking the prototype testing duly witnessed by the representative of the Employer/Engineer. This is applicable particularly for P&E covered under Section 9.2, 9.3.1, 9.3.2 and oscillation test of the vehicle wherever applicable.
- 13.3 Stage Inspection shall necessarily be required for the P&E covered in Section 9.3 and 9.4 and shall cover the manufacturing of shell, bogie, painting, quality of welding etc. The stage inspection protocol shall also be approved during design stage.
- 13.4 The Inspection will be carried out by the Employer or his nominee. The cost of travel, boarding and lodgings for personnel involved in inspections will be on the Employer's account. At least eight weeks' notice shall be given to the inspecting authority to enable him to arrange the necessary inspection.
- 13.5 The contractor shall submit its Internal Inspection Report as per the ITP at least 2 weeks before the due date of inspection as per clause 13.1 above.
- 13.6 The Contractor shall also submit clause by clause comments complying the specification of the P&E while submitting a request for inspection.
- 13.7 The Employer's representative shall inspect the P&E as per the Internal Inspection Report and approved ITP. The inspecting officials shall verify the conformity of the machine with respect to the specification as per the approved design, Internal Inspection Report and ITP. The Employer/Engineer's representative nominated for the inspection shall have the facilities for monitoring all tests and have access to all testing records.
- 13.8 The P&E's conformity/non-conformity with respect to each item shall be jointly recorded before the issue of the Inspection Certificate and approval before dispatch of the machine. The proforma for Inspection Certificate shall be finalized during the design approval stage.
- 13.9 The Contractor shall provide, without extra charge, all material, equipment, tools, labour and assistance of every kind which the Employer or his nominee may consider necessary for any of the tests and examinations, which he or his nominee shall require to be made at the Contractor or his Specialist/Other Manufacturer's premises and shall pay all costs involved thereto.



- 13.10 The Contractor shall also provide and deliver free of charge, at such places as the Employer or his nominee may nominate such materials as he or his nominee may require to test by chemical analysis or at any other independent testing lab. The need for such testing will arise only when the Inspecting officials' doubts for any reason the quality of material which is having implication in the reliability or safety performance of the machine. The cost of any such tests will be borne by the Contractor' account unless states otherwise in the particular specification in terms of the Para 2 of clause 7.5 of the GC/FIDIC.
- 13.11 It shall be the responsibility of the Contractor to ensure that only such goods as has been duly inspected and approved by the inspecting authority are offered for arranging shipment/dispatch to the Employer's nominated place.
- 13.12 All P&E shall be marked prominently with the logo of DFCCIL. The logo shall also be embossed on major assembly/sub-assembly for easy identification of parts during maintenance service. The Contractor shall seek guidance and approval from the Engineer/Employer about the logo mark, location of the marking, assembly or sub-assembly considered relevant for such marking etc. before dispatch of the P&E to the site.
- 13.13 **List of documents to be annexed in the Inspection Report should include:**
- Manufacturer's Test Certificate i.e. prototype/factory acceptance/routine test as the case may be including major assembly/sub-assembly.
 - Manufacturer's Internal Inspection Report.
 - Employer's nominee Inspection Certificate and clearance for dispatch.
 - List of serial numbers of major sub-assemblies along with report of the inspection authority seal locations.
 - List of packages forming full or part of the complete P&E.
 - Quality Certificates of bought out assemblies/ sub-assemblies by the Contractor.
 - List of spare parts dispatched along with the machine.
 - List of tools dispatched along with the machine.
 - List of. Manuals, Drawings, Spare Parts Catalogues, etc. dispatched along with the machine, duly indicating the number of sets of each.

14. Receipt of the P&E at site

- 14.1 DFCCIL is constructing depots for basing the P&E under procurement. The maintenance depots are termed as Track Machine Depot (TMD), Integrated Maintenance Depot (IMD) and Sub-Integrated Maintenance Depot (SIMD) and detailed in Attachment No.6. The maintenance depots are under construction and the nomination of the depot for receipt of the P&E shall be decided while giving approval by the Engineer for dispatch. The approval shall generally be based on the progress of construction, manning of the Employer's staff and availability of other conveniences.
- 14.2 Suitable space for accommodating the engineer, staff, material and tools, etc. of the Service Organization of the Contractor shall be provided at nominated TMD/IMD/SIMD by the Employer to facilitate Commissioning, Site Acceptance Test, Training and compliance of the Defect Notification Period. (this should be read along with clause 19.1 below).



- 14.2.1 The contractor shall be provided with electricity (air-conditioning load limited to 5 ton) and water, sourced from utility, free of cost, during the execution of the Contract but only at TMD/IMD/SIMD.

14.3 Commissioning and Site Acceptance Test

- 14.3.1 The P&E shall be received by the Contractor at the nominated site. Any damage to the P&E during transportation shall be at the cost of the Contractor. The repair of the damages shall be carried out only with the consent of the Employer. In case the Employer considers that the damages are heavy, the Contractor shall arrange for the replacement of the P&E.
- 14.3.2 No Co-ordination is envisaged with Other Contractors of packages as mentioned in sub-clause 1.1 above, and necessary assistance to the Contractor for providing power supply, node for data cable etc. will be provided by the Employer/Engineer wherever considered necessary subject to all material inputs are met by the Contractor.
- 14.3.3 The Employer shall depute his representative during the commissioning test for testing as per the ITP approved by the Employer.
- 14.3.4 On confirmation that the machine passes the commissioning test, the Contractor, in writing, shall propose to undertake Site Acceptance Test for a period of seven days during which the machine shall work for minimum 20-50 hours depending on the type of the P&E and to be decided during design approval. The objective of Site Acceptance Test is to prove the ITP of items which can only be tested during service and primarily consists of output, energy efficiency, speed, hauling capacity, safety, etc. The Site Acceptance Test for the objective of the validation will be conducted on the first P&E only, and balance P&E shall be put into service after commissioning.

14.4 On confirmation of all above requirements, the Engineer will issue 'the Taking Over Certificate' of the respective P&E subject to

- a) Compliance of sub-clause 16.4.1, 16.4.2 and 16.6 of this Section 8 Vol II
- b) Training of adequate personal for the operation of the P&E as per sub-clause 18.3 below.
- c) The Taking Over Certificate of the last P&E of each type is subject to submission of necessary documents complying to 16.4.3 and 16.4.4

The Site Acceptance Test of few of the machines such as Shoulder Ballast Cleaning Machine, Mobile Rail Grinding Machine for corrective mode of working, TRC, ORC, OHE rehabilitation/renewal equipment, etc., may be arranged on Indian Railways network since the DFCCIL network is new and the desired functional test may only be possible over IR network. Such approval shall be obtained by the Employer for required testing over the Indian Railways territory. In view of this, the minimum number of days and working hours may be more and shall be provided by the Contractor in the ITP.

15. Inspecting Officials-powers of rejection

The Employer shall have the power to: -



- a) Reject any P & E or part thereof submitted for design approval that it cannot approve in accordance with the contract, owing to the adoption of unsatisfactory method(s) of manufacture, or offered equipment not complying with the specification.
- b) Reject any P & E submitted after inspection, during commissioning or test after commissioning as not being in accordance with the specifications.
- c) Mark the rejected Plant & Equipment with a rejection mark so that they may be easily identified if resubmitted.
- d) The Inspecting Official's decision as regards the rejection shall be final and binding on the Contractor. However, any disputes arising out of it shall be settled in terms of Clause 20 of GC/FIDIC.
- e) In case a P&E has to be re-tested, the entire cost involved in re-testing, including travel expenses, boarding and lodging incurred by the inspecting Officials of the Employer/Engineer shall be borne by the Contractor.
- f) In case any of the P & E is rejected by the Inspecting Officials at the destination, and the Contractor fails to remedy the defects or deficiencies recorded in the Inspection Notes within the stipulated period for delivery, the Employer shall be at liberty to cancel the Contract as per Clause 15 of GC/FIDIC.

16. Operation and Maintenance manuals

16.1 The operation and maintenance manual shall be supplied to the field unit after the approval of the Engineer and complying each of the conditions stipulated in the tender document. The approval will be given after the design is approved and Site Acceptance Test is completed.

16.2 The Contractor shall prepare and provide to the Employer operating and maintenance manuals for all systems and subsystems in sufficient detail to enable the Employer to understand and be trained proficiently how to operate, test, maintain, overhaul and repair the P&E to meet the specified reliability and availability requirements.

16.3 Manuals shall include, but not be limited to, the following types:

- (a) Equipment operating manuals;
- (b) Equipment maintenance manuals;
- (c) Equipment workshop maintenance manuals; and
- (d) Equipment illustrated parts catalogues.

16.4 The information contained within the various manuals shall include, but not be limited to the following:

16.4.1 Equipment Operating Manual:

- a) General description of the equipment and its subsystems;
- b) Operating instructions and Trouble Shooting Directory;



- c) Illustrations depicting equipment locations and layouts together with appropriate nomenclature to facilitate maintenance;
- d) Common fault handling procedures, and major incident, e.g. Recovery procedures; and
- e) Facility of remote diagnostic features.

Total number of manual in hard copy to be supplied shall be calculated as 2 numbers per serial number of P&E, 2 numbers for the base, i.e. TMD/IMD/SIMD, 2 numbers for the Employer and two numbers for the Engineer.

16.4.2 Equipment Maintenance Manual:

- a) General standard practices applicable to maintenance and repair of the equipment;
- b) Schematic diagrams;
- c) Lubrication list and Cleaning agent list;
- d) Wiring and cabling diagrams, including interconnection lists with source and destination descriptions for each wire;
- e) Torque schedule for various types of fasteners;
- f) Purchase specification with technical details for various consumable/spares which are directly procured by the Contractor from the market;
- g) Applicable special tools and test equipment list;
- h) Checklist for each level of examinations from the lowest level of examination for first level of overhaul;
- i) Schedule of materials for each level of examination;
- j) Detailed work instructions for the inspection, calibration, testing, adjustment of all assemblies and/or modules and/or subsystems for each level of examination and/or overhaul. The work instructions shall include all precautions to ensure safety of personnel; and
- k) Troubleshooting flowcharts for common failure symptoms.

Total number of manual to be supplied shall be calculated as 2 numbers per serial number of P&E, 2 numbers for the base, i.e. TMD/IMD/SIMD, 2 numbers for the Employer and two numbers for the Engineer.

16.4.3 Equipment Workshop Maintenance Manual:

- a) Master schedule for the overhaul and mid-life refurbishment of the vehicle, including all modules and/or assemblies and/or components;
- b) Bill of materials for workshop overhaul and mid-life refurbishment programs; and
- c) Workshop overhauls procedures for dismantling, lifting, inspection, re-assembly and testing of the vehicles, including all assemblies and/or modules. The work instructions shall include precautions to ensure safety of personnel.

Total number of manual to be supplied shall be calculated as 2 numbers to base at TMD, 2 numbers for the Employer and one number for the Engineer.

16.4.4 Equipment Illustrated Parts Catalogue:

- a) Equipment hierarchy for the equipment, modules and assemblies, down to component level;
- b) A list of components and related parts, including description, component identification code (similar code as used in the equipment hierarchy), name of the OEM, the OEM's part number or drawing number;
- c) Cutaway drawings and exploded view drawings for identification of all parts; and

- d) Total number of manual to be supplied shall be calculated as 2 numbers to base at TMD, 2 numbers for the Employer and one number for the Engineer.

16.5 All manuals shall be written in concise and simple English and with pictures, photos and illustrations, and shall be sufficient in content to provide the Employer with adequate guidance on all features of the design, which impacts on the operation, maintenance, and repair of the P&E.

16.6 Similar manuals shall also be provided for the

- (a) Accessories equipped with P&E as detailed in the Particular Specification of respective P&E.
- (b) Special tools and test equipment for P&E
- (c) Any other item considered necessary during a design approval stage

16.7 Manuals shall also be supplied in electronic format both in the original software in which it was written and in PDF format. The formats shall be agreed with the Engineer and shall have searchable feature.

16.8 For any modifications or situations which warrant a change in maintenance practice, the Contractor shall update all relevant approved manuals and corresponding copies in electronic format up until the end of the Defects Notification Period. Revisions in manuals and /or electronic format shall be properly recorded by the Contractor to ensure that they are traceable by the Employer.

17. Spare Parts

17.1 This shall be read along with para 16.4.4 above.

- (a) The expected life or limit of working hours of the wearable components shall be advised along with their condemning limits.
- (b) The Contractor, along with the approved design shall furnish the required spare parts details in a separate list indicating description, part number, quantity, whether imported or indigenous and their source of supply if not manufactured by the Contractor and sourced from trade.
- (c) The Specialist or Other Manufacturer shall be responsible for the subsequent availability of OEM spare parts to ensure trouble free service for a minimum period of 15 years.
- (d) For indigenous parts and bought out components and assemblies, the source and other relevant technical details shall be supplied before offering the first P & E for inspection.

18. Training

18.1 The contractor shall provide training to the Employer and his nominated staff in the maintenance and operation of each type of the P&Es at his works and at the time of commissioning. The training program shall generally consist of the following.



18.2 Training during manufacturing: Maximum training period for each of the P&Es at manufacturer works during the process of manufacturing/assembly for the trainee to understand the assembly, understanding design features, working, Do's and Don'ts, operating features, interaction with the employer to whom the P&E supplied earlier, etc. The tentative details are given below. The training at the works of Specialist Manufacturer may also include for major assemblies which are also given in 11.14 & 11.15, but included in the maximum limit given below, if involves visit to a foreign country, and to be decided during a design approval stage.

| Sl. No | Description | Minimum Training Period in working days | No. of Personnel |
|--------|---|---|------------------|
| 1 | Continuous Tamping Machine with integrated dynamic stabilizer | 5 days | 4 |
| 2 | Ballast Regulating Machine with Hopper | 5 days | 4 |
| 3 | Shoulder Ballast Cleaning Machine | 5 days | 4 |
| 4 | Points and Crossing Tamping Machine | 5 days | 4 |
| 5 | Dynamic Stabilizer | 5 days | 4 |
| 6 | Duo-matic Two Sleeper Tamping machine | 5 days | 4 |
| 7 | Mobile Rail Grinding machine | 15 days | 6 |
| 8 | Track Measurement and Recording Equipment of TRC | 10 days | 6 |
| 9 | OHE Measurement and Recording Equipment of ORC | 10 days | 6 |
| 10 | Inspection Vehicle | 5 days | 2 |
| 11 | Rail Bound Mobile Vehicle for Civil Engineering works with MMU Equipment | 5 days | 10 |
| 12 | Tower Wagon 8-Wheeler | 5 days | 10 |
| 13 | Bridge Inspection Vehicle | 5 days | 2 |
| 14 | Rail cum Road based vehicle with motorized elevated working platform (MEWP) | 5x2 days | 4 |
| 15 | Wheel Impact Load Detector | 5 days | 2 |
| 16 | Hot Axle and Hot Wheel Detection | 5 days | 2 |
| 17 | Remote Control Discharge System Ballast Hopper Wagon | 5 days | 2 |
| 18 | Non-Self-Driven OHE Rehabilitation / Renewal Vehicle | 5 days | 4 |
| 19 | Single Pass Ultrasonic Rail Flaw Detector (sub-clause 2.7 of Section 9.4.1) | 5 days | 5 |
| 20 | Hydraulic Re-railing and Rescue Equipment (clause 5 of Section 9.5.1) | 5 days | 2 |

18.2.1 The training shall be at the manufacturer premises which can be in India or abroad or both as decided by the Employer depending on the importance of assembly/sub-assembly involved. The travel, boarding, lodging expenses and other facilities at the premises will be borne by the Contractor. The training for the P&E listed at Sl.No. 10, 11, 12, 17 and 20 shall be in India only.

18.2.2 Training Schedule may undergo a change based on the Specialist/Other Manufacturers identified for one or more P&E and shall take a final shape at the design approval stage. Any addition of the man-days of training shall be limited to training in India only preferably at Site.

18.2.3 The training schedule shall be completed before the issue of the Taking Over Certificate of the Works.

- 18.3 Training during or after commissioning of the P&E in Operation: The number of personnel will be decided for each base station (TMD, IMD and SIMD) at the time of the design approval stage. The training material and competent person for the training shall be provided by the Contractor and shall ensure that the training of nominated person is completed for operation of the P&E.
- a) Trainer-man days shall depend on the intricacies of the P&E involved and the Contractor shall specify the Trainer-man days required to train the operators to the full satisfaction of the Employer. The Contractor may also specify the training need at his works in India, if considered necessary during a design approval stage. The cost of in-house boarding and lodging at manufacturers place shall be borne by the Contractor.
 - b) A provisional competency certificate shall be given to each of the personnel trained, only when he is found competent to operate the P&E. The Contractor shall depute his competent staff for a period of 2 hours per P&E/operator to observe and monitor the competency of the staff and arrange for corrective action.
 - c) On final evaluation of the competency of the operating staff, a Competency Certificate duly signed by the Contractor and the Employer's representative shall be issued.
- 18.4 To provide minimum 100 man-days in 4-5 spells of service to accompany with each of the Track Recording Car (TRC), OHE Recording Car (ORC) and training of minimum five personnel of the Employer in each for this measuring equipment to the full satisfaction of the Employer. The trained staff shall be able to work independently thereafter. This shall be completed during pendency of the Contract.
- 18.5 Training for the maintenance of each of the P&E is to be given to Employers personal for on-the- job training wherein trainee will actually do the job under the Contractor supervision and staff. The Employer shall nominate his staff for training as per his assessment to the Contractor. The Contractor shall advise the minimum educational standard of the staff to be associated for on-the-job training. The training of the staff shall be completed within the Defect Notification Period of the P&E.
- 18.6 In case, the Contractor consider it necessary to train the staff for operation and maintenance at his work, the same shall be submitted during design approval stage and necessary action initiated with the approval of the Employer. The expenditure to be incurred for boarding and lodging shall be borne by the Contractor for training at his premises.

19. Defect Notification Period

- 19.1 Each of the P&E shall be warranted by the Contractor for a minimum period of Two years or 104 weeks from the date of issue of the Taking Over Certificate.



19.2 The Defect Liability shall consist of the following:

- a. The Defect Notification Period shall include repairs and replacement of the assembly/sub-assembly/component which has resulted in the failure of the P&E and making it not performing to the standards stated in the specification of each of P&E.
- b. Any part of the equipment failing or providing unsatisfactory service due to defective design, maintenance, material, workmanship, operation and maintenance within the Defect Notification Period (DNP), the DNP will stand extended for another period of 24 months from the date it is put into service again but limited to the modification carried out.
- c. In case a P&E undergoes repairs requiring replacement of assembly or sub-assembly, the Defect Notification Period stands revised to fresh two years from the time the P&E has been repaired but limited to that assembly or sub-assembly.

19.3 Penalty for delay in attending the defects

- a) The time limit for attending the defects during Warranty which results in non-functioning of the P&E to deliver the services shall not be more than 5 (five) calendar days and a penalty of Rs. 5000/- (five thousand)/P&E for each day or part thereof; of delay, shall be imposed. For the purpose of counting the delay, the day on which the notice is issued shall not be counted.
- b) For other defects, the Contractor shall arrange the rectification of defects within 10 working days.
- c) A system of defect reporting and rectification shall be finalized at the time of the design approval stage.

20. Organizational Setup

The Contractor shall set up an exclusive organisation for smooth execution of the contract, namely Project Organisation and Service Organisation for the following functions

20.1 Project Organisation

- 20.1.1 The organisation shall be responsible for all issues related to Contract Agreement, design, procurement, inspection, testing, supply, etc. and shall have specialist namely Project Manager, Quality Manager, etc.

20.2 Service Organisation

20.2.1 The Contractor shall establish a Service Organization in the premises of the Employer with the following responsibilities assigned: -

- a) Receipt of the P&E at site, commissioning, Site Acceptance Test and Oscillation trial for acceptance of the P&E
- b) To ensure timely repairs of defects reported during the Defect Notification Period.
- c) Training of operating staff and issue of competency certificate
- d) On- the-job and at manufacturer's works training as considered necessary and decided during design approval stage
- e) Coordination with the Employer's representative in the field during the use of the respective P&E for any issue in delivery of the required performance of the P&E
- f) For arranging necessary spares when indented by the Employer



- 20.2.2 The Service Organization shall be headed by a Service Engineer of minimum experience as specified in Vol I with suitable expertise as per requirement in the field of erection, commissioning and maintenance of mechanical and electrical assets.
- 20.3 The Employer shall provide required space for the supervisor, staff and stores at one or two locations on the entire network of WDFC. The decision of the Employer shall be final on the allotment of space for the Contractor.
- 20.4 The engagement of Service Engineer and required expert staff shall continue till such time the Performance Certificate of this Contract is issued or as considered necessary.

21. Infringement of patent rights

DFCCIL shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, use of similar components in the design and development of the P&E and any other factor not mentioned herein which may cause such a dispute. The entire responsibility to settle any such disputes/matters lies with the Contractor.

22. Confidentiality and Public Relations

- 22.1 The Contractor shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out its obligations under it or to comply with applicable Laws.
- 22.2 The Contractor shall ensure confidentiality of the operating and maintenance data during the commissioning and till the defect notification period and shall not divulge such information without prior approval of the Employer.
- 22.3 The Contractor / Specialist/Other Manufacturers shall not publish/present at seminars, forums or otherwise circulate alone or in conjunction with any other person, any articles, photographs or other materials relating to the Contract, the Site, the Works, the Project or any part thereof, nor impart to the Press, or any radio or television network any information relating thereto, nor allow any representative of the media access to the Site, Contractor's Works Areas, or off-Site place of manufacture, or storage except with the permission, in writing, of the Employer. The provisions of this Sub-Clause shall not exempt the Contractor from complying with any statutory provision in regard to the taking and publication of photographs. The Contractor shall ensure that his Specialist/Other Manufacturers of any tier shall be bound by a like obligation and shall, if so required by the Employer, enforce the same at his own expense.
- 22.4 Details of the Publicity and Public Relations are described in Appendix No. 7 -Publicity and Public Relations to the Employer's Requirements.

23. Project Calendar

- (a) The first Week or Month shall be counted as zeroth Week or Month in which the Commencement Date falls.
- (b) The project weeks shall be commenced on a Monday. A day shall be deemed to commence at 0001 hour on the morning of the day in question. Where reference is made to the completion of an activity or milestone by a particular week, this shall mean by midnight on the Sunday of that week.
- (c) A 7-day week calendar shall be adopted for various (Works) programme schedules for scheduling purposes.

- (d) Basic work Unit shall be “days” for scheduling purposes.
- (e) The presentation shall be in ‘Week’ units for project purposes.
- (f) In case of any discrepancy arising in Week or Monthly scheduling, Weekly schedule shall prevail.

24. Monitoring of Progress

A system of monthly progress meeting shall be put in place. The system for the monitoring of the progress meeting is given at Appendix 4.

25. Sanction of Vehicle Based P&E by DFCCIL

Any rail moving vehicle for working over DFCCIL or Indian Railway network shall require sanction of the competent authority. For this purpose, a Speed Certificate is issued by the concerned authority, based on which the sanction for working of the vehicle based on the fixed infrastructure is issued by the competent authority. The Contractor shall be required to obtain the Speed Certificate as follows:

25.1 Provisional Speed Certificate from RDSO

- a. Whenever a new rolling stock is introduced in Indian Railways, a provisional speed certificate is issued by RDSO based on certain design parameters of the vehicle which is generally 65 Kmph. Provisional speed certificate is issued without conducting oscillation trial run. Provisional speed certificate is necessary for transport of the rail bound vehicle on IR network, if required. The cost to obtain Provisional Speed Certificate from RDSO, when required for transportation on IR network, shall be borne by the Contractor. Provisional Speed Certificate, if movement is required over DFCCIL network shall be issued by DFCCIL and all cost shall be borne by the Employer subject to submission of dynamic vehicle simulation as mentioned below.
- b. The Contractor shall be submitting documents for the Rail Bound Vehicle requiring issue of provisional speed certificate from RDSO to conduct dynamic vehicle simulation on NUCARS
 - i. Particular required in respect of the Rolling stock under consideration. Annexure VII of Specification No. 1 of Vol III
 - ii. Brake Design details of the P&E for calculation of emergency braking distance. Annexure V of Specification No. 1 of Vol III
 - iii. Information required for processing provisional speed certificate Annexure VIII of Specification No. 1 of Vol III
 - iv. P&E details for simulation of P&E on NUCARS or similar Track vehicle simulation software Annexure II of Specification No. 1 of Vol III
 - v. RDSO criteria for certifying the speed potential of the vehicle Annexure IX of Specification No. 1 of Vol III



25.2 Sanction of vehicle for working over DFCCIL network

- a. The Maximum permissible speed of 100 Kmph or above of rail base P&E over DFCCIL network shall be certified by conducting oscillation test by an Independent Agency and/or Accessor to be engaged by the Contractor at his cost. In case, the design of the one or more P&E vehicle is similar confirming to the parameters which determines the dynamic behavior vide 25.1(b) above, the oscillation tests may be limited to one such vehicle only.
- b. The Contractor shall propose not more than two Independent Agency/Accessor having an experience of conducting minimum two oscillation trials on two different world Railways during the last 5 years preceding the Bid Due Date successfully and shall submit the credentials in details during design approval stage. The Engineer shall examine the credentials and shall intimate the Contractor of the qualified agency/accessor for the purpose. The Contractor shall choose the one of his choice from the qualified agency/accessor.
- c. The acceptance criteria shall be finalized during design approval stage based on the UIC 518 or RDSO depending on the requirement of Commissioner of Railway Safety.
- d. In case, RDSO speed certification for the same design and suspension system is available and submitted along with test results, the Engineer may consider waving off of the need of (a) above.
- e. The Employer, on finding the test results as per the criteria finalized and based on the report of the Independent Accessor, shall issue Provisional Sanction of the vehicle for the Contractor to claim its payment.
- f. The Employer shall approach Commissioner of Railway Safety (CRS) and Ministry of Railway for the Sanction of the Vehicle over DFCCIL network. In case, CRS insists Oscillation Test to be done by RDSO, the same will be done and all cost will be borne by the Employer.
- g. In case, any non-conformity is communicated by RDSO, the Contractor shall arrange rectification of the defects of the P&E, if any, during the pendency of the Contract. In case, the Contractor desires to depute its representative to accompany tests to be done by RDSO, it will be permitted.



APPENDIX NO. 1

RELIABILITY, AVAILABILITY, MAINTAINABILITY AND SAFETY (RAMS)

1. General

- 1.1 The project is to be designed with a high degree of reliability and availability, in order to provide a dependable service, thereby increasing patronage and revenues from the system.
- 1.2 The optimisation of the system with respect to reliability, availability, maintainability and safety shall be planned and shall form an integral part of the project from its inception through to its operational life as the 'life cycle cost' of a major system is an aspect which in the long term can affect the financial viability of the project.
- 1.3 The Contractor shall demonstrate that the issues of RAMS will be managed during all stages of the project.
- 1.4 The RAMS management process shall address all aspects of the System and shall be demonstrably integrated into the project as a whole and this is to be achieved through the development of a process that as a minimum shall address the following:
 - a) Definition of RAMS requirements.
 - b) Planning and implementation of RAMS tasks for all project phases.
 - c) Assessment and control of impacts and threats to RAMS requirements.
 - d) Demonstration of compliance with RAMS requirements.
 - e) Program of on-going monitoring of compliance.
 - f) Applying of the Indian Standards, norms, regulations, instructions and the Employer's Requirements / Specifications.
 - g) Operational compatibility with the neighboring railway systems and electrical locomotives.
- 1.5 This Appendix provides the scope of the processes related to RAMS management for the project as a whole.

2. Definitions

- 2.1 The following terms define the relationships between the key parameters that are to be specified and managed.
- 2.2 These parameters are not to be used interchangeably and shall be used in the correct context in all documentation and the definitions of relevance are:
 - a) **Reliability** is the probability that an equipment item or system can perform a required function under given conditions for a given time interval.
 - b) **Availability** is the probability that an equipment item or system is in a state to perform a required function under given conditions over a given time interval, assuming that the required external resources are provided.
 - c) **Maintainability** is the probability that a given active maintenance action, for an item of equipment or system under given conditions of use, can be carried out within a stated time interval when the maintenance is performed under stated conditions and using stated procedures and resources.
 - d) **Safety** is the probability that an equipment or its system is in a state to perform a required function of safety towards wheel not derailing, safety towards fire, safety to operating and maintenance staff under given conditions for a given time interval.



- 2.3 In more general terms, the reliability (including safety) of a system is a measure of its failure frequency, the availability is a measure of system actual up time compared to total scheduled time for operation, and the maintainability is a measure of the time taken to reinstate the system following failure.

3. RAMS Management Programme

- 3.1 The RAMS programme shall be integrated into the overall project schedule so that the results, recommendations and insights from detailed RAMS studies will influence the development of the project as a whole.
- 3.2 The RAMS specifications generally in compliance to the Specifications given in Section 9 shall be developed during design stage approval based on the Contractors proposal.
- 3.3 The management process will not only identify the technical assessments to be undertaken but also relate these to the overall project program.
- 3.4 Outlines of the studies that shall be expected during the project to demonstrate the achievement of the specified targets shall be indicated by the Contractor in its proposed design to be submitted during design stage.



APPENDIX NO. 2

QUALITY ASSURANCE

1. General

- 1.1 The Contractor including its Specialist and Other Manufacturers shall maintain and implement a quality management system that shall remain in effect during the execution of the Works. The Contractor's quality management system shall be tailored specifically to the Contract and the Works in accordance with ISO 9001 – Quality Management System, the latest edition of the International Standard ISO 9001, and shall submit his quality management system titled as the Project Quality Assurance Plan for the Engineer's review as specified herein.
- 1.2 The Project Quality Assurance Plan documentation shall include, but shall not be limited to the following: -
 - (a) Quality Assurance Plan (as Contractor's integrated quality assurance documentation covering all the Specialist and Other Manufacturer);
 - (b) Design Quality Assurance Plan;
 - (c) Manufacturing Quality Assurance Plans (as including factory Inspection and Test Plan); and
 - (d) Service Quality Assurance Plan (as including Commissioning and Acceptance Test Plan);
- 1.3 The Contractor shall plan, perform and record all quality control activities to ensure that all Works are performed in accordance with the requirements under the Contract and are detailed in the quality plans which are required herein. Such activities shall include, without limitation, the inspections and/or test expressly or implicitly required by the Contract.
- 1.4 Quality audits shall be carried out by the Engineer and surveillance audit shall be carried out by the Employer to verify the Contractor's implementation and compliance with the quality management system as specified herein.

2. Submission of Quality Documentation

- 2.1 Quality system documents to be submitted shall embrace all activities of the Contractor and his Specialist/Other Manufacturer(s) of any tier, including his suppliers for major assemblies, accessories (making a part of the P&E) for the execution of the Works.
- 2.2 Within 42 days after the Commencement Date, the Contractor shall submit the following documents for review by the Engineer:
 - (a) Contractor's Quality Assurance Philosophy
 - (b) Design Quality Assurance Plan and any associated work instruction and/or standard forms which the Contractor proposes to be used for the Contract.
 - (c) Manufacturing Quality Assurance Plan; and
 - (d) Service Quality Assurance Plan
- 2.3 The Contractor shall submit the separate Quality Assurance Plans for managing, controlling and recording the design, manufacturing process including service at site for individual P&E of the Works.



- 2.4 The Contractor shall, and/or as requested by the Engineer, continuously review and update the quality system documents to meet the requirements and development of the Works throughout the duration of the Contract. For any amendment to the quality system documents, the Contractor shall prepare and submit the proposed amendment for consent of the Engineer.
- 2.5 The Plan shall clearly define the Contractor's policy, Quality Assurance Organization, Management responsibility, the requirements for Quality Assurance personnel, their qualifications, skills and training, the Contractor's Quality Audit schedule.
- 2.6 Records of certifications shall be maintained and monitored by the Quality Assurance personnel. These records shall be made available to the Engineer / Employer for inspection and review as and when required.
- 2.7 The Quality Assurance operations shall be subject to the Engineer's / Employer's verification at any time.
- 2.8 The verification shall include: surveillance of the operations to determine that practices, methods and procedures of the plan are being properly applied; inspection to measure quality of items to be offered for acceptance; and audits to ensure compliance with the Contract documents.
- 2.9 The Contractor's Quality Audit schedule shall be submitted to the Engineer for consent every three months or more frequently as required.
- 2.10 The Contractor including his Specialist and Other Manufacturers shall provide all necessary access, assistance and facilities to enable the Engineer / Employer to carry out on-site and off-site Quality Audit / surveillance audit to verify that the Contractor's quality assurance system which has been consented by the Engineer, is being implemented fully and properly.
- 3. Controlled Copy of Quality System Documentation**
The Contractor shall promptly supply the Engineer with six (6) controlled copies of his quality system documents duly consented by the Engineer. The Contractor shall maintain such controlled documents throughout the duration of the Contract. In addition, the Engineer may request further copies of the quality system documents and these documents shall reach to the Engineer office within fourteen (14) days of such request.
- 4. Project Quality Assurance Plan**
- 4.1 The Project Quality Assurance Plan shall establish the Contractor's management structure (including Specialist/Other Manufacturers) which functions efficiently to execute the Works in compliance with the Employer's Requirements under the Contract and shall, without limitation, define as follows:
- (1) A dedicated Quality Assurance Team(s)
 - (2) Appointment of a Quality Assurance Engineer as described hereinafter;
 - (3) Hierarchy of the quality management system documentation for managing and controlling the whole system.
- 4.2 The Contractor shall submit the Curriculum Vitae (CV) of the top position of his Quality Assurance Team(s).



- 4.3 The Project Quality Assurance Plan shall without limitation include Quality Assurance procedures for design, manufacturing, inspection, supply, installation, testing and commissioning and shall contain control processes for each stage in the work such as design verification and validation, management of change control, non-conformance procedures, control on sub-standard practices, inspection, testing, auditing and so on.
- 4.4 The Project Quality Assurance Plan shall also include a full list of quality management procedures, method statements, inspection and test plans, standards and protocol and/or standard forms, which shall form the frame work of the Project Quality Assurance Plan. It shall define specific procedures to perform the quality management activities and to record the evidence of the activities performed and/or the results achieved. It shall detail the system and the procedure by which the Contractor shall ensure that-
- The Quality Assurance Plan is fully observed at all times and
 - Any non-compliant and sub-standard materials, practices and / or works are brought back to compliances
- 4.5 It shall cover the requirements of the International Standard ISO 9001 in compliance with the Contract as precedence requirements, and shall, without limitation, include the basic management disciplines as follows:
- (1) Review, approval and updating management of the quality system documents to ensure their continuing suitability and effectiveness;
 - (2) Design control management to all manufacturing of each type of P&E, including design works carried out by Specialist/Other Manufacturers. The procedures shall clearly define the review and verification procedures of the designs submittals and the design packages described under the Contract;
 - (3) Drawing management in the Contractor's main office and site office(s), including procedures of production, approval, updating, maintaining, storage and distribution;
 - (4) Document management, including procedures of registration, updating, indexing, filing, maintenance, storage and distribution and monitoring and recording of the submission and re-submission to the Engineer;
 - (5) Monitoring, recording and control of the quality system of his Specialist/Other Manufacturers with respect to their quality of works with relevant time schedule; and
 - (6) Quality control of the Works including Quality audits to be held on the Contractor and Specialist/Other Manufacturers, suppliers and design consultants of any tiers.

5. Design Quality Assurance Plan

The Contractor shall prepare the Design Quality Assurance Plan separately for each P&E forming part of the Works. The Design Quality Assurance Plan shall establish the Contractor's policy for the design works in compliance with the Employer's Requirements under the Contract.

6. Service Quality Assurance Plan

6.1 Service Quality Management Provisions

The Contractor shall prepare a Service Quality Plan separately for the part of the Works entrusted to the Service Organisation. The Service Quality Plan shall include the comprehensive service quality management at site in compliance with the Employer's Requirements under the Contract and shall, without limitation, define as follows:

- (1) Organization of the Contractor's staff directly responsible for the day-to-day management of the Works on the site; and
- (2) Allocation of responsibilities and authorities given to identified personnel or representative of Specialist and Other Manufacturer for receipt and commissioning of the Works;

6.2 Commissioning and Site Acceptance Test at Site



- (1) The Contractor shall prepare and maintain a full list of the all Inspection and Test Plans needed under the Contract to the Engineer for his consent and approval.
- (2) Each Inspection and Test Plan for the particular activity shall define, without limitation:
 - (a) Scope of activities covered by the plan;
 - (b) A sequence of the commissioning work related to the activities in the scope;
 - (c) Personnel responsible for undertaking the inspections and/or tests and the personnel responsible for certifying the inspections and tests;
 - (d) Inspections and/or test methods;
 - (e) Availability of measuring and diagnostic tools, equipment for the test plan etc.; and
 - (f) Documents to be used for reporting the results of the inspections and/or tests with sample documents incorporated into the Plan

7. Manufacturing Management and Quality Assurance Plans

7.1 Manufacturing Quality Management Provisions

The Manufacturing Quality Plans shall define the Contractor's Specialist and Other Manufacturers management structure and quality management system for the manufacturing process of the key items of the manufacturing process of respective P&E of the Works, and for the items as requested by the Engineer. Separate Manufacturing Quality Assurance Plans shall be prepared for each manufactured item and submit them to the Engineer for consent.

Each Manufacturing Quality Assurance Plans for manufacturing process management shall be established in compliance with the Employer's Requirements under the Contract and shall, without limitation, define as follows:

- (1) Scope of activities and items covered by the plan;
- (2) Organization of the Contractor and Specialist/Other Manufacturer responsible for the day to day management of the manufacturing process of the items;
- (3) Allocation of responsibility and authority given to identified personnel for the day to day management of the manufacturing process with particular reference to the supervision, inspection and testing of the process and manufactured items;
- (4) Specific methods including handling and management of the manufacturing process and manufactured items, including but not limited to the following:
 - (a) Particulars of the materials to be used in the manufacturing process;
 - (b) Monitoring and management of manufacturing process in compliance with the consented drawings and specifications;
 - (c) Identification or referencing procedures for traceability of the manufactured items;
 - (d) Identification of the inspection and test status of the materials and the final manufactured item;
 - (e) Disposition of nonconforming materials and the manufactured item;
 - (f) Handling, storage, packaging, preservation and delivery of the manufactured item; and
 - (g) Procedure of monitoring and recording of the ordering and delivery of the item.

7.2 Manufacturing inspection and test provisions

- (1) The manufacturing Inspection and Test Plan (ITP) to be prepared by the Contractor including its Specialist and Other Manufacturers.



- (2) In addition to the inspection by the Contractor and the Engineer, the Employer may, at its own cost, depute its representative or nominate any other independent inspection agency for supervising, monitoring, inspection testing of raw materials and manufacturing process at the factory. To facilitate such an inspection, the detailed production/manufacturing plan shall be provided by the Contractor to the participants of the inspection as well as to the Engineer / Employer at least six weeks in advance of the commencement of the manufacturing process along with the description of mandatory specifications and tests proposed during the manufacturing process and the tests intended to be conducted on the finished product along with codal permitted tolerances.

8. Design Review Procedure

8.1 Contractor's Design Team(s)

- (1) The Contractor including its Specialist and Other Manufacturers shall be responsible for the design of the Works and shall ensure his design is correct / accurate and in compliance with the Employer's Requirements and Specifications contained in the Contract. The Contractor including its Specialist and Other Manufacturers shall also be responsible for the manufacturing, inspection, supply, installation, testing and commissioning of the P&E of the Works and shall ensure that all the supplied P&E are as per the performance parameters detailed in the Employer's Requirements and Specifications in the Contract.
- (2) The Contractor shall establish his dedicated design Team(s) referred to as the Design Team(s). Since the Contractor will be engaging many Specialist Manufacturer and Other Manufacturers and hence the Design Team(s) can be identified and introduced to the Engineer respectively. Design team(s) to ensure that their design works are strictly in compliance with the Employer's Requirements and Specifications and for the benefit of the Employer. On the other hand, to clarify the responsibilities and the authorities, the Contractor shall also establish a Service Team(s) independent of the Design Team(s). Thereby the Contractor is responsible for assuring the quality of the Works as required in the Employer's Requirements and Specifications in the Contract.

8.2 Design Team(s)

- (1) The Contractor shall submit a list of Design Team(s) along with the members responsible for the finalization of the design of each of the P&E to the Engineer.
- (2) This Design Team(s) shall attend the Monthly Meeting to be held with the Engineer at regular interval in regards to issue of "Notice of No Objection" (NONO) certificate.
- (3) **Internal Authorization Process**
 - (i) All design submissions including Technical Design, Manufacturing Design, As-Built Documents shall include a valid "Design Certificate" (as set out as Attachment QA-1 enclosed herewith with this Appendix), duly signed by the individuals who actually does the design. In case the Contractor himself is not a designer than the authorized representative of the Specialist Manufacturer or Other Manufacturer or Supplier of Accessories provided as part of the P&E shall demonstrates that:
 - (a) Design of the P&E complies with the Employer's Requirements and Specifications and other requirements of the Contract;
 - (b) In-house checks have been undertaken to conform the completeness, adequacy and validity of the design as per all the quality assurance procedures;
 - (c) All the required approvals have been obtained; and
 - (d) Design has been performed and finalized utilizing the skills of a professionally qualified, competent and experienced designers and engineers.



- (ii) The Contractor shall fully verify the respective design outputs as a set of submissions through the Internal Authorization Process by signing and attaching "Design Certificate" as the covering document.
- (iii) After receiving the "Notice of No Objection" or "Notice of No Objection with Comments" in respect of the Design, all the original paper drawings in respect of Working Drawings shall be endorsed as "Good for Manufacturing" by Design Team(s) before issuing it to the factory or submitting to the Engineer for his endorsement as specified in the Employer's Requirements – Design and Drawings Clause 11 Section 8.
- (iv) In case the Contractor contemplates any change in the design already submitted to the Engineer for consent and / or for the design and drawings for which the Contractor has already received 'Notice of No Objection', it shall be dealt as per the provisions of Design Review Procedure to be provided in the Contractor's document.
- (v) ISO 9001:2008 shall be applied to the Internal Authorization Process by being tailored specifically to the Contract.

9. Tests

Tests to be carried out for quality assurance purposes shall be as specified in the Specifications (Volume II of the Bid Documents) and as per the Quality Assurance Plan / Inspections and Test Procedures duly consented by the Engineer based on the relevant Codes.

10. Quality Audits

- 10.1 The Contractor shall carry out quality audits on the Works at quarterly intervals, or at such other intervals as the Engineer may require, to ensure the continuing suitability and effectiveness of the quality management system. Reports of each such audit shall be submitted promptly to the Engineer for review.
- 10.2 The Contractor shall submit for review by the Engineer details of the authority, qualifications and experience of personnel assigned to quality audit activities before carrying out quality audits.
- 10.3 The Engineer shall require quality audits on the Contractor and his Specialist/Other Manufacture of any tier to be carried out by his representative or the Employer's staff. In such case, the Contractor shall afford to such auditors all necessary facilities and access to the activities and records to permit this function to be performed.
- 10.4 Upon receipt of corrective action request (CAR) or similar document issued by the Engineer as a result of quality audits, the Contractor shall promptly investigate the matter and submit the proposed corrective and preventive actions within 14 days to the Engineer for review. The Contractor shall take timely corrective and preventive actions to rectify the matter and to prevent re-occurrence. Evidence to demonstrate effective implementation of corrective and preventive actions shall be submitted by the Contractor to the Engineer for review.

11. Notification of Nonconformities

- 11.1 If, prior to an issue of the Taking-Over Certificate for the Works or the relevant Section, the Contractor has used or proposes to use or repair any item of the Works which does not conform to the requirements of the Contract, the Contractor shall immediately submit for review by the Engineer of such proposal and supplying full particulars of the nonconformity and, if appropriate, of the proposed means of repair.



11.2 If the Engineer issues nonconformity report or similar documents to notify the Contractor for any item of the Works which does not conform to the requirements of the Contract, the Contractor shall promptly investigate the matter and, within 14 days of notification by the Engineer, submit to the Engineer for review the remedial measures and necessary actions to be taken to rectify the item and to prevent re-occurrence.

11.3 The Contractor shall maintain and update a nonconformity register to indicate the status of all nonconformities which are identified by the Engineer/ and or the Contractor. The Contractor shall submit the register for review upon request by the Engineer.

12. Monthly Progress Report on Quality Management System

12.1 The Contractor shall continuously monitor the performance of the quality management system and shall include the same in each Monthly Progress Report as required in Appendix 4 [Monthly Progress Report] to the Employer's Requirements.

12.2 The Contractor shall provide and maintain at all stages of the Works, a quality control register or registers to identify the status of inspections, sampling and testing of the work and all certificates. Such register shall be updated by the Contractor to show all activities in previous months and shall reach the Engineer's office before 7th working day of each month. Each register shall:

- (a) List the certificates received for each batch of goods and materials incorporated in the Works and compare this against the certification required by the Contractor and the Contractor's quality plans;
- (b) List the inspection and testing activities undertaken by the Contractor on each element or segment of the Works and compare these activities against the amount of inspection and testing required by the Contract and the Contractor's quality plans;
- (c) Show the results of each report of inspection and/or test and any required analysis of these results and compare these results against the pass/fail criteria; and
- (d) Summary of any actions proposed by the Contractor to overcome any nonconformity.

The Engineer shall submit the same to the Employer along with his observations / comments before 15th working day of each month.

13. Quality Records

The Contractor shall ensure that all the quality records as objective evidence of the implementation of the quality management system are properly indexed, filed, maintained, updated and stored.



Attachment: QA-1

Design Certificate [A Sample Format, subject to Consent by the Engineer]

This Design Certificate refers to P&E -----
System/Sub-System: -----
Total No. of Documents to be submitted: -----
Documents for which NONO issued by Engineer-----
Current Document No. -----comprising of

[description of the P&E for part of the Works (as applicable) to which the submission refers]

Designer's Statement:

We hereby certify that:

- a) the design of the P&E (as applicable), as illustrated and described in the documents complies with the Employer's Requirements and Specifications requirements and the preliminary designs, design briefs and Specifications of those elements of the P&E Works (as applicable) as illustrated and described in the documents comply with the Employer's Requirements and Specifications requirements
- or
- the design of the P&E Works (as applicable), as illustrated and described in the documents, complies with the Employer's Requirements and Specifications requirements except in the following respects:
- (i) (to be completed by the Contractor / Designer)
 - (ii) (etc.)
- b) an in-house check has been undertaken and completed to confirm the completeness, adequacy and validity of the design of the P&E as illustrated and described in the submitted documents.
- c) the product specification as per the Employer Requirement confirms to the similar product under RDSO specification No. -----and design has already been approved by RDSO with approved drawings also attached and
- d) in-house check has been done confirming that provisions given in clause 5 of section 8 has been taken due care in the design as applicable and in particular for the following
- i. Fire Safety (Clause No. 4.10 and 4.11 Section 8)
 - ii. Redundancy (Clause No. 13.1 Section 8)
 - iii. Anti-theft measures of items which are easily accessible to miscreants (Clause 5.3 Section 8)

Signed by 'Authorised Representative'
(for Designer M/s -----)

Name
Position/ Designation
Date

Contractor's Certification:

We certify that all designs have been made utilising the skill and care to be expected of a professionally qualified, competent and licensed designer, experienced in work of similar nature and scope. This further certifies that all works relating to the preparation, review, checking and certification of design has been verified by us.

Signed by 'Authorised Representative'
(for Contractor M/s -----)

Chief Design Engineer
Name:
Position / Designation:
Date:
Place:

Contractor's Representative Name:

Position / Designation:
Date:
Place:



APPENIDX NO. 3

PROJECT PROGRAMME REQUIREMENTS

1. General

1.1 The Programme has the following three primal purposes in three respective phases of the contract procedure. Those purposes on respective phases are clarified as follows:

a) Bid Programme

The proposed program by the Contractor during the bidding process shall be submitted Section wise detailing all activities of design, manufacturing, inspection, testing, commissioning, training etc. for ensuring timely supply of each of the P&E as per Time for Completion. This shall be used for evaluating the Bids and used to develop the contractual agreement between the Employer and the Contractor;

b) Design Programme

The Contractor shall submit a detailed time programme to the Engineer for his consent within 28 days after the Commencement Date. While preparing this, the Contractor shall duly consider the submittal of Designs as per the Sections detailed in Time for Completion. This programme shall incorporate provisions of time for Engineer to issue Notice of No objection and to adhere to the Time for Completion. It shall be referred to as the Design Programme, and become an integral part of the Contract; and

c) Supply Programme

In continuation of the Design Programme, the Contractor shall submit the detailed tentative programme for manufacturing, inspection, supply, commissioning, Site Acceptance Test. Oscillation Test and Training in respect of all P&E's forming part of a Section as applicable for the Works.

2. Methodology

2.1 Unless otherwise instructed by the Engineer, the Programme shall be in the form of a Critical Path Method (CPM) Network showing critical path along with the Narrative Statements. The programme shall also be submitted in the form of a Time Bar-chart showing a Critical Path and S-curve (cumulative progress in percentage). The Time Bar-chart Schedule shall list all main activities and connected sub-activities.

2.2 The CPM Network shall be prepared in accordance with commonly accepted practices and shall show graphically the chain of activities/sub-activities and their sequential relationship with each other from the Commencement Date to the day of issue of Taking-Over Certificate of the Section and whole of the Works. It shall include all activities with their durations along with earliest and latest event times, dates of submission of the Contractor's drawings, schedule of manufacturing, inspection, supply, commissioning and Site Acceptance Test. and shall meet the provisions of the Contract in all respects.

2.3 In preparing the CPM Network and the Time Bar-chart Schedule showing a Critical Path and S-curve, the Contractor shall make due allowances for delays, holidays, local working conditions etc. Under no circumstances shall the CPM Network or the Time Bar-chart Schedule show a completion date beyond the range in months specified for each Section of the Works.



APPENDIX NO. 4

MONTHLY PROGRESS REPORT

1. General

The Contractor shall submit to the Engineer, a Monthly Progress Report (MPR). This Report shall be submitted on the last working day of each calendar month and shall account for all work actually performed from 26th day of the last month and up to and including the twenty-fifth (25th) day of the month of the submission and referred to as the 'Report Month'. It shall be submitted in a format to which the Engineer shall have given his consent, describing, but not limited to, the topics listed below.

2. Design Status

Status of design progress shall be reported for all P&E forming part of the Section giving the stages of Design Status.

3. Physical Progress

It shall describe the status of works performed, significant accomplishments, including critical items and problem areas, corrective actions taken or planned and other pertinent activities, in respect of all the items / sub-items of the schedule of supply/ cost centre in each Section of the Works and shall, in particular, address interface issues, problems and resolutions, representation of progress measured in percentage terms compared with percentage planned as derived from the Works Programme.

The Physical Progress shall be reported to include percentage of Works, Section wise, accomplishment based on the Cost Centers.

4. Programme Update

4.1 Programme Update for the entire project shall include but not limited to the following items:

- (1) The Monthly Programme Update shall be prepared by recording actual activity completion dates and percentage of activities completed up to the twenty-fifth (25th) of the month together with estimates of remaining duration and expected activity completion based on current progress. The Programme Update shall include
 - (a) to account for the actual progress;
 - (b) updated Works Programme to reflect modifications in the design and manufacturing Programme;
 - (c) status of every Work in progress, its graphic representation (completed and remaining) in respect of the identified Works in the Report Month as well as for all the major Works and relevant activities; and
 - (d) Progress 'S' curve indicating Base Line 'S' Curve for the accepted programme and physical Progress 'S' curve.
- (2) The Programme Update shall be accompanied by an Activity Report and a Narrative Statement which shall explain the basis of the contractor's submittal regarding:
 - (a) Work Programme – explaining determination of activity duration and describing the Contractor's approach for meeting schedule of supply of P&E as specified in the Contract.
 - (b) Updated Work Programme – stating in the narrative, the Works actually completed and reflecting along the Critical Path in terms of days ahead or behind allowable dates. Specific requirements of narrative are:



- i. Identification of causes of actual and potential delays (if any) in respect of supply of P&E as per schedule given for completion of Section and Works;
 - ii. Provide explanation of the Works affected due to delays and proposed corrective action / mitigation measures to achieve the supply of the P&E as per the range in months given for each Section;
 - iii. Identification of any deviation from previous month's Critical Path;
 - iv. Clear identification of every activity with number and description for activities in progress and activities scheduled to be completed; and
 - v. Provision of time required to cater for the Design Changes and Variation order, if any.
- (c) Programme Status presenting:
- i. Works Programme status up to and including the current Report Month with cumulative progress to date and a forecast of remaining work;
 - ii. Programme bar-chart size A3 and a time-related logic network diagram on an A1 size, including activity listings; and
- (d) Activity Variance Analysis analyzing activities planned to start prior to or during the Report Month but not started at the end of the period as well as activities started and/or completed in advance of the Works Programme.

5. Three Month Rolling Programme

- 5.1 The Three Months Rolling Programme shall be an expansion of the Works Programme, covering sequential periods of three months.
- 5.2 The Three Month Rolling Programme shall provide more detail of the Contractor's plan, organisation and execution of the work within these periods.
- 5.3 In particular, the Contractor shall expand each activity planned to occur during the next three (3) month period, if necessary to a Weekly level of detail.
- 5.4 The Three Month Rolling Programme shall be developed as a Critical Path Method (CPM) network, and shall be presented in bar chart and time-scaled network diagram format. Bar charts shall be presented on an A3 size and time-scaled networks diagrams on an A1 size reproducible media. Tasks in the programme shall be derivatives of and directly related to tasks in the consented Works Programme.
- 5.5 The Contractor shall describe the discrete work elements and work element inter-relationships necessary to complete all works and any separable parts thereof including work assigned to Specialist/Other Manufacturers / suppliers.
- 5.6 Each activity in the Three Month Rolling Programme shall be coded, or described so as to clearly indicate the corresponding activity in the Works Programme.
- 5.7 The Three Month Rolling Programme shall be issued on a monthly basis.

6. Three Month Rolling Programme Revisions and Updates

- 6.1 The Three Month Rolling Programme shall be extended forward each month as described above. Each submission of the Three Month Rolling Programme shall be accompanied by a Programme Analysis Report, describing actual progress to date, and the forecast for activities occurring over the next three-month period.

- 6.2 If the Three Month Rolling Programme is at variance with the Works Programme, the Programme Analysis Report shall be accompanied by a supporting Narrative Statement describing the Contractor's plan for the execution of the activities to be undertaken over the three-month period, including programme assumptions and methods to be employed in achieving timely completion.
- 6.3 The Contractor shall revise the Three Month Rolling Programme or propose revisions of the Works Programme, or both, from time to time as may be appropriate to ensure consistency between them.

7. Financial Status

The MPR shall also include the following aspects of the financial status:

- (1) A narrative review of all significant financial matters, and actions proposed or taken in respect to any outstanding matters.
- (2) A spread sheet summarizing each major activity as defined in Appendix 3 [Project Programme Requirements].
- (3) A spread sheet indicating the status of all payments due and made.
- (4) 'S' curve for the cash flow planned as per the Contract and as actual till the date of MPR including describing the variance.
- (5) A report of the status of any outstanding claims.
- (6) The report shall in particular provide interim updated accounts of continuing claims.
- (7) Any other information as required by the Engineer.



APPENDIX NO.5

CAD and DOCUMENT STANDARDS

1. Requirements on Documents

1.1 General

Within 28 days after Commencement Date, the Contractor (incl. Specialist/Other Manufactures shall submit a Document Control Procedure to the Engineer for review, which shall comply with the detailed technical requirements herein and also with the procedural requirements described in Appendix 6 [Document Submission and Review Procedure] in the Contract.

(1) Drawing Register

The Contractor shall submit the Engineer a CAD and document management system with a drawing register procedure as part of the Document Control Procedure in electronic copy and hard copy, with which he shall submit each submission of drawings and update at an interval agreed by the Engineer.

The drawing register shall be in a format submitted in the CAD and Document Management System for review and agreed without objection by the Engineer and shall include each document reference number, version, date, title and data-file name.

(2) Records and Reports

All Reports and records shall be submitted-via Project Management Information System to the Engineer and shall be in a format agreed by the Engineer as outlined below. One hard copy of all the reports and records duly signed by the Contractor shall also be submitted to the Engineer.

1.2 Cover Format (Arial)

- (a) Heading and name of client are on top, in capital, size 10.
- (b) Name of the project is in bold letter, size 24.
- (c) Content of document is in bold capital, size 18.
- (d) Documents' reference number is in bold capital, size 14
- (e) Company name: capital, size 14.
- (f) Company's logo is in size 35x40 (WxH) mm.
- (g) Address of the company is in normal letter, size 10.

1.3 Document Format (Arial)

- (1) General regulations
 - (a) Height of letter: applied size 10.
 - (b) Paper size A4 (A3 is used for table.)
 - (c) Periods, semicolons, etc. shall be put right after the letter.
 - (d) The space between paragraphs and headings is 1 line.
 - (e) Main headings: are placed in number's order and the period is right after the heading, then a space, written in bold capital letters. For ex.: **1. IN BOLD CAPITAL:**
 - (f) Other headings: are placed in number's order and the period is right after the heading, then a space, written in bold normal letters. For ex.: **1. In bold normal letter:**
- (2) Note
 - (a) Notes of tables shall be included in the table; in case if they are not able to be included, they shall be noted clearly that they are notes for which table.
 - (b) Notes are usually in italic letters.
- (3) Contents of the documents
 - (a) Following the Indian regulations, standards of technical process on survey, design, experiment, etc.

1.4 Document Numbering System



The Contractor shall prepare the document numbering system and describe it in the Document Control Procedure.

1.5 Units

The Contract shall utilize the SI system of units.

2. Requirements on Drawings

2.1 General

- (1) The Contractor shall adopt a title block similar for all drawings prepared under the Contract.
- (2) Each drawing shall be uniquely referenced by a drawing number and shall define both the current status and revision of the drawing.
- (3) The current status of each design drawing shall be clearly defined by the use of a double letter code as follows:

| | | |
|----|---|---------------------------------|
| TD | - | Technical Design Drawing |
| MD | - | Manufacturing Technical Drawing |
| BD | - | As-Built Drawing |

2.2 Drawing Numbering System

- (1) The drawing number shall comprise nine (9) letters/digits plus a revision letter in the following format:

Drawing No. Revision

n / xx / xx / nnnn x

(A) (B) (C) (D) (E)

(Note: This format permits the use of a full 10 - character computer reference, combining the Drawing No. and Revision.)

- (2) (A) - Two digits (from 11 to 19) {plus one alphabet (from A to C) only for Special Steel Bridge Package} denoting the Contract Package Number of project e.g.

- 11 - CT P-11 Civil/Building/Track Works (JNPT – Vaitarana Section);
 - 12 - CT P-12 Civil/Building/Track Works (Vaitarana – Sachin Section);
 - 13 - CT P-13 Civil/Building/Track Works (Sachin – Vadodara Section);
 - 14 - CP-14 Integrated Package (Civil/E&M/S&T) Works (Rewari – Dadri Section);
 - 15A - CT P-15A Special Steel Bridges in JNPT – Vaitarana Section;
 - 15B - CT P-15B Special Steel Bridge across Narmada River;
 - 15C - CT P-15C Special Steel Bridges in Rewari – Dadri Section;
 - 16 - EM P-16 Electrical and Mechanical (E&M) Works;
 - 17 - ST P-17 Signal & Telecommunication (S&T) Works;
 - 18 - PE P-6 Plant and Equipment Works;** and
 - 19 - RS P-7 Electrical Locomotives and Maintenance Depot
- In view of this, n shall be taken as '18'

- (3) (B) - A two-digit code denoting the P&E e.g.



| | |
|----|--|
| 01 | Continuous Tamping Machine with integrated dynamic stabilizer |
| 02 | Ballast Regulating Machine with Hopper |
| 03 | Shoulder Ballast Cleaning Machine |
| 04 | Points and Crossing Tamping Machine |
| 05 | Dynamic Stabilizer |
| 06 | Duo-matic Two Sleepers Tamping Machine |
| 07 | Mobile Rail Grinding Machine |
| 08 | Track Recoding Car (TRC) |
| 09 | OHE Recoding Car (ORC) |
| 10 | Inspection Vehicle |
| 11 | Rail bound mobile Vehicle for Civil Engineering works with MMU Equipment |
| 12 | Tower Wagon 8-wheeler |
| 13 | Bridge Inspection Vehicle |
| 14 | Rail cum Road Multi Utility Vehicle with MMU Equipment |
| 15 | Rail cum Road vehicle with crane for Civil Works |
| 16 | Rail cum Road vehicle with crane for OHE Works |
| 17 | PSI equipment testing Van (Road only) |
| 18 | Rail cum Road based vehicle with motorized elevated working platform (MEWP) |
| 19 | Vehicle Condition Monitoring Equipment Base Station consisting of Wheel Impact Load Detector (WILD) & Hot Axle & Hot Wheel (HAHW) Detector |
| 20 | Ballast Hopper Wagon with remote control discharge |
| 21 | OHE Rehabilitation/Renewal Equipment |
| 22 | Flat Wagon for carrying Rails |

3. CAD Standards

3.1 Introduction

The main objectives of the CAD standards are as follows:

- (1) To ensure that the CAD data files produced for each P&E are coordinated and referenced in a consistent manner.
- (2) To provide the information and procedures necessary for a CAD user from one discipline or external organization to access (and use as background reference), information from a CAD data file prepared by another discipline or external organization.
- (3) To standardize the information contained within CAD data files which may be common to more than one discipline such as drawing borders, title boxes, grid lines etc.
- (4) To establish procedures necessary for the management of CAD data files.
- (5) To ensure all the Contractor along with his Specialist/Other Manufactures use 'Model Space' and 'Paper Space' in the production of their CAD files'.

3.2 CAD Data Creation, Content & Presentation

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

- (1) Model Space Files (if applicable)
 - (a) Typically, CAD "Model Space" files shall be required for general arrangement and location plans and shall consist of a series of other "Model Space" referenced CAD files covering the total design extents at a defined building level (the number of referenced files shall be kept to an absolute minimum). Data contained within a CAD "Model Space" files shall be drawn at full size (1:1) and located at the



correct global position and orientation on the Project Grid / or defined reference points.

- (b) Each CAD “Model Space” file shall relate to an individual discipline. Drawing border / text, match / section lines or detailed notation shall NOT be included within a CAD “Model Space” file. Dimensions shall be included within a CAD “Model Space” but located on a dedicated layer. Elevations, Long Sections and Cross Sections shall also be presented in CAD “Model Space” as defined above, but do not need to be positioned and orientated on the Project Grid.

(2) Paper Space CAD Files

- (a) “Paper Space” CAD files shall be utilised to aid the process of plotting “Paper” drawings and shall be primarily a window of the CAD “Model Space” file. A “Paper Space” CAD file shall typically contain drawing borders, text, match or section lines & detailed notation. Once these files are initially set up and positioned the majority of “Paper Drawing” plots at various scales as consented by the Engineer shall be efficiently and consistently generated by displaying different combinations of element layers and symbology contained within the “Paper Space” file and the referenced “Model Space” files.

- (b) The purpose shall be to ensure that total coordination is achieved between the CAD “Model Space” file and the “Paper Drawing” output during the revision cycle of the design and production process. Duplicated data in “Model and Paper Space” files shall not be acceptable unless an automatic update link exists between the two data sets. “Paper Space” files shall not typically be required as part of the CAD Media Receipt from contractors, unless specifically requested.

3.3 CAD Quality Control Checks

- (1) Random CAD Quality Control Audits shall be carried out by the Engineer on all CAD media received and transmitted.
- (2) These checks DO NOT verify the technical content of the CAD data received or transmitted (as this is the responsibility of the originating organization), however compliance with CAD and drafting standards shall be checked.
- (3) In addition, the Contractor who transmit and receive CAD data from the Project shall have CAD quality control procedures in place. A typical quality control procedure shall contain CAD data quality checking routines coupled with standards for CAD data transmittal and archiving.

3.4 Revisions

- (1) All design, manufacturing, Industry symbols produced as CAD Cells shall typically conform to Indian regulation.
- (2) The following example text indicates the current CAD file revision, i.e. ‘Revision [A]’. This shall be allocated to a defined layer on all CAD “Model Space” files, in text of a size that shall be readable when the CAD “Model Space” file is fitted to the screen, with all levels on.\

3.5 Block Libraries, Blocks, & Block Names

- (1) All design, manufacturing, Industry symbols produced as CAD Cells shall typically conform to Indian regulation.
- (2) All Blocks created shall be Primitive (i.e. NOT Complex) and shall be placed Absolute (i.e. NOT Relative).
- (3) The Contractor’s specific block libraries shall be transmitted to the Engineer together with an associated block library list containing the filename (max. 6 characters) and block description. The Contractor shall ensure that the library is regularly updated and circulated to all other users, together with the associated library listing.



- (4) All Blocks of a common type, symbols or details shall initially be created within a CAD “Model Space File” specifically utilized for that purpose. These files shall be made available to the Engineer / Employer as required.
- (5) All Blocks created shall typically be 2D unless 3D is specifically requested. In both instances they shall have an origin at a logical point located within the extents of each Block’s masked area or volume.

3.6 CAD Dimensioning

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

3.7 CAD Layering

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

3.8 Global origin, Location and Orientation on the Alignment Drawing (if applicable)

- (1) Location or Plan information in “Model Space” files shall coincide with the correct location and orientation on the Project grid for each specific contract.
- (2) Location plans shall have at least three setting out points shown on each CAD “Model Space” file. Each setting out point shall be indicated by a simple cross-hair together with related Eastings and Northings co-ordinates. The Contractor shall establish the setting out coordinates for his respective Works, which shall then be used by the Other Contractors.

3.9 Line Thickness and Color

To facilitate the consistent plotting by the Contractor and other users, the colour codes, line shape, line thickness / pen sizes etc. for different applications of the works / work elements shall be assigned by the Contractor and submitted to the Engineer for his consent.

3.10 Master List of Documents for Notice of No Objection / Consent / Approval

The Contractor shall furnish the Engineer a master list of the technical documents for Notice of No Objection / consent / approval, which he proposes to prepare and submit under the Contract, within 42 days from the Commencement Date. The master list shall include the drawing number, title and the Contractor's target date for the first submission of each document for Notice of No Objection / consent / approval.

The master list of documents to be submitted shall be subject to the Engineer's consent.

The master list shall be used to monitor submission and Notice of No Objection / consent / approval of each drawing.

3.11 CAD Utilization of 2D & 3D Files

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

3.12 CAD File Numbering

- (1) Contractor’s CAD File Numbering shall be as described in clause 2.2 above.

- (2) Employer's CAD File Numbering: This will follow the numbering system as specified above except that the status of the drawing shall be with the letter "E".

3.13 CAD File Naming Convention – General

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

4. Submission, Receipt and Transmittal of Documents and Drawings

4.1 Submission of the Documents and Drawings

Unless and otherwise instructed by the Engineer, when the Contractor submit any documents and drawings to the Engineer for his check/ review/ approval/ consent/ issue of "Notice of No Objection" as well as in respect of "Good for Manufacturing Drawings" and "As Built Documents", the Contractor shall prepare six (6) sets of hard copies (controlled copies) with one (1) set of CDs of submitting documents and CAD data of submitting drawings.

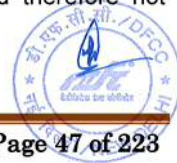
4.2 Data Transfer Media and Format

When data is received & transmittal between the Engineer / Employer and the Contractor, the media shall be as follows:

- (1) Data Exchange Format
 - (a) Document including tables and figures: PDF (.pdf)
 - (b) Drawings: AutoCAD latest version (.dwg)
- (2) Operating System - Windows XP/VISTA
- (3) Data Transfer Media: 12cm Compact Disc (650 MB) is highly preferred
- (4) All CDs or tapes shall be labeled on the data shield with:
 - (a) Name of Company / Contractor
 - (b) Project Title
 - (c) Drawing Filenames
- (5) The Contractor shall ensure the supplied media is free from virus.

4.3 CAD Media Receipt & Transmittal

- (1) CAD Media Transmittal (from the Contractor to the Engineer) – this shall consist of the following:
 - (a) CAD Digital Media shall typically contain CAD "Model Space" and "Paper Space" files;
 - (b) CAD data sheet;
 - (c) CAD issue/ revision sheet; and
 - (d) CAD Quality Checklist confirming compliance.
- (2) The above CAD media shall be collectively known as "CAD Media Transmittal Set". The CAD data file transmittal format required by the Engineer from all contractors shall be in AutoCAD (version 2011)
- (3) All CAD media received from contractors shall be retained by the Engineer as an audit trail / archive of a specific contractor's design evolution.
- (4) CAD Media Receipt (from the Engineer to the Contractor)
 - (a) CAD media should normally be as obtained from the respective Other Contractors and Interfacing parties, but should the Engineer issue CAD media it shall consist of the following:
 - i. CAD Digital Media typically contain only CAD "Model Space" files.
 - ii. CAD data sheet.
 - iii. CAD issue / revision sheet
 - (b) Each CAD transmittal disk shall be labelled with proper disk label as approved by the Engineer. Any CAD data transmittal without this label is assumed to be provisional information not to have been quality checked and therefore not formally issued.



APPENDIX 6

DOCUMENT SUBMISSION AND REVIEW PROCEDURE

1. Document Control Procedure

- 1.1 Within 28 days after Commencement Date, the Contractor shall submit the Document Control Procedure to the Engineer for review, which shall include but not be limited to the following:
- (1) a document approval system which shall specify the level of authority for approval of all documents before submission to the Engineer and in accordance with the requirements as specified in Appendix 2 [Quality Assurance];
 - (2) a system of issuing documents to ensure that pertinent documents are issued to all appropriate locations;
 - (3) a document changes or re-issue system to ensure that only the latest revision of a document can be used; and
 - (a) contract number;
 - (b) discipline;
 - (c) submission reference number; and
 - (d) revision indicator.
- 1.2 Project records will eventually be used by the Employer to manage, operate and maintain the Works after the completion of the Contract for supply of P&E and for future reference.
- 1.3 The Contractor shall submit the documents as required by the Engineer as project records in full and on time. The Engineer shall determine the adequacy of the project records.

2. Submission and Response Procedure

- 2.1 Except where specific procedures are given for certain items, all submissions shall be submitted and reviewed according to the procedure laid down in the following clauses.
- 2.2 Each submission shall be accompanied by a brief introduction to explain which subsystem - part of the Works to which the submission refers, listing the documents enclosed with the submission, and describing in outline how all relevant requirements of the Employer's Requirements are achieved by the proposals.
- 2.3 For each stage of submittal, the Contractor shall prepare a Submission Response Request (SRR) carrying the date of submission, the submission reference number as defined above, the submission title, the stage of submission (e.g. Technical Design, etc.), and the signature of the Contractor's Representative to confirm that, in the opinion of the Contractor, the submission:
- (1) complies with all relevant requirements of the Employer's Requirements;
 - (2) contains, or is based on auditable and proven or verified calculations or design criteria;
 - (3) has been properly reviewed by the Contractor, according to the Contractor's Project Quality Assurance Plan, to confirm its completeness, accuracy, adequacy and validity;
 - (4) has taken account of all requirements for approval by statutory bodies or similar organizations, and that where required, such approvals have been granted; and
 - (5) contains six (6) properly signed copies of the "Design Certificate", if necessary, as required in Appendix 2 [Quality Assurance] and the Employer's Requirements.



- (6) In case of new products / technologies, certification from the client railway of the organized railway system certifying its established and proven record under similar atmospheric and operational conditions as specified in Clause 13.1.1 of Specifications (Volume III of Bid Documents)
- 2.4 The Engineer's response to the submission shall be made within 21 calendar days of receipt of the submission.
- 2.5 Throughout each Design Stage, the Contractor (including his Specialist and Other Manufactures as applicable) shall attend monthly design review meetings with the Engineer. At these Engineer's review meetings, the Contractor shall present information, drawings and other documents to the Engineer in respect of all submissions programmed to occur during the following four week-period. The Contractor's presentations shall be in sufficient depth to enable the Engineer to obtain a clear understanding of the Contractor's proposals and to discuss the methodology and process used in reaching the proposed design solutions. Unless otherwise directed by the Engineer, all meetings shall be convened in Engineer's Office or Contractor's Main Office or at the Site Office or at any other location as decided by the Engineer.
- 2.6 The Contractor shall record all of the Engineer's observations and any agreed actions resulting from the Engineer's review meeting and shall address each of these fully before submission of the respective documents for formal review.
- 2.7 If, in the Engineer's opinion, following receipt of a submission there is benefit to be gained from a meeting with the Contractor to clarify or discuss any of the contents of the submission, he shall notify the Contractor accordingly with not less than 5 days advance notice, and the Contractor shall attend at the time and place appointed by the Engineer.
- 2.8 In case of use of new products / technologies (other than RDSO design), requiring evaluation and validation of RDSO (as specified in clause 13 of Specifications (Volume III of the Bid Documents), the Engineer's response to the submissions by the Contractor shall be made within 126 days (18 weeks) from the date of submission of complete relevant data / certification by the Contractor

3. Engineer's Response

- 3.1 The Engineer shall respond in one of the following three ways:
- (1) Notice of No Objection
 - (2) Notice of Objection (With "A" Comments)
 - (3) Notice of No Objection with Comments
- 3.2 Definition of Engineer's response:
- (1) "Notice of No Objection": if following his review of the submission, the Engineer has not discovered any non-compliance with the contract, the Engineer shall issue to the Contractor a formal "Notice of No Objection" (NONO). A NONO from the Engineer irrespective of with or without comments does not in any way imply the Engineer's consent of the submission nor does it remove any responsibility from the Contractor for complying with the Contract. Issue of a NONO from the Engineer entitles the Contractor to proceed to the next stage of the programmed work.



- (2) "Notice of Objection (With "A" Comments)": if following his review of the submission, the Engineer discovers major non-compliance, discrepancies or omissions etc. that in his opinion are of a critical nature, the Engineer shall issue a "Notice of Objection" (NOO) with type "A" comments. The Contractor shall revise and reissue the submission addressing the Engineer's comments. Following the issue of a NOO by the Engineer the Contractor is not entitled to proceed to the next programmed stage on the path in the relevant network as previously consented by the Engineer until all of the Engineer's comments have been fully addressed and a NONO is issued.
- (3) "Notice of No Objection" (With Comments)": if following his review of the submission, the Engineer discovers discrepancies or omissions etc. that in his opinion are not of a critical nature, the Engineer shall issue a "Notice of No Objection" (NONOC) with Comments. The Contractor shall respond to the comments, agreed and incorporated prior to inclusion in the "Construction Package". Following the issue of a NONOC by the Engineer, the Contractor is entitled to proceed to the next stage of the programmed work subject to the inclusion of amendments necessary to address the comments.



APPENDIX NO.7 PUBLICITY AND PUBLIC RELATIONS

1. General

The responsibilities of the Contractor or his Specialist/Other Manufacturers of any tier with the specific written approval of the Engineer / Employer shall without limitation include:

- (1) Inform and explain to the public on the background, the need and the development of the project;
- (2) Promote the project to the public and the parties concerned with a positive message;
- (3) Raise the community's awareness on the needs of the modernized heavy load railway transportations system for the nation's future development;
- (4) Highlight how the project improves the environment and transport condition of the people and brings about the benefits to the people;
- (5) Ensure adequate transparency of the project to the public and key stakeholders;
- (6) Gain support and minimize objections from the community and the parties concerned;
- (7) Establish a sense of partnership among the Government and stakeholder groups in the development of the project;
- (8) Provide proper responses to comments, criticism and complaints during the construction stage;
- (9) Resolve issues and crises arising during the course of Manufacturing;
- (10) Communicate with the concerned parties and to show them the team is keen to prevent and/or mitigate any nuisance due to the completion of the Project at the earliest possible time;
- (11) Prepare and supply all necessary drawings, photomontages, documents, consultation papers, presentations, display materials for public consultations; and
- (12) Provide assistance and information to facilitate all PR activities as instructed by the Project Quality Plan and / or as required by the Employer / Engineer.

2. Public Consultation (if required)

The Contractor shall carry out with the guidance of the Engineer, but not be limited to, the following public consultation works:

- (1) The Contractor shall inform and consult the relevant Government departments concerning the project, local residents, property management offices, shops, schools and sensitive receivers at least three months prior to the commencement of manufacturing works;
- (2) The Contractor (or the specialized subcontractor if hired) shall organize and participate in Commissions and Public Hearing with relevant authorities concerning the civil, ecological and archeological issues.
- (3) The Contractor shall gain support, ease concerns and minimize objections from the public affected by the manufacturing works during the public consultation;
- (4) The Contractor shall address public concerns and feedbacks as far as possible to minimize disturbance to the public during commissioning and site acceptance test at the Contractor's own expenses;



The Contractor shall ensure proper communications to the public by establishing an effective communication channel. The communications shall be open and transparent in the form of an interactive two-way system. Stakeholders and parties concerned shall be updated regularly on the progress of Works and development of the projects in particular during any stage on matter relating to ground movement, vibration and special traffic arrangement, etc. by an easily accessible system. Queries, feedbacks and comments from the stake holders and parties concerned shall be considered and handled properly in an effective manner. An effective communication system of on-site notices, website and hotlines shall be set up.

3. Public Relations Tools

The Contractor shall provide and make use of, but not be limited to, the following Public Relations (PR) tools in carrying out his PR duties:

3.1 Newsletter

The Contractor shall design and produce newsletters with the guidance of the Engineer and acceptance by the Employer at three months interval throughout the execution period and distributed to concerned Government departments, Employer, related competent agencies, NGOs or individual members of the public, local authorities and people in the affected areas, etc. as advised by the Employer. The newsletters shall be published in both English and Hindi providing in depth descriptions of the project and the latest development and progress of the project. The highlight shall be on the benefits of the project, milestone events of the Works activities and mitigation measures taken to minimize the impact to the public. Ways of communication channels shall also be published in the newsletters such as the phone numbers of the enquiry hotline and the email address for enquires, etc.

3.2 On-site Notice

The Contractor shall post on-site notices with the consent of the Engineer with clear description of the Works and indication of anticipated completion date together with the enquiry hotline and internet website information. Advance notices shall be given in carrying out the Works with great impact on local residents. The design of this notice shall be well considered to be in harmony with the local landscape and surrounding features.

3.3 Hotline

The Contractor shall set up a 24-hour hotline with the consent of the Engineer to provide enquiry services to the public and the Contractor shall ensure queries and enquiries regarding the project are taken seriously and dealt with swiftly. Whenever complaint / query is received, response shall be made within 14 calendar days. If a longer processing time is needed, an interim reply shall be served to the complainant within 14 calendar days.

3.4 Public Relations Plan

The Contractor shall produce a Public Relations (PR) Plan. The PR Plan shall include the methodology specific ways and actions to be carried out for proper informing and consulting the public and promotion of the project. The PR Plan shall also include the methodology, specific ways and actions to handle reactions from the public, in particular issues relating to congestion, pollution, vibration, ground movement, noise and nuisance (during commissioning and Site Acceptance Test), etc. The PR Plan shall give proposals and details on effective liaison, consulting, informing, meeting, contacting, clarifying with the public and gaining their support and understanding on the importance and benefits of the project and the mitigation measures to reduce the impacts which may be generated during the execution stage of the project. The Contractor shall update quarterly and submit the PR Plan including a summary of PR events conducted and complaints/ queries handled in the past quarter and PR events to be conducted and complaints/ queries envisaged in future throughout the Contract Period.

4. Coordination with Other Contractors

The Contractor shall, subject to the instruction of the Engineer, coordinate with the Other Contractors and related competent agencies in the implementation of PR activities



Section 9: Employer's Requirement – Particular Specification of P&E



1. General

- 1.1 There are 22 (twenty-two) P&E scheduled for procurement. These 22 P&E are grouped in 10 (ten) groups depending on the functionality, similarity of sub-assembly/components/manufacturer, utility, technology, commonality, configuration, vehicle, mechanical transmission etc. The groups, sub-groups and page number at which the specification is given are as follows:

| Reference Specification No. | Description | Page No. |
|-----------------------------|---|----------|
| Section 9.1 | Mechanized Track Maintenance Machines | 55 |
| Section 9.1.1 | Continuous Tamping Machine with integrated dynamic Stabilizer | 65 |
| Section 9.1.2 | Ballast Regulating Machine with Hopper | 71 |
| Section 9.1.3 | Shoulder Ballast Cleaning Machine | 74 |
| Section 9.1.4 | Points & Crossing Tamping Machine | 78 |
| Section 9.1.5 | Dynamic Stabilizer | 83 |
| Section 9.1.6 | Duo-matic - Two Sleepers Continuous Tamping Machine | 85 |
| Section 9.2 | Mobile Rail Grinding Machines | 88 |
| Section 9.3 | Self-driven Recording and Measurement Cars | 107 |
| Section 9.3.1 | Track Recording Car(TRC) | 121 |
| Section 9.3.2 | OHE Recording Car(ORC) | 132 |
| Section 9.3.3 | Inspection Vehicle | 143 |
| Section 9.4 | Self-Driven Rail Bound Maintenance Vehicle | 145 |
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| Section 9.5 | Rail-cum-Road Maintenance Vehicle | 168 |
| Section 9.5.1 | Rail cum Road Multi Utility Vehicles with MMU Equipment | 170 |
| Section 9.5.2 | Rail cum Road Vehicle with Crane for Civil works | 190 |
| Section 9.5.3 | Rail cum Road Vehicle with Crane for OHE works | 192 |
| Section 9.5.4 | PSI Equipment Testing Van (Road Only) | 194 |
| Section 9.6 | Rail cum Road Based Vehicle with Motorized Elevated Working Platform (MEWP) | 196 |
| Section 9.7 | Vehicle Condition Monitoring Equipment Base Station | 204 |
| Section 9.7.1 | Wheel Impact Load Detector (WILD) | 209 |
| Section 9.7.2 | Hot Axle and Hot Wheel Detection (HAHW) | 212 |
| Section 9.8 | Ballast Hopper wagon with remote control discharge | 215 |
| Section 9.9 | OHE Rehabilitation and Renewal Equipment | 218 |
| Section 9.10 | Flat wagon for carrying Rails | 222 |

- 1.2 The Sketches attached with various Particular Specification is only for indicative purpose and the optimized dimensions and layout shall be finalized during design approval stage considering the SOD/SSOD/Attachments and Employer's Requirement. There is no Sketch no. 10.



Section 9.1 Mechanized Track Maintenance Machines

This General Specification covers the following P&E

- Continuous Tamping Machine with integrated dynamic stabilizer (Section 9.1.1)
- Ballast Regulating Machine with Hopper (Section 9.1.2)
- Shoulder Ballast Cleaning Machine (Section 9.1.3)
- Points and Crossing Tamping Machine (Section 9.1.4)
- Dynamic Stabilizer (Section 9.1.5)
- Duo-matic two sleeper tamping Machine (Section 9.1.6)

1. GENERAL

- 1.1** This is a general technical specification applicable for all the mechanized track maintenance machines as given above. The specification has been prepared based on RDSO specification and given in Vol III from Specification No. 1 to 6. In case of any doubt arising or clarification required to be given by the Engineer during design approval stage, it may also refer RDSO specification, as applicable.
- 1.2** All the P&E in this Section are termed as Key Machines for which Qualification Criteria requiring minimum Experience is stated in Vol I of this Bid Document.
- 1.3** The Bidder shall specify the model offered (similar to the Particular Specification which also complies with the Evaluation and Qualification Requirement Section 2. Vol, I) and furnish the detailed technical description of the machine. Systems/sub-systems of the working mechanism of the machine as per relevant particular specification and all the items of the specifications in general shall be described in detail with sketches to show the manner in which the requirements of the specifications are accomplished by the machine (model) offered.
- 1.4** The Bidder shall submit the calculation for the selection of the rating of each of the equipment as applicable to confirm its adequacy for the application of related track machine listed in the section 9.1.1. to 9.1.6 during design approval stage.
- 1.5** The Bidder shall submit the performance parameters of each of the P&E which shall be better or equal as compared to the parameters specified in the Sections 9.1.1 to 9.1.6.
- 1.6** Photographs of the type of machine in working mode along with video/animation shall be enclosed with the offer. The photographs shall also show the close ups of various working assemblies/systems and the full machine. The Bidder shall furnish a compact disc or DVD or USB showing the working of the machine in real time under field conditions.
- 1.7** Each of the machine covered under this section of the specification shall be provided with an industrial quality heavy duty portable computer (Laptop-tough book) for keeping record of the overall aspects of working, spares management and reporting. The detailed specification of the laptop is attached at Annexure 1 to this section.

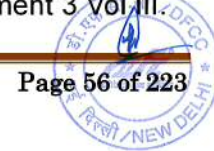


2. DIMENSIONAL AND OPERATING REQUIREMENTS

- 2.1** The diesel-powered equipment shall be robust, reliable and suitable for working on DFCCIL and IR network. The design and dimensions of the machine components shall be to metric standards.
- 2.2** The machine shall be a self-propelled bogie type vehicle. The profile of the machine longitudinally and in cross section during transfer as a self-propelled vehicle or towed in train formation shall be within the maximum moving dimensions of DFCCIL and IR. The Bidder shall provide sketches of the machine in plan and shall give calculations to prove that the machine does not cause infringement while moving on a 1 in 8½ curve.
- 2.3** The distance between bogie pivots shall be such as to avoid excessive rail stresses during different operations and calculations shall be submitted during design approval stage. Adequate clearance shall be allowed so that no component infringes the minimum clearance of 102 mm from rail level while travelling.
- 2.4** Wherever applicable, axle load shall be lesser than 20.32t with minimum axle spacing of 1.83 m. Load per meter shall not exceed 7.67t. Axle loads up to 22.82 tonne and lower axle spacing may be permitted, provided the load combinations do not cause excessive stresses in the tracks & bridges of DFCCIL and IR. Stresses in the tracks & bridges shall be calculated by the Contractor on DFCCIL network and submitted during design approval stage.
- 2.5** It shall have a minimum wheel diameter of 914 mm (new wheel profile). However, lesser diameter up to 730 mm (new wheel profile) can also be considered provided it meets the condition laid down in clause 2.3 at its condemnation limit and rail wheel contact stresses for 72 UTS rail are within permissible limits. Forged wheels similar to Indian Railways profile shall be provided on the machine. It is desirable that 50mm margin between new and permitted worn wheel diameter should be available, but this should not be less than 20mm. The worn-out wheel diameter (condemning worn out diameter) based on the criteria of rail wheel contact stress for various maximum axle loads are as under.

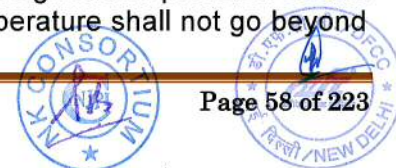
| Maximum Axle load (tonne) | Minimum worn-out wheel diameter (mm) |
|---------------------------|--------------------------------------|
| 22.82 | 908 |
| 22.00 | 878 |
| 21.50 | 860 |
| 21.00 | 841 |
| 20.32 | 816 |
| 20.0 | 805 |
| 19.5 | 787 |
| 19.0 | 768 |
| 18.5 | 750 |
| 18.0 | 732 |
| 17.5 | 713 |
| 17.4 | 710 |

The permitted worn out wheel diameter should be specified by the manufacturer. The diameter of wheel for assessment of permitted axle load will be the worn-out wheel diameter. The new wheel profile on the machine shall be as per Indian Railway standard RDSO Drg. No. SK-91146 and given at Attachment 3 Vol III.



- 2.6 It shall be capable of continuous negotiating curves up to 2218 m radius, super elevation up to 185 mm and gradients up to 3% in travel mode. The Contractor shall specify the minimum attainable speed, as per simulation to be submitted, under the above limiting condition.
 - 2.7 It should be capable of continuous operation during the varying atmospheric and climatic conditions occurring throughout the year. The climatic condition is detailed in attachment 14.
 - 2.8 All the system components on the machine, which are vulnerable to moisture ingress and adversely affected during rains, should be covered by a roof or suitable arrangement so that the machine is able to work continuously even during rains.
 - 2.9 During the transfer from one station to another, it shall be capable of travelling on its own power at a speed of 100 km/h. Since the machine is likely to cover long distances on its own power, the travel drive system should be robust for continuous running for minimum 8 hours. The machine should be capable of hauling an 8-wheeler coach/Wagon (90 gross ton approximately). The maximum speed possible with 80 gross ton wagon attached to it through simulation studies shall be submitted.
 - 2.10 It shall be capable of working without requiring power block in electrified sections of IR and DFCCIL network.
 - 2.11 The machine or its any part shall not infringe the adjoining track while opening and closing of work. During working also, it shall not infringe the adjoining track and it shall be possible to permit trains at full speed on that track.
 - 2.12 It should be possible to drive the P&E in both directions at the same speed.
- 3. DIESEL ENGINE**
- 3.1 The machine shall be powered by a diesel engine (s) preferably indigenous, with a proven record of service in tropical countries with a service network in India. Robust construction and low maintenance cost are of particular importance and shall be demonstrated in the maintenance schedule submitted at the time of design approval. Adequate allowance shall be made for de-rating of diesel engine under the most adverse climatic conditions mentioned in this specification elsewhere.
 - 3.2 High-speed diesel oil to Indian Standard specifications shall only be used. A minimum fuel capacity sufficient for continuous operation for eight hours but not less than 900 litres shall be provided.
 - 3.3 Sight glass type fuel measuring gauge, preferably of full height shall be provided on the fuel tank.
 - 3.4 For starting the engine, storage batteries of well-known Indian make shall be provided. The engine shall normally be push/pull button start type or key type. The details of the storage battery and the standards to which it is manufactured shall be submitted along with manufacturer recommended life as per the environmental and working condition specified.

- 3.5** Since the engine is to work outdoors under extreme dusty condition, the air intake system shall be designed suitably so as not to allow dust through the air intake system.
- 3.6** There is likelihood of dust deposition over the engine body and surrounding area over the oil and lubricant spill-over. The Contractor shall ensure robust design to avoid oil and lubricant spill over, and will be treated as a type defect if observed during the Defect Notification Period. In case, air cooled engines are proposed by the Contractor, maintenance equipment for cleaning and maintenance of the air cooling fans shall be provided by the Contractor along with.
- 3.7** The engine parameter monitoring gauges like temperature, RPM, lube oil pressure shall be direct reading type mounted on the engine, backed up by electrical/mechanical gauges in the operator's cabin showing the absolute readings along-with safe limits suitably colored. There shall be an audiovisual warning (safety mechanism) to the operators in case of any of these parameters exceeding the safe limit and engine shut down circuit in case of operator's failure to respond.
- 3.8** A suitable interlock mechanism should be provided to start the prime mover at no load only and gradual loading after the start of the prime mover. A fail-safe clutch mechanism should be provided to meet this requirement. The engine power take-off shall be coupled to the main gearbox through a flexible coupling. The engine shall be mounted on suitable anti-vibration mounting.
- 3.9** The engine should have Electronic Control Module (ECM) or similar arrangement for taking out operating parameters on a real-time basis, such as RPM, load, fuel consumption, temperature, pressure maintenance and diagnostic data as well as trip and historical data. These data should be displayable on a centralized computer based control and monitoring system. It should also be possible to transfer these data onto a USB device and transfer through internet to the Maintenance Service Organization located at TMD/IMD to assist in repairing minor faults and avoiding discontinuation of the work resulting in returning of the machine without completing the schedule work.
- 3.10** The engine emission standards shall conform to latest Bharat Stage norms applicable for such type of engines as directed by CPCB, Ministry of Environment and Forests, Govt. of India.
- 3.11** The P&E shall be equipped with the centralized computer based control and monitoring system which shall monitor the health parameters such as temperature, pressure, rpm, current as applicable and related to engine, hydraulics, pneumatics, electrical, battery etc.
- 4. COOLING SYSTEM**
- 4.1** The cooling system shall be efficient and designed for a maximum ambient temperature specified. The Contractor shall note that the machine shall be working under extremely dusty conditions and the cooling mechanism shall be designed to take care of such environmental conditions.
- 4.2** The adequate heat transfer arrangement shall be designed and provided so that under extreme heat conditions. the system oil temperature shall not go beyond the designed and range specified in the manual.



5. BRAKES

- 5.1** The machine shall be fitted with compressed air brakes and applying equally on all wheels. A provision shall exist to couple a camping coach for the staff being hauled by the machine. Fail safe braking mechanism system shall be provided so that in case of any failure of brake circuit, brakes shall apply automatically. The brakes shall be protected from ingress of water, grease, oil or other substances, which may have an adverse effect on them. The brake lining shall be suitable for high ambient temperature specified. The force required for operating the brakes shall not exceed 10 kg at the handle while applying by hand and 15 kg on the pedal, when applied by foot. In addition, mechanical brake shall also be provided for use in an eventuality of failure as well as for parking. Beside this, pneumatic parking brake shall be provided on the wheel.
- 5.2** The machine shall be equipped with suitable arrangement of braking so that while attached in train formation, the machine can be braked by the traction vehicle having compressed air braking system. In addition, the machine shall also be equipped with a suitable air brake system in the driving cabin so that attached wagon or coach compatible with the IR system while being hauled by the machine can be braked.
- 5.3** There should be a provision of the emergency brake application in the machine either travelling alone or coupled with the coach/wagons, in addition to the normal braking system of the machine, using the compressed air. The emergency braking distance (EBD) of the machine at the maximum design speed on level track shall not be more than 600 m. Design calculations for the braking effort and EBD at the maximum design speed of the machine on level track & at a falling grade of 1 in 33 should be provided by the Bidder.
- 5.4** Clearly visible brake lights shall be provided at both ends of the machine, which will be automatically operated when brake is applied or released. This is required to alert the operator of any track machine or self-propelled vehicle following this machine.
- 5.5** The brake shoes shall preferably conform to RDSO specification and sources from a RDSO approved Indian manufacturer. In case an alternative design is proposed, indigenous availability is a must.

6. HORN, HOOTER AND SAFETY SWITCHES

- 6.1** The machine shall be provided with dual tone (low tone & high tone) electric / pneumatic horns facing outwards at each end of the machine at suitable locations for use during travelling to warn the workmen of any impending danger. Control shall be provided in close proximity to the driver permitting the driver to operate either horn individually or both horns simultaneously. The horns shall be distinctly audible from a distance of at-least 400 m from the machine and shall produce sound of 120-125 dB at a distance of 5 meters from horn (source of sound). The higher tone horn shall have a fundamental frequency of 370 ± 15 hertz.
- 6.2** In addition, separate electric horns with push button, type switches, shall be provided at suitable locations in all cabin(s) and on machine body for communication between the machine staff about infringement/malfunctioning or any other trouble.

- 6.3** Pneumatically/electrically operated hooters capable of producing intensity of sound between 105-110 dB at a distance of 5 meters (when measured in still air in a closed room) and variation in intensity of sound shall not be more than 5 dB. The hooter shall be provided facing outwards at each end of the machine at suitable locations, operated by means of push buttons provided in the cabins to warn the staff working on/around the machine about approaching train on adjoining track. Additionally, switches for such hooter shall be provided outside to the machine frame and near the both side exit gates so that it can be operated by staff present at the work site near the machine. The hooter shall also be operable from a remote point at a distance of at least 300 m from the hooter.
- 6.4** Adequate numbers of safety stop/ switches should be provided all around so that in case of any danger to the worker as well as hitting of any obstructions by working unit like signaling cable, joggle fish plate, etc. during work, so that the operator can be warned or the machine can be stopped immediately.
- 6.5** Safety equipment like jacks, pullers turfers and other such equipment specific to the machine for restoring and towing failed units of the machine during working shall be provided on the machine. A List of such items shall be submitted along with the Bid.
- 6.6** The machine shall be provided with an emergency backup system to wind up the machine in the event of failure of a prime mover or power transmission system of the machine.
- 7. DRIVE MECHANISM**
- 7.1** The machine should be provided with an efficient traction drive system for traction during the operation. The machine's driving system shall be through hydrodynamic/hydrostatic/electrical (for running) and hydro-dynamic/hydro-static (for working) coupled power transmission arrangement capable of achieving full speed in both directions. The system should be so designed that all the driving wheels work in synchronization and there is no slippage/skidding of the wheel during the work drive.
- 7.2** The driving mechanism, in work mode shall be adequately designed to handle the acceleration and the braking force. A suitable synchronization circuit to control the synchronization of the desired output with the machine drive/ braking system in the working mode shall be provided to prevent any damage to the machine system on account of non-synchronization.
- 7.3** Suitable differential systems may be provided between coupled wheels on the same bogie.
- 7.4** Suitable flow divider/throttling arrangement may be provided to equalize the tractive effort amongst different bogies.
- 7.5** The Contractor shall provide the necessary technical details, including circuit diagrams to confirm the above requirements.
- 7.6** Adequate gauges should be provided in working and driving cabins near operator's seat. Solenoid valves shall be provided near the linkage assembly, for indication, flow control and carrying out the necessary adjustment in the field.



- 7.7** To the extent possible hydraulic and pneumatic component/assembly should be fixed at a suitable location, preferably on the side frame of the machine so as to avoid the need of going on top of the machine for day-to-day maintenance schedules.
- 7.8** The pneumatic circuit should be provided with air dryer of adequate capacity to ensure use of moisture free air for the smooth operation of the pneumatic system of the machine.
- 7.9** The machine shall be equipped with adequate safety circuit such that if any unit/part which may endanger the safety is unlocked, the machine shall not move during run drive. The indication of locking and unlocking of all units should be displayed in the cabin.
- 7.10** On board system for online filtration and monitoring the quality of hydraulic oil in hydraulic circuit should be provided. The gauge should clearly indicate if the hydraulic oil is contaminated beyond the permissible limits and requires immediate replacement.
- 8. HOOKS AND BUFFERS**
- 8.1** The machine shall be fitted with hooks and buffers of IR design on both ends for coupling it with other vehicles for running it in train formation and for attachment with the coach, locomotives and wagon.
- 9. HEAD LIGHT, FLASHER LIGHT AND OTHER LIGHTING ARRANGEMENTS**
- 9.1** The electrical equipment to be provided shall conform to relevant standard specifications and shall be suitable for Indian climatic conditions. The machine shall be equipped with twin beam LED lamp pre-focused headlight, conforming to RDSO specification no. EL/TK/41 or equivalent or International Standard ensuring a light intensity of 3.2 Lux at ground level at the track center at a distance of 305 meters away on a clear dark night at each end with two front parking lights which can be switched to red or white according to the direction of the travel.
- 9.2** Powerful swiveling floodlights preferably with LED lamp and suitable luminaire shall also be provided to illuminate the working area sufficiently bright for efficient working during the night. Details shall be submitted during the design stage.
- 9.3** In addition, minimum eight power point locations (24-volt DC/15-amp socket) shall be provided with the outside frame of the machine two in front, two in rear and two on both sides for providing lighting arrangements during night working.
- 9.4** The amber color LED based flasher light producing not less than 500 Lux at 1 meter and 55 lux at 3 meters in line measurement in the axial direction from flasher light shall be provided at both ends in the machine to give indication to the train arriving on another line about any impending danger at both ends. The flashing frequency shall be 40 ± 5 flashes per minute and dominant wavelength of 590-595 nanometers to be visible at a distance of 2 Km in clear daylight and not be affected by sunlight glare. Suitable waterproof enclosures conforming to IP65 shall be provided.



9.5 Preferably electric power of 24 V (maximum up to 110 V) shall be used for operation of any electrical circuit.

10. CHASSIS AND UNDERFRAME

10.1 The chassis shall be of standard welded steel sections and of steel sheets so as to permit transportation of the machine in train formation without endangering the safety of the train. The under frame shall be constructed with rolled steel section and/or plates and shall be designed to withstand a maximum static squeeze test load of 102 T i.e. 51 t at each buffing point without any permanent distortion. The under frame shall be sufficiently robust for safe travel of the machine in train formation and not necessarily as last vehicle.

10.2 The suspension system shall preferably be in two stages with suitable springs and damping arrangement. Effective measures shall be adopted to minimize the weight transfer during starting, stopping and run.

11. CABINS

The Cabins of the P&E shall be designed and all measurement features provided relevant for the respective P&E. However, following general provisions are applicable for the all the P&E covered in this specification.

11.1 The machine shall be equipped with fully enclosed, sound and heat insulated air conditioned and pressurized cabins with safety glass windows at both ends. The electronic equipment shall be so designed that it shall be able to work without air conditioning under climatic conditions specified.

11.2 The cabin shall be ergonomically designed layout of seats, meters, gauges, operating handles, switches, pedals, emergency switches, front/back/side view, etc. within the reach of the operator of Indian origin and generally conforming to UIC 651 and related international standards.

11.3 It shall be possible to have a clear view of the track ahead while driving the machine in both directions from the cabin. The cabin layout shall be such that, before leaving the machine the operating staff has full view on both the side to avoid any danger to them from trains on adjacent tracks.

11.4 One screen wipers preferably operated by compressed air or electrically operated shall be provided on the windscreens.

11.5 4 Nos. Fire extinguisher (dry chemical type) shall be provided in the cabs with suitable mounting arrangement.

11.6 The machine shall be provided with well-designed space for keeping the tools, maintenance and operating manual and spares required for on the site repair of the machine to attend the breakdowns and other working requirements.

11.7 If more than one cabin is used, the necessary intercommunication system shall be provided inter-connecting all the cabins and should be so oriented that the operator, seating on the seat of either cabins/working cabin, can distinctly hear the conversation.

11.8 The cabin shall have sitting arrangement for minimum 6 machine staffs.

12. TOOLS AND INSTRUCTION MANUALS

- 12.1** Each machine shall be supplied with a complete kit of tools required by the operator in an emergency and for the normal working of the machine. The list of tools to be provided shall also include all tools necessary for on-site maintenance and repair of the entire machine including specialized equipment. All special tools shall be listed and catalogued illustrating the method of application. The Bidder shall along with his offer submit the list of tools to be supplied along with each machine. The list can be modified to suit the Employer's requirement during the design stage (Refer sub-clause 3.4.5 Section 8).
- 12.2** Detailed operating manual, maintenance and service manual as per clause 16.1 Section 8 shall be provided.
- 12.3** One portable diesel operated D.C. welding plant (with the provision of auxiliary output of minimum 2.5 kW, 230 V AC for the lighting) of reputed make preferably made in India with a minimum 5kVA capacity shall be provided. It should be capable of welding up to 5 mm. electrode (dia) at 60% duty. The sufficient welding cable shall be provided with the welding plant for the day to day repairing of the machine and its wearing parts. The diesel tank capacity shall not be less than 15 liters. One set of safety items for welder such as Helmet, safety gloves etc. shall also be provided.
- 13.** During the design approval, the Engineer will list out the important sub-assemblies required to be taken for factory acceptance test irrespective of manufactured by the Specialist/Other Manufacturers or sourced from vendor for which the cost will be borne by the Employer (Refer sub-clause 11.15 Section 8).
- 14.** The Contractor shall submit the vehicle dynamic simulation test report conforming to the speed potential, oscillation, hauling capacity, etc. The Bidder shall arrange to demonstrate that the parameters of the machines offered comply with the Employer Requirement by submitting detailed calculations, simulation etc.
- 15.** All machines covered under this specification shall undergo Site Acceptance Test on the first machine after completion of commissioning test. The machine shall be able to demonstrate the performance parameters as specified for each type of machine.



Annexure 1 to Section 9.1

Specifications of Heavy Duty Industrial Quality Water proof & shock proof Laptop (Tough book)

| | |
|-----------------------|---|
| CPU | Intel Core i-5 processor, speed 2.4 GHz or higher version |
| Operating System | Windows 7 professional or higher version |
| RAM | 4GB or more and expandable up to 16GB |
| Storage | Shock mounted flex connect hard drive with quick release 1000 GB or More |
| Display | Minimum 13" high definition LED or better with anti-reflective and anti-glare treatment |
| Keyboard | Backlit 61 key QWERTY keyboard. Touchpad with vertical scrolling support. |
| Wireless | Integrated Gobi 2000 mobile broadband or better, Bluetooth V 4.0 or better. |
| Durability features | Product shall be durable and meet the latest MIL standard. Moisture and dust resistant screen, Key board and touch pad. |
| Pre-Loaded Software's | Antivirus software for 18 months validity Microsoft office 2016 complete bundle |
| Power supply | Long life Li-ion battery, minimum 5400 m AH |
| Warranty | 3-year warranty will be enforceable directly by the Employer |



Section 9.1.1

Continuous Tamping Machine with integrated dynamic Stabilizer

This specification shall be read in continuation of the General and Technical specification given in Section 9.1

1. General

- 1.1** The machine shall consist of a tamping and stabilization unit to work in synchronization.
- 1.2** The stabilizing unit shall be in the form of trailer linked with the tamping portion of machine by suitable coupling. The stabilizing unit shall be operated by same operator who is operating the tamping unit. No separate operator for stabilizing unit shall be required. Stabilizing unit shall be so synchronized with the tamping unit that stabilization can be made to automatically start from the first sleeper tamped and stop at the last sleeper tamped.
- 1.3** The machine should be capable of performing both the function of tamping and stabilizing independently also.

2. Tamping

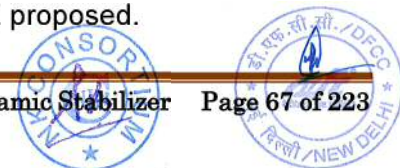
- 2.1** The machine shall be capable of carrying out automatic lifting, levelling, tamping, lining along with simultaneous stabilization of the tamped track, at the peak rate of 3500 sleepers or more per hour over a period of not less than 10 minutes and an average of not less than 2700 sleepers in an effective hour of working on all types of track structures over DFCCIL network and Indian Railways.
- 2.2** The time shall be counted from start to finish of the tamping work at the work place. Stoppage of work not attributable to machine shall be discounted. The setting up time and winding uptime shall be measured and the total time taken by the two operations of setting up and winding up of the machine together shall not exceed 10 minutes. The setting up time shall be counted from the time machine arrives at the site to the time the work is started. The winding up time will be counted from the time the work is stopped to the time machines starts moving away from the work site.
- 2.3** The Bidder shall furnish the full details of the working cycle of the machine, its timings and other operational details including performance parameters which shall only be better than as given in sub-clause 2.1 above.
- 2.4** The machine shall be provided with automatic tamping equipment. Separate tamping units have to be provided for each rail. Each unit comprises of tamping tools, shall be operated hydraulically.
- 2.5** The necessary work units shall be positioned on an under-frame separate from the main frame capable of cyclic movement from sleeper to sleeper, independent of the main frame, to facilitate continuous working for high output so that the operator does not get undue fatigue due to acceleration pull, breaking jolt in each tamping cycle.



- 2.6** The tamping below the sleepers, after the track geometry correction, shall be based on vibratory squeeze principle to achieve a durable compaction. The amplitude, vibration frequency and squeezing pressure to achieve a durable compactness shall be specified.
- 2.7** The ballast depth ranging from 300 mm to 350 mm shall be effectively compacted having a zone of influence of tamping of approx. 150mm layer below the bottom of sleepers. The maximum depth of concrete sleeper is equal to 210mm. There should be provision for step-less adjustment of the depth of tamping tools to suit different types of sleepers.
- 2.8** The Amplitude and vibration frequency of the tamping tool should be such that durable compactness under the sleeper is achieved. The squeezing time shall 0.8 sec or more. The vibration frequency and vertical load of stabilizing unit should be such that controlled settlement, lasting consolidation and substantial increase in post tamping lateral ballast resistance of sleeper is achieved. Details of all the above parameters shall be submitted with the offer.
- 2.9** The tamping tools should come to rest automatically after they encounter the resistance from the ballast to pre-selected squeezing pressure and hold the squeezing pressure for pre- set time. It shall be possible to vary the squeezing pressure, squeezing time, to suit varying track structure and ballast conditions.
- 2.10** The lifting system shall be such that the track can be lifted without bearing on the ballast. The machine frame and the lifting system shall be strong enough to bear the track lifting forces for all types of track structures for 150 mm lifts in one go. The free rail length between the two bogies of the main machine shall be long enough to permit the track lifting up to 150 mm in one go, having 60 Kg rails on concrete sleepers without excessive stresses in the rail or on the lifting mechanism. The lifting system should hold the rail continuously rather than releasing and re-lifting the rail at every tamping cycle. However, the lifting/lining system and tamping should be so synchronized that the track is stiffly held in position and there is no movement in the track when the tamping tool is inserted for tamping. This is required to ensure that the lift and slew are not altered during the process while the track is being tamped.
- 2.11** The machine shall be provided with automatic levelling equipment which will permit correct levelling of the track including provision of super elevation along with tamping. Tolerance achievable shall be as follows:
- | | | |
|-------------|---|-----------------------|
| Unevenness | : | ± 1 mm on 3.6 m Chord |
| Cross level | : | ± 1 mm |
| Alignment | : | ± 2 mm on 7.2m Chord |
| Twist | : | 1 mm/m |
- 2.12** The machine shall be fitted with automatic lining equipment capable of carrying out the lining simultaneously with levelling. The machine shall also have the ability to slew 60 Kg concrete sleeper track up to 150 mm in one go for all types of track structures.



- 2.13** The machine shall be capable of tamping, lifting, lining and stabilization of the track with up to 60 Kg long welded rails or short welded rails or fish-plated rails laid on pre-stressed concrete sleepers, steel trough sleepers, CST-9 and wooden sleepers. The normal sleeper spacing in different track structures on DFCCIL is 60 to 65 cm and Indian Railways from 55 cm to 75 cm. The tolerance of sleeper spacing over the DFCCIL network on turnout is ± 2.5 cm and tangent track is ± 1 cm.
- 2.14** It shall be possible to control the target track geometry parameters, in infinitely variable steps from operators/front cabin. To suit this, suitable proportional /servo control systems shall be provided.
- 2.15** The tamping tool holding arrangement in tamping arm of tamping bank should be cylindrical compressible type with bolting and dowel arrangement such that no hammering is normally required for fixing and removing the tamping tools.
- 2.16** The rail top to sleeper bottom depth may vary from 260mm to 420mm.
- 2.17** The tamping tool holding arrangement for fixing and removal shall be operator friendly.
- 3. Working Cabins:**
- 3.1** The machine shall be provided with a computerized unit for the overall control of its working system for all possible track geometry. The system shall be so designed that for working on tracks with pre-decided target geometry, the standard track geometry data as well as correction values can be entered prior to work either directly on the system or via USB, CD or DVD. For working on tracks with unknown target geometry, it shall be possible to determine the correction values by making a measuring run and subsequent geometry compensation of the recorded data considering obligatory point and constrains of lifting and lining etc. Interactive processing of the target profile by the operator shall be possible.
- 3.2** Track parameters shall be displayed in graphic as well as text form on a colour monitor. It shall be possible to guide the working system of the machine continuously and automatically by this unit. The software shall be Windows based. The hardware shall be sturdy for operations under conditions of shock, vibrations, dust, electromagnetic influences from outside and interruption of power supply. The unit shall have adequate memory to keep records of minimum 100 km of work performed; new track geometry obtained and enables transfer of the data via USB, CD or DVD as required.
- 3.3** The machine shall be capable of measuring and recording the unevenness, alignment and cross level in real time on a print out before and after the tamping and stabilization by the machine. It shall also record progress vis-a-vis time.
- 4. Stabilizing Unit**
- 4.1** The stabilizing unit shall be an integral part of the machine. It shall achieve effective and continuous stabilization of the track and shall be able to match the working speed of the tamping portion without loss in stabilizing quality. The Bidder shall submit the technical details of the P&E proposed.



- 4.2** During the operation, the stabilizer unit shall be capable of lowering the track in a controlled manner, while maintaining the pre-stabilized geometry. Proper longitudinal and cross-level control mechanisms shall be provided to achieve this. The manufacturer shall clearly explain the mechanism in its offer.
- 4.3** The stabilizing unit shall be capable of continuous stabilization of track structure as specified. To achieve a controlled settlement and a lasting consolidation of such heavy track, it shall be equipped with minimum two independent stabilizing units, applying suitable and variable vertical load upto 12 tonne or more each.
- 4.4** The stabilizing unit shall be capable of pre-loading the track. While pre-loading the track by stabilizing unit, the driving wheels should provide adequate adhesion to avoid wheel slippage/loss of traction and risk of derailment.
- 4.5** The horizontal and vertical force and frequency of vibration shall be adjustable so as to carry out effective stabilization on various types of track structures.
- 4.6** The machine shall be equipped with suitable mechanisms to control the degree of settlement of the track which shall copy the pre-stabilizing geometry by automatically increasing/relieving the vertical load on the stabilizing units. For optimum results, mechanism shall work independently for the left and right-hand rail.
- 4.7** It shall be possible to pre-select stepless, the frequencies of stabilizer vibrations which shall be between 0-45 Hz for optimum adjustment to suit the various kinds of track structures. During work near fixed structures like bridges, it shall be possible to pre-select a frequency within that range, which is beyond the natural frequency of the structure. In this context, it is also essential that the vibrations be automatically cut off, when the machine working speed reduces below prescribed cut off speed to be prescribed by the manufacturer in the offer.
- 4.8** The stabilizing unit shall be equipped with a frequency modulation measuring unit for optimum regulation of frequency. The machine shall be equipped with display units for monitoring vibration frequency, and degree of settlement on both rails.
- 4.9** To avoid damages on the rail surface by excess friction and force by the rollers and to achieve a force free resettlement of the ballast grains only lateral vibrations shall be permitted and those lateral vibrations by stabilizing unit shall be created without any vertical impact on ballast.
- 4.10** The Stabilizing unit while working as an independent unit shall comply with the specification as detailed for an independent unit under section 9.1.5.
- 4.11** The machine shall be equipped with an electronic device for measuring and recording the following track parameters in a separate measuring run:



- a. Versine of the reference rail
- b. Alignment of the reference rail
- c. Longitudinal level left
- d. Height left
- e. Height Right
- f. Super elevation
- g. Twist

The hardware shall preferably consist of touch panel computer with a flash disc and ink-jet printer. The report shall allow evaluations when threshold values are overstepped. Standard deviations shall be calculated in 200 m sections or the parameter alignment of the reference rail, longitudinal level and twist.

5. Site Acceptance Test

This shall be conducted on the first machine and as per the ITP finalized during design approval stage and shall include and not limited to the following items.

- a. Site Acceptance Test shall be conducted after the pre-commissioning test are completed successfully.
- b. Dimensional check of loading gauge, MMD, buffer height, clearances, length of the machine bogie distances etc.
- c. Testing for negotiability on a 1 in 8½ turnouts.
- d. Running speed test when hauled with self-power shall be at least 10% more than the maximum speed.
- e. Construction and engineering of the machine and its ability to perform all the functions as laid down in the specification.
- f. Amount of lowering up to 20 mm by stabilizing unit maintaining track parameters within permissible type.
- g. General lift during working up to 20 mm.
- h. Lifting of track in non-working mode of 150 mm in one go to be conducted at a siding.
- i. Maximum slew during working up to ± 10 mm.
- j. Slewing of track in non-working mode of 150 mm in one go to be conducted at a siding.
- k. The machine shall be able to tamp and stabilize 2700 sleepers in one effective hour of working.
- l. The machine shall be able to achieve a peak tamping and stabilizing rate of 3500 sleepers or more per hour over a minimum 10-minute period.
- m. The setting up time and winding up time shall be measured and the total time taken together shall not be more than 10 minutes. The setting up time shall be counted from the time the machine arrives at site and the time it actually starts the tamping operation. Similarly, the winding up time starts from the time machine stops operation and the time leaves the site.



6. Spare Parts

The Contractor shall supply one set of spare Tungsten Carbide Tip Tamping Tool (TCTT) confirming to RDSO Specification No. TM/HM/6/320 (Rev-2-2016) as applicable for the P&E covered under this specification or equivalent suitable for the design of the P&E approved by Engineer.



Section 9.1.2 Ballast Regulating Machine with Hopper

This specification shall be read in continuation of the General and Technical specification given in Section 9.1

- 1 The machine shall be capable of making a ballast profile on straight track and also curved track of radius up to 176 m with super elevation. A typical ballast section is given for IR (Annexure II of Specification 2 of Vol III) and DFCCIL network (Attachment 5 of Vol III). However, the ballast slopes between two tracks may not be well defined due to excess ballast. The machine shall be capable of working up-to a nominal ballast size of 65 mm or below for various types of sleepers like wooden, CST-9, Steel trough and concrete.
- 2 The machine shall be equipped with all essential working units like center plough, shoulder ploughs, sweeper/broom units and brushes for fastenings. Center plough, shoulder ploughs, sweeper/broom units, brushes for fastenings and ballast hopper shall be integral part of the machine. For utmost versatility and running quality of the machine, all these units should preferably be mounted centrally, i.e. between front and rear running gear.
- 3 The center plough and shoulder ploughs shall be capable of moving the ballast longitudinally along the track or across it for establishing the desired ballast profile in both sides.
- 4 All the ploughs shall be made of suitable material capable of moving the ballast without showing any stress.
- 5 Wherever required, the ploughs shall be hydraulically adjustable both vertically and horizontally and shall allow step-less variation, so as to adopt required height or any shoulder angle up to the angle of repose.
- 6 Individual height adjustment of the blades shall be possible to allow dosage of the ballast at the required location. The machine shall also be capable of quickly adapting to the changing circumstances and ballast distribution on the ground without the operator having to leave the cabin.
- 7 The shoulder ploughs shall be capable of avoiding obstacles like km posts, OHE installation, signal posts etc. in such a manner as to prevent ballast from heaping up and still keeping the shoulder ballast slope at the same angle. The safety device shall be provided to restrict the movement of shoulder plough up to 2675 mm from the canter line of the track on which the machine is working at any stage, to avoid any infringement to moving dimensions on the other track.
- 8 The shoulder ploughs shall be capable of working independently of each other and in both directions.
- 9 Along with center plough, the shoulder plough shall be capable of forming a mobile ballast box to enable some quantities of ballast to be transported along the track.



- 10 The machine shall be equipped with sturdy metal inverted troughs to cover the rail and fitting area to avoid flooding of the rail area with ballast at any stage of working.
- 11 The sweeper picks up unit (broom) shall be capable of picking up the ballast and depositing the same on either or both the shoulders by means like transverse conveyor belts. It should also be able to pick up the surplus ballast and to place it on a conveyor belt for transporting it to the ballast hopper.
- 12 The machine shall have the separate arrangement (brooms/brushes) to clean the rail fitting area or any ballast / small clip. The arrangement may preferably consist of wheel shaped brushes (two for each rail) which remove the ballast by rotating motion. Any variation shall be brought out by the Contractor satisfying the Employer's Requirement.
- 13 The machine shall be able to carry out the following jobs in one working pass in normal situations.
 - a) Shifting of ballast from left to right shoulder or right to left shoulder of the track.
 - b) Ploughing of excess ballast from the centre to desired one or both shoulders or from the shoulders to the centre.
 - c) Individual height adjustment of the blades shall be possible to allow dosage of the ballast at the required location.
 - d) Making the desired ballast profile.
 - e) Sweeping / brooming the excess ballast from the top of sleepers and depositing it on the shoulders.
 - f) Brushing away fine chips / ballast from the fastening area.
 - g) Collection of surplus ballast and conveying it to ballast hopper and discharging it on the shoulders and tamping area.
- 14 The machine shall be capable of regulating ballast at least up to 2000 M³ per hour of working. It shall also be able to regulate the ballast at the rate of 1.5 track km per hour in one or more working passes following a tamping machine.
- 15 The time required for starting the work after arrival of the machine at the site together with time for winding up the machine and starting back from the site after stoppage of work shall not be more than 6 minutes.
- 16 The machine shall have a hopper of capacity not less than 10 M³. The hopper should be equipped with a floor conveyor for maximum use of its capacity during loading. Preferably it shall have an arrangement of foldable flaps (over and above the capacity of 10 M³) to enable the capacity to increase to 12 M³ with flaps in open position. The hopper shall be equipped with proper ballast loading into hopper and unloading/discharging arrangements with chutes for distributing the ballast on shoulders and tamping area.
- 17 **Site Acceptance Test**

This shall be conducted on the first machine and the ITP shall include following items.

- a) Site Acceptance Test shall be conducted after the pre-commissioning test are completed successfully.
- b) Dimensional check of loading gauze, MMD, buffer height, clearances, length of the machine bogie distances etc.
- c) Testing for negotiability on a 1 in 8½0 turnouts.
- d) Running speed test when hauled with self-power shall be at least 10% more than the maximum speed.
- e) Construction and engineering of the machine and its ability to perform all the functions as laid down in the specification.
- f) Cross section of ballast shall be taken at every 10 m or at low/high profile peaks of cross section and excess of over mean value shall be calculated. The machine shall be able to regulate in a distance of 250 m at the rate of min. 2600 cum/hr.
- g) The machine shall be capable of generally regulating the ballast following a tamping machine at the rate of min 2.0 track km in one hour of working in one or more passes.
- h) In case required, the Site Acceptance Test may be conducted over Indian Railway network, if such stretch is not available over DFCCIL network to demonstrate the capability of the machine in full.

In case, any modification is found necessary as a result of test, the same shall be carried out by the Contractor at his own expenses.



Section 9.1.3 Shoulder Ballast Cleaning Machine

This specification shall be read in continuation of the General and Technical specification given in Section 9.1.

- 1 The machine shall be capable of working on all types of track structures of DFCCIL and of IR including long welded rails of 60Kg. /52Kg. /90-R sections laid on concrete/steel-trough/CST-9/wooden sleepers.
- 2 Since the machine is required to work in the dusty environment, all the components, including gear boxes, bearings, drive motors, pumps, electric and electronic control shall be of robust design, shielded and sealed from the dust and spill over ballast pieces. Suitable protection covers must be provided so that these components do not fail prematurely.
- 3 The various assemblies and the machine as a whole should provide adequate safety to the workmen working close by in connection with the machine operations. Various mechanisms shall be so designed that the ballast pieces do not fall on persons standing nearby. The necessary safety equipment shall form a part of the machine's Tools & Plants. The Bidder shall supply these items as a part of the Bid price.
- 4 It shall be capable of excavating ballast on the sleeper shoulders up to a distance of 2600 mm from the track centre and a depth of 900 mm, below the rail top. The excavation depth shall be adjustable to suit the requirement at the site.
- 5 The ballast shall be excavated up to the desired depth and width in one working pass.
- 6 It shall be possible to screen the ballast from either or both shoulders in one pass.
- 7 The machine shall be able to excavate ballast from the end of the sleepers to the toe of the ballast section to comply with the track structure of IR and DFCCIL. The width of excavation, measured from the end of the sleeper, shall be adjustable from 500 mm to 1300 mm depending upon the site conditions.
- 8 The undercutting on shoulders shall be done at a cross slope of 1 to 30 towards outside of the track for good drainage on double line track. The slope shall be in the same direction on both shoulders.
- 9 The excavating mechanism of the machine shall be retractable towards the track centre so as to avoid hitting of OHE mast foundations and at the same time, excavating the shoulder ballast from the area.
- 10 The machine shall have a mechanism to excavate ballast from under the sleeper bottom, up to 100 mm distance from the sleeper ends towards the track centre, to break the mud pockets. It shall be possible to use this mechanism only when considered necessary.



- 11 The excavation units shall be laterally adjustable for compensation of various sleeper lengths or for meeting certain other site conditions. The shift of the inner cutting face of the excavating mechanism shall vary from 1300mm to 1500mm, from the track centre, on either side of the track.
- 12 The machine shall be able to adjust the continuously variable speed from 0 to 1.5 kmph while in the work mode.
- 13 The screening unit shall be capable of screening the excavated ballast through a series of screens. The maximum and minimum sizes of the ballast retained shall be 65 mm and 25 mm respectively. The screening unit shall automatically remain in a horizontal position laterally, even when working on curves up to a super elevation of 185 mm.
- 14 It shall be possible to dispose of the spoils (oversize as well as the undersized ballast and muck) on the cess at a distance of not less than 5 meters from the center of the track, on either side of the machine. The spoils conveyor system shall be such that the spoils does not fall on the cleaned track and dimensions within the MMD of electrified territory.
- 15 The Bidder shall also provide a suitable safety mechanism to ensure that the spoil conveyor do not hit the mast and cause damage even due to the error of the operator like non-withdrawal of the spoil conveyor in time to by-pass the mast.
- 16 Loading of spoil into a muck wagon attached to the machine shall also be possible, when required, while working in the yards, built up area or cuttings etc. Machine during its working mode shall be capable of hauling/pushing muck wagon attached with the machine. The maximum trailing load of muck wagon is 800 tonne approximately. The muck carrying wagon shall be air braked vehicles.
- 17 The machine shall deposit cleaned ballast on either or both shoulders as required. There shall be not too short deposit of the cleaned ballast or heaping up of the ballast at the beginning/end of the work or during any stoppage of the work.
- 18 The machine after putting the cleaned ballast into the track shall make the desired ballast profile on either or both the shoulders. The side ploughs shall be suitably designed for necessary adjustment to achieve the required width and slope of ballast on the shoulders. It shall be possible to suitably retract the side of ploughs near the mast or signal posts etc.
- 19 Top of the sleeper end, fastening area and rails shall be cleaned of ballast pieces, using end ploughs and brooms.
- 20 After carrying out the work, the machine shall leave the track in a condition so as to permit movement of trains at maximum sectional speed without tamping, while the temperature is in the working range.
- 21 The machine shall have suitable mechanism to retract the excavating, regulating and other mechanisms from their working position on the approaches of level crossings, bridges, turnouts, etc. It shall be possible to retract and lower these assemblies

within about 1 metre of the level crossing, bridge, etc. so that there may be minimum loss of shoulder ballast cleaning operation.

- 22 The Time required for starting the ballast excavation and screening after arrival at the site of work together with the time required between stopping of the screening work and the starting of the machine for return journey shall be less than 15 minutes. A lower time for setting up and winding up is desirable. The Employer attaches utmost importance to the effective utilization of the traffic block made available for working of the machine.
- 23 The output of the machine in one hour of effective working shall not be less than screening of 500 m³ (five hundred cubic metre) of ballast.
- 24 The excavating and pick up mechanism shall be so designed that nearly all the excavated material is picked up for screening. Not more than 2% of the total material excavated by volume shall be left behind by the picking up mechanism.
- 25 The efficiency of screening shall be judged by collecting 5 samples of the screened material as it falls from the machine before its deposition on the track. Not more than 4% of this material by volume shall pass through a 25-mm sieve (ISI standard).

26 Site Acceptance Test

This shall be conducted on the first machine and the ITP shall include the following items.

- a) Site Acceptance Test shall be conducted after the pre-commissioning test are completed successfully.
- b) Dimensional check of loading gauze, MMD, buffer height, clearances, length of the machine bogie distances etc.
- c) Testing for negotiability on a 1 in 8½° turnouts.
- d) Running a speed test when hauled with self-power shall be at least 10% more than the maximum speed.
- e) Construction and engineering of the machine and its ability to perform all the functions as laid down in the specification.
- f) The machine crew shall be either trained personnel of DFCCIL or the staff of the Contractor.
- g) Dry weather, ambient temperature between 0 to 40 degrees centigrade.
- h) Straight track with Gradient up to 1/200.
- i) The maximum approach of the machine laterally and the depth is as per the specification.
- j) Output of the machine in one hour of working for the quantity of the ballast screened.
- k) Satisfactory working of the system of the disposal of the spoils.
- l) Efficiency of screening as detailed above.
- m) The time shall be counted from the time the machine arrives at the place of work to time it is ready to start back from work after winding up the operation. The setting up time and winding up time shall be measured and the total time taken by the two operations of setting up and winding up of the machine together shall not exceed 15 minutes.
- n) Screening of both shoulders simultaneously.
- o) Cutting depth shall be at least 200 mm below the bottom of the sleeper on both shoulders.
- p) Generally, no ballast piece bigger than 150 mm. Over-size between 75 mm and 150 mm not exceed 1%. Size of ballast to be recovered between 25 mm and 75 mm. The ballast not generally cemented.
- q) No water pockets, no mud pumping, grass in limited quantity.



- r) Normal moisture content of permanent way.
- s) Spoil below 25 mm size up to a maximum of 30% by volume for this purpose 4 representative samples shall be collected from the test length and screened at site for calculation of the spoil content. An average value shall be worked out which shall not exceed 30% by weight. While collecting the samples, it shall be ensured that the entire section to be excavated and screened is picked up.
- t) The formula for calculation of the output shall be as follows:
$$V (\text{Output}) = \frac{\text{Total volume in M3 excavated for screening}}{\text{Time in hours}}$$

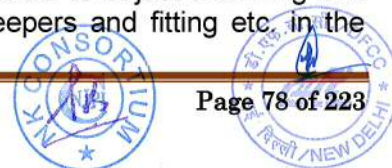
V represents the volume of the excavated ballast which shall not be less than 500 m³/hr. Time shall be measured in hours discounting the stoppages not attributable to machine failures.
- u) If considered necessary, the Site Acceptance Test of the machine shall be arranged over IR track, if the situation so warrants if it is not possible to conduct the Site Acceptance Test to the full capability of the machine.
- 26.1 Samples of the screened ballast shall be collected before it drops on the shoulder and shall be screened separately to assess the quantity of under size elements. Under size material up to 25 mm shall not exceed 4% by volume to the screened ballast. 5 Samples shall be collected and an average volume shall be worked out for the purpose of this test.
- 27 In case, any modification be found necessary as a result of the tests, these shall be carried out by the Contractor at his own expenses and with the approval of the Employer.



Section 9.1.4 Points & Crossing Tamping Machine

This specification shall be read in continuation of the General and Technical specification given in Section 9.1

- 1 A separate tamping unit shall be provided for each rail, each unit comprising of tamping tools operated hydraulically. It shall be possible to tamp all four rails of the turnout up to back leg of the crossing. The layout drawing of 1 in 12 and 1 in 8½ canted turn-out is given at Attachment 15 in Vol III., indicating the portion of turn out to be tamped. For the same, four independent tamping units shall be provided with necessary arrangements, for lateral shifting to adjust them on the rails of the turnout. Tamping unit shall also be adjustable from operator's seat for tamping of slanting sleepers. Similarly, it shall be possible to adjust the tamping tools in a manner so that all the accessible tamping zone on either side of the rails and sleepers are tamped effectively provided there is space for tamping tools to go into the ballast. It shall be possible to tamp longest sleeper in one operation.
- 2 Tamping action shall be based on vibratory squeeze principle with tamping tools, operating under the same pressure but independent of one another. The amplitude and vibration frequency and squeezing pressure to achieve a durable compaction shall be specified.
- 3 Amplitude, vibration, frequency and squeezing pressure of tamping tools shall be such that durable compaction under the sleeper is achieved.
- 4 The tamping tools shall come to rest automatically after they encounter the resistance from the ballast of the pre-selected pressure. The pressure shall be variable so that, it can be adjusted according to ballast conditions. It shall be possible to vary the peak squeezing pressure exerted by the tamping tools, to suit the different type of track structure.
- 5 The lifting system shall be such that the track can be lifted without bearing on ballast shoulders outside the sleepers. The machine frame and lifting system shall be strong enough to withstand the track lifting forces for all types of track structure for 150mm lift in one go depending upon the requirement.
- 6 The free length between the two bogies should be long enough to permit the track lifting up to 150mm in one go, with 60kg rails on concrete structure, without excessive stresses in the rail or on the lifting mechanism.
- 7 The machine shall be provided with the automatic levelling equipment, which will permit correct levelling of the track and point & crossing including provision of super elevation along with tamping.
- 8 While working on plain track, the lifting system should hold the rail continuously, rather than releasing and re lifting of rail at every tamping cycle.
- 9 The machine shall be fitted with automatic lining equipment capable of carrying outlining simultaneously with levelling. It shall be possible to adjust the lining unit longitudinally depending upon the position of the sleepers and fitting etc. in the turnout.



- 10 The machine shall be able to achieve the following tolerances
 - a. Unevenness: ± 1 mm on 3.6m cord
 - b. Cross level: ± 1 mm
 - c. Alignment: ± 2 mm on 7.2m chord
 - d. Twist: 1mm/m
- 11 The machine shall be capable of carrying out on plain track, automatic lifting, levelling, tamping and lining of 1000 sleepers in an hour of working. When tamping turnouts, it shall be capable of tamping one turnouts of 1 in 120 on PSC sleeper, complete with 10 sleepers on straight portion on the approaches of the turnouts in an hour of working.
- 12 The time shall be counted from start to finish of tamping work at the work places. Stoppage of work not attributable to machine shall be discounted. The setting up time and winding uptime shall be measured and the total time taken by the two operations of setting up and winding up of the machine together shall not exceed 10 minutes.
- 13 The machine shall be capable of automatic leveling, lining and tamping of turnout with CMS and built up crossing of angles 1 in $8\frac{1}{2}$, 1 in 12 and 1 in 16 laid on wooden, steel or concrete sleepers without dismantling the turnout.
- 14 The machine shall also be capable of tamping, lifting and lining up to 60kg/m long welded rails, short welded rails and fish plated track with rails laid on concrete sleepers, steel trough sleepers, CST-9 or wooden sleeper as the minimum clear distance between the joint sleeper is 50 mm, the machine shall be able to tamp these two sleepers together. The normal sleeper spacing in different rack structure in IR is 50 cm to 75 cm.
- 15 The machine shall be capable of slewing of track if required, up to 150mm in one go on all types of track structures. The machine shall also be capable of lifting the track if required up to 150mm in one go on all types of track structures.
- 16 The tamping tools shall be capable of tamping ballast up to a depth of 150mm below the bottom of the sleepers. There shall be provision for step less adjustment of depth of tamping tools.
- 17 It shall be possible to control the target track geometry parameters infinitely variable steps, from the operators/ front cabin. To suit this suitable proportional/ Servo control system shall be provided.
- 18 Considerable pull is applied on the rail while operating the machine from one line on the turnout for tamping or lifting. The other track on the turn out acts as an anchor and adds to the requirement of lifting force. This may result in over stressing of the fastenings of the track from which the machine is operating. The machine, therefore, shall have the arrangement to lift the other track of the turnout also while the track on which the machine is working is lifted for tamping. Proper mechanism shall be provided to ensure that the lifting of the other track is carried synchronously and the



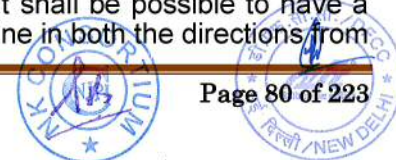
lifting operation is cut off automatically when desired or when the specified lift is reached.

- 19 The rail top to sleeper bottom depth may vary from 260 mm to 420mm. There shall be provision for step less adjustment of the penetration depth of tamping tools to suit different types of rail and sleepers. The machine to be provided with the penetration assistance system to achieve full penetration even in caked ballast bed.
- 20 Important tamping parameters like Datum Rail, General lift, single insertion or double insertion, design or smoothening mode, time of the start and end of the work, squeezing pressure, squeezing time, vibration pressure and tamping depth etc. shall be shown on a display in the working cabin. It shall be possible to draw these data from the system itself after work via USB port on a memory stick for the purpose of record.
- 21 A programmable logic control system shall be provided in the machine so that the work like lifting, lining, tamping and work drive of the machine will commence only when all conditions for their working /movement is fulfilled.
- 22 In case of failure of the up and down cylinders of tamping unit, there should be an arrangement for lifting the tamping units mechanically by lifting equipment like trifor/chain pulley etc. Any other alternative arrangement for mechanically lifting tamping unit in such failures may also be provided.
- 23 The machine should be equipped with a centralized computer based control and monitoring system which shall monitor the health of machine working system such as engine (lube oil pressure, temperature, rpm, etc.), hydraulics (hydraulic pressure in different units, temperature, oil level in tank etc.), pneumatic (pressure of different units), electrical (charging/discharging rate, voltage etc.). All these data should be displayed on a monitor installed in working cabin. Arrangement for providing 3G/4G internet connection for sending data in soft format directly from the computer should also be available.
- 24 The machine shall be equipped with an electronic device for measuring and recording the following track parameters in real time:
 - a) Alignment and longitudinal level on minimum 7.2 m chord length
 - b) Cross level difference and twist at every 0.6 m or less interval.
 - c) Super elevation
 - d) Lifting value

The hardware shall consist of a touch panel computer with flash disc and an ink-jet printer. There should be provision to fix the threshold value of the above parameters and it shall be possible to draw reports to allow evaluations when threshold values are overstepped. Standard deviations shall also be calculated in 200 m sections of the track parameters, i.e. alignment of the reference rail, longitudinal level and twist. The track parameters of corrected track to be recorded during tamping. There should be no need for a separate measuring run after tamping.

25 Cabins

- 25.1 The machine shall be equipped with fully enclosed air conditioned and pressurized cabins with safety glass window at both the ends. It shall be possible to have a clear view of the track ahead while driving the machine in both the directions from



the cabins at either end. The cabin layout shall be such that, before leaving the machine, the operating staff has full view on both the sides, to avoid any danger to them from trains on the adjacent tracks.

- 25.2 The gauges, instruments and controls shall be suitably located in the operator's cab so that they can be observed without undue fatigue to the operator.
- 25.3 The operator's cabin shall be ergonomically designed to have easy access to all the controls. The operator shall have a full view of the working area from the operating seat to have a full control over the work.
- 25.4 One screen wiper preferably operated by compressed air or electrically operated shall be provided on each of the wind screens.
- 25.5 Suitable numbers of fire extinguisher (dry chemical type) shall be provided in all the cabins.
- 25.6 The machine shall be provided with well-designed space for keeping the tools and spares required for on-site repair of the machine to attend the break downs and other working requirements.

26 Site Acceptance Test

This shall be conducted on the first machine and the ITP shall include the following items.

- a) Site Acceptance Test shall be conducted after the pre-commissioning test are completed successfully.
- b) Dimensional check of loading gauge, MMD, buffer height, clearances, length of the machine bogie distances etc.
- c) Testing for negotiability on a 1 in 8½0 turnouts.
- d) Running a speed test when hauled with self-power shall be at least 10% more than the maximum speed.
- e) Construction and engineering of the machine and its ability to perform all the functions as laid down in the specification.
- f) The machine crew shall be either trained personnel of DFCCIL or the staff of the Contractor.
- g) Dry weather, ambient temperature between 0 to 40 degrees centigrade.
- h) Point and crossing on straight track or a curve with radius minimum up to 1000 m.
- i) Straight track with Gradient up to 1/200.
- j) Clean ballast cushion min 150 mm below the bottom of sleeper.
- k) Regular sleeper spacing of ±2 cm.
- l) General lift up to 20 mm.
- m) Maximum slew up to ± 10 mm.
- n) The machine shall be capable of carrying out on plain track, automatic lifting, levelling, tamping and lining of 1000 sleepers or more in an hour of working. While tamping the turnouts, it shall be capable of tamping one, 1 in 12 turnouts, including 10 sleepers on plain portion on the approaches of the turnouts in an hour of working. The time shall be counted from the time the machine arrives at the place of work to time it is ready to start back from work after winding up operation. The setting up time and winding up



time shall be measured and the total time taken by the two operations of setting up and winding up of the machine together shall not exceed 10 minutes.

In case, any modification is found necessary as a result of the tests, these shall be carried out by the Contractor at his own expenses and with the approval of.

27 Spare Parts

The Contractor shall supply one set of spare Tungsten Carbide Tip Tamping Tool (TCTT) confirming to RDSO Specification No. TM/HM/6/320 (Rev-2-2016) as applicable for the P&E covered under this specification or equivalent suitable for the design of the P&E approved by Engineer.



SECTION 9.1.5

Dynamic stabilizer

This specification shall be read in continuation of the General and Technical specification given in Section 9.1.

- 1 The Dynamic Track Stabilizer in this section is an independent unit and put to work behind tamping machines. The machine shall be capable of operation on various types of track structures of DFCCIL and IR.
- 2 It shall be capable of working at varying speeds to achieve effective and continuous stabilization of the track. It shall be capable of stabilizing, not less than 2.5 km. of the track in one hour of effective working. The stabilizing speed shall be adjustable infinitely at speeds from 0 – 2500 m/hr.
- 3 During the operation, the machine shall be capable of lowering the track in a controlled manner, while maintaining the pre-stabilized geometry. Proper longitudinal and cross-level control mechanisms shall be provided to achieve this. The manufacturer shall clearly explain the mechanism in its offer.
- 4 To achieve a lasting consolidation of such heavy track, the machine shall be equipped with two independent stabilizing units, applying a maximum vertical load of 12 tonne each.
- 5 To achieve a controlled lowering of the track, the stabilizing unit shall be capable of pre-loading the track as mentioned in above clauses. While pre-loading the track by stabilizing unit, the driving wheels should provide adequate adhesion to avoid wheel slippage/loss of traction. To ensure sufficient traction and avoid the risk of derailment, the total weight of the machine shall be at least 2.5 times the maximum possible vertical stabilizing load.
- 6 The machine shall be equipped with a suitable mechanism to control the degree of settlement of the track. For this purpose, a proportional servo controlled levelling system, automatically controlling the degree of settlement of the track shall be provided. This installation shall copy the pre-stabilizing geometry by automatically increasing/relieving the vertical load on the stabilizing units. For optimum results, levelling system shall work independently for the left and right-hand rail.
- 7 It shall be possible to preselect the step less frequency of vibrations which shall be between 0-45 Hz. For optimum adjustment to suite the various kinds track structures. During work near fixed structures like bridges, it shall be possible to pre-select a frequency within that range, which is beyond the natural frequency of the structure. In this context, it is also essential that the vibrations be automatically cut off, when the machine stops.
- 8 The machine shall be equipped with a frequency modulation measuring unit for optimum regulation of frequency. The machine shall be equipped with display units for monitoring vibration frequency, amplitude of vibration and degree of settlement on both rails.
- 9 To avoid damages on the rail surface by excess friction and force by the rollers, the lateral vibrations shall be created without any vertical impact.

- 10 It shall be able to work on single and double track sections as well as on platform lines.
- 11 It shall also be capable of working on points and crossing of 1 in 8½, 1 in 12 and 1 in 16 crossing angles and laid on wooden/steel through/concrete sleepers.
- 12 It shall be capable of carrying out stabilization work in both directions. The machine's driving system shall be through hydro-dynamically-coupled power shift arrangement, capable of achieving full speeds in travel mode in both the directions.

13 Site Acceptance Test

This shall be conducted on the first machine and the ITP shall include the following items.

- a) Site Acceptance Test shall be conducted after the pre-commissioning tests are completed successfully.
- b) Dimensional check of loading gauge, MMD, buffer height, clearances, length of the machine bogie distances etc.
- c) Testing for negotiability on a 1 in 8½° turnouts.
- d) Running speed test when hauled with self-power shall be at least 10% more than the maximum speed.
- e) Construction and engineering of the machine and its ability to perform all the functions as laid down in the specification.
- f) The machine crew shall be either trained personnel of DFCCIL or the staff of the Contractor.
- g) Dry weather, ambient temperature between 0 to 40 degrees centigrade.
- h) Point and crossing on straight track or a curve with radius minimum up to 1000 m.
- i) Gradient up to 1/200.
- j) Clean ballast cushion min 150 mm below the bottom of sleeper.
- k) Amount of lowering up to 20 mm.
- l) The setting up time and winding up time shall be measured and the total time taken by the two operations of setting up and winding up of the machine together shall not exceed 10 minutes.

In case, any modification be found necessary as a result of the tests, these shall be carried out by the Contractor at his own expenses and with the approval of Employer.



SECTION 9.1.6 **Duo-matic - Two Sleepers Continuous Tamping Machine**

This specification shall be read in continuation of the General and Technical specification given in Section 9.1

- 1 Duomatic Two Sleeper Tamping Machine shall be capable of carrying out automatic lifting, leveling, lining and tamping at the peak rate of 2600 sleepers per hour over a period not less than 10 minutes and average of 2000 sleepers in an hour of working over the track structure as given in Attachment No. 4 Vol III and also on all types of track structures, including wooden/CST-9/ST/ Concrete sleepers on 90R/52 kg/60/68 kg rails prevailing over Indian Railways. The normal sleeper spacing in different track structures on DFCCIL is 60 to 65 cm and Indian Railways from 55 cm to 75 cm. The tolerance of sleeper spacing over the DFCCIL network on turnout is ± 2.5 cm and tangent track is ± 1 cm. The machine shall be capable of tamping, lifting and lining track with 90 R, 52 Kg, 60 Kg, 68 Kg long welded rails or short welded rails or fish plated rails laid on pre-stressed concrete sleepers, steel trough sleepers, CST-9 and wooden sleepers.
- 2 On the joint sleepers, with clear spacing being only 50mm, the machine shall be equipped with a mechanism to tamp these two sleepers together.
- 3 The ballast depth ranging from 300 mm to 350 mm shall be effectively compacted having zone of influence of tamping confined to approximately 150 mm layer below the bottom of sleepers. There shall be provision for step-less adjustment of the depth of tamping tools to suit different type of sleepers. The maximum depth of concrete sleeper is equal to 210 mm. At deep screening or at renewal site it shall be possible to undertake tamping up to 350 mm or more in layers by tamping of first 150 mm layer followed by filling of ballast and tamping of another top 150 mm layer.
- 4 The tamping below the sleepers, after the track geometry correction, shall be based on vibratory squeeze principle, to achieve a durable compaction. The amplitude and vibration frequency and squeezing pressure to achieve a durable compaction shall be specified in the Bid.
- 5 It shall be possible to vary the peak squeezing pressure exerted by the tamping tools, to suit the different types of track structures.
- 6 The tamping tools shall come to rest automatically after they encounter the resistance from ballast to pre-selected squeezing pressure and hold the squeezing pressure for a pre-set time. It shall be possible to vary the squeezing pressure holding time, to suit the varying ballast conditions.
- 7 On DFCCIL and Indian Railways, Rail top to sleeper bottom depth may vary from 260 mm to 420 mm. There shall be provision for step-less adjustment of the penetration depth of tamping tools to suit different types of rails and sleepers.
- 8 The machine shall be able to achieve the following tolerance:
Unevenness: : ± 1 mm on 3.6 m Chord Cross level: ± 1 mm
Alignment : 2 mm on 7.2m Chord Twist : 1 mm/m



- 9 It shall be possible to control the target track geometry parameters, in infinitely variable steps, from the operator's/front cabin. To suit this, suitable Proportional/Servo Control Systems shall be provided.
- 10 Separate tamping unit shall be provided for each rail, with adequate number of tamping tools to impart adequate vibrations and squeezing of the ballast below the sleepers. The tamping unit shall be provided with necessary arrangements for lateral shifting to adjust them over the rails in sharp curves, to align the tamping units centrally over the rails.
- 11 The work units of tamping, lifting and lining shall be positioned on an under frame (satellite frame) separate from the main frame capable of cyclic movement from sleeper to sleeper, independent of the main frame, so that the operator does not get undue fatigue due to acceleration, pull, braking jolt in each tamping cycle. The movement of the main frame shall be synchronous with movement of satellite frame, so as to achieve a continuous tamping of track.
- 12 The lifting system shall be such that the track can be lifted without bearing on the ballast. The machine frame and lifting system shall be strong enough to withstand the track lifting forces for all types of track structures for 150 mm lifts in one go.
- 13 The free rail length between the two bogies should be long enough to permit the track lifting up to 150 mm in one go, having 60 kg rails on concrete sleeper, without excessive stresses in the rail or on the lifting mechanism.
- 14 While working on track, the lifting system should hold the rail continuously, rather than releasing and re-lifting the rail at every tamping cycle. However, the lifting/lining system and actual tamping should be so synchronized that the track is stiffly held in position and there is no movement in the track when the tamping tool is inserted for tamping. This is required to ensure that the lift and slew are not altered during the process while track is being tamped.
- 15 The machine shall be fitted with automatic lining equipment capable of carrying out lining simultaneously with leveling. The machine shall also have the ability to slew 60 kg concrete sleeper and rail track up to 150 mm in one go for all type of track structures.
- 16 The tamping tool arrangement in tamping arm of tamping bank should be cylindrical compressible type with bolting and dowel arrangement such that no hammering is normally required for fixing and removing the tamping tools.
- 17 Working Cabins:
 - a) The working cabins of the machine shall be air-conditioned. The air-conditioning provided shall be of a robust industrial design capable of operating in a highly dust laden environment. However, the electronic equipment should be so designed that the machine shall be able to work without air-conditioning, under the climatic conditions described in Vol III.
 - b) The machine shall be provided with a computerized unit for the overall control of its working system for all possible track geometry. The system shall be so designed that for working on tracks with pre-decided target geometry, the standard track geometry data as well as correction values can be entered prior to work either directly on the system or via USB, CD or DVD. For working on tracks with unknown target geometry, it shall be possible to determine the correction values by making a measuring run and subsequent geometry compensation of the recorded data considering obligatory point



- and constrains of lifting and lining etc. Interactive processing of the target profile by the operator shall be possible.
- c) Track parameters shall be displayed in graphic as well as text form on a colour monitor. It shall be possible to guide the working system of the machine continuously and automatically by this unit. The software shall be Windows based. The hardware shall be sturdy for operations under conditions of shock, vibrations, dust, electromagnetic influences from outside and interruption of power supply. The unit shall have adequate memory to keep records of minimum 100 km of work performed, new track geometry obtained and enables transfer of the data via USB, CD or DVD as required.
 - d) The machine shall be capable of measuring and recording the unevenness, alignment and cross level in real time on a print out before and after the tamping and stabilization by the machine. It shall also record progress Vis-a-vis time.

18 Site Acceptance Test:

This shall be conducted on the first machine and the ITP shall include and not limited to the following items.

- a) Site Acceptance Test shall be conducted after the pre-commissioning test are completed successfully.
- b) Dimensional check of loading gauze, MMD, buffer height, clearances, length of the machine bogie distances etc.
- c) Testing for negotiability on a 1 in $8\frac{1}{2}^{\circ}$ turnouts.
- d) Running speed test when hauled with self-power shall be at least 10% more than the maximum speed.
- e) Construction and engineering of the machine and its ability to perform all the functions as laid down in the specification.
- f) General lift during working up to 20 mm.
- g) Lifting of track in non-tamping mode of 150 mm in one go.
- h) Maximum slew during working up to ± 10 mm.
- i) Slewing of track in non-working mode of 150 mm in one go to be conducted at a siding.
- j) The machine shall be able to tamp and stabilize 2000 sleepers in one effective hour of working.
- k) The machine shall be able to achieve a peak tamping and stabilizing rate of 2600 sleepers or more per hour over a minimum 30-minute period.
- l) The setting up time and winding up time shall be measured and the total time taken together shall not be more than 10 minutes. The setting up time shall be counted from the time the machine arrives at site and the time it actually starts the tamping operation. Similarly, the winding up time starts from the time machine stops operation and the time leaves the site.

19 The machine shall be equipped with an electronic device for measuring and recording the following track parameters in a separate measuring run:

- a) Versine of the reference rail
- b) Alignment of the reference rail
- c) Longitudinal level left
- d) Height left
- e) Height Right
- f) Super elevation
- g) Twist

20 Spare Parts

The Contractor shall supply one set of spare Tungsten Carbide Tip Tamping Tool (TCTT) confirming to RDSO Specification No. TM/HM/6/320 (Rev-2-2016) as applicable for the P&E covered under this specification or equivalent suitable for the design of the P&E approved by Engineer.



Section 9.2 Mobile Rail Grinding Machines

1 General

- 1.1 These specifications provide the technical requirement for the manufacture and supply, testing and commissioning of a self-propelled Rail-Grinding Machine (RGM) of Minimum 72 stones module, Rail head Profile inspection & analysis system and rail profile measuring equipment along with a digital camera for use on the tracks of DFCCIL and Indian Railways.
- 1.2 The RGM is meant for grinding the rails in preventive and corrective mode to improve the rail wheel contact band, its location and to remove fatigued material having micro cracks and other surface defects on the rail head and remove corrugations.
- 1.3 The RGM shall be able to effectively grind open track, switches, and rail having checkrail.
- 1.4 The RGM shall be accompanied with another self-propelled, Broad Gauge (1676 mm) Rail Bound vehicle, hereafter referred as Rail Inspection Vehicle-RIV. The RIV shall be installed with Rail Head Profile Inspection & Analysis System to facilitate advance digital inspection of rails for selection of an optimum grinding program.
 - 1.4.1 The RIV is meant for collecting digitized image of the transverse profile of rail head for detailed analysis and for generating grinding plans to be used on Rail Grinding Machine.
 - 1.4.2 The main objectives of RIV are:
 - i. Recording digital image of the rail head profiles for selection of optimum grinding pattern, number of grind pass required and grinding speed per pass for any section of track.
 - ii. Assessing the grinding requirements due to surface defects on rail top after recording visuals of the rail top.
 - iii. GPS based route data recording of the track features.
 - iv. RIV shall preferably shall be of design similar to the Specification 9.3 for the purpose of standardization and ease in maintenance of vehicle.
- 1.5 One number of air conditioned, non-self-propelled staff rest van having resting capacity of about total 12-15 persons with layout to be finalized during design approval stage and to be developed by the Bidder making best use of the space and provide necessary facilities such as kitchen, WC, lounge with dining room etc. The Contractor shall consider provision of the vehicle as detailed in Specification 9.3 and 9.4.
- 1.6 One number of water tank wagon for sprinkling water as per requirement during rail grinding process shall be provided.
- 1.7 The Bidder shall specify the make and model complying as per this specification. System/sub-systems of the working mechanisms of the RGM and RIV and all the items of the specifications in general shall be described in detail along with the sketches to show the manner in which the requirement of the specifications are accomplished by the RGM & RIV.

- 1.8 The Bidder shall submit the performance parameters of the P&E in conformity to the requirement of output parameters given in this specification.
- 1.9 Photographs and video (in compact disc//Pen drive) of the type of machine offered in working mode (showing the working of machine in real time under field conditions) be enclosed with the offer. This shall also show close-ups of various working assemblies/systems and the full machine.
- 1.10 The Bidder shall also submit the dimensions, layout, configuration, installed capacity of the Diesel Engine and its utilization for different activities, oil consumption for different speed and depth of cut, life of the grinding stone etc. for the Employer to have the complete understanding of the offered machine.
- 1.11 Any other requirement not specified herewith shall be governed in accordance with the Rail Grinding Machine specification of Indian Railways as given in Specification No. 7 Vol III.

2 Dimensional and Operating requirements of RGM and RIV

- 2.1 The diesel-powered self-propelled rail-grinding machine and RIV shall be robust, reliable and suitable for working on DFCCIL and IR track. The design and dimensions of the RGM and RIV components shall be to metric standards. Quality assurance during manufacturing of the machine shall be in accordance of the details furnished in section 8 of this Bid document.
- 2.2 The Rail Grinding Machine and RIV shall be a Diesel powered (preferably indigenous) self-propelled bogie type vehicle(s) with minimum 4 axles (2 bogies) for each vehicle. It should be reliable and suitable for working on DFCCIL and Indian Railway track structure. Shared 2 axle bogies between two grinding cars and/or between two grinding buggies/carriages are not acceptable.
- 2.3 The profile of the on-track RGM and RIV longitudinally and in cross section during transfer as self- propelled vehicle or towed in train formation shall be within the DFCCIL and Indian Railways SOD and complying with the minimum and maximum moving dimensions of DFCCIL and IR. The Bidder shall provide sketches of the machine in plan and cross-section and shall give calculations to show the extent of lateral shift at the ends, centre and any other relevant cross section and to prove that the machine does not cause infringement while moving on a 1 in 8½ turnout.
- 2.4 Adequate clearance shall be allowed so that no component infringes the minimum clearance of 102 mm from rail level while travelling.
- 2.5 Wherever applicable, axle load shall be less than 20.32 T with minimum axle spacing of 1.83m. Load per meter shall not exceed 7.67 tones. Axle loads up to 22.82t and lower axle spacing may be permitted provided the load combinations do not cause excessive stresses in the track and bridges of IR. Stresses in the track and bridges shall be calculated by DFCCIL/RDSO based on design data submitted by the firm.



2.6 The RGM and RIV shall have a desirable wheel diameter of 1000 mm or more (new wheel profile). However, lesser diameter up to 760 mm for new wheel profile can be permitted provided it meets the condition laid down in clause 2.4 at its condemnation limit as per design and rail wheel contact stresses for 72 UTS rails are within permissible limits. The new wheel shall have a minimum wear margin of 50mm before reaching condemnation limit. Forged wheels similar to Indian Railways profile shall be provided on the machine. The worn-out wheel diameter based on the criteria of rail wheel contact stresses for various maximum axle loads are as under:

| Maximum Axle load (tone) | Minimum wheel diameter (mm) |
|--------------------------|-----------------------------|
| 22.82 | 908 |
| 22.00 | 878 |
| 21.50 | 860 |
| 21.00 | 841 |
| 20.32 | 816 |
| 20.0 | 805 |
| 19.5 | 787 |
| 19.0 | 768 |
| 18.5 | 750 |
| 18.0 | 732 |
| 17.5 | 713 |
| 17.42 | 710 |
| 17.0 | 700 |

Permitted worn out wheel diameter should be specified by the manufacturer. The diameter of wheel for assessment of permitted axle load will be the worn-out wheel diameter. The wheel profile shall be as per Indian Railway standard wheel profile.

2.7 The RGM and RIV shall be capable of negotiating 1 in 8½ turnout, super elevation up to 185 mm and gradients up to 3% in travel mode. The Bidder shall specify the minimum attainable speed under the above limiting conditions, which in any case shall not be less than 25 kmph. Water wagon and camping coaches shall be considered as part of consist/formation while travelling up to 3 % gradient.

2.8 The RGM and RIV shall be capable of continuous operation during the varying atmospheric and climatic conditions as detailed in Section 8.

2.9 The Rail Grinding Machine in consist/formation and Rail Inspection Vehicle (in composition with all its integral part) shall be capable of travelling at a speed of 100 km/h in either direction when travelling on its own power. Since the machines are likely to cover long distances on their own power, the travel drive system should be robust to sustain these requirements during the life of the machine without much break down/failure.

2.10 The RGM and RIV shall be capable of working without requiring power block in electrified sections. 25 kV traction power is used with an overhead wire at 5.5 m above rail level. On bridges and tunnels, the height is restricted to 4.8 m. In the work mode, no part of the machine and RIV should rise beyond 4.265 m. above rail level for safe working in the electrified sections.



- 2.11 RIV's accuracy of measurement shall not be affected in any manner due to overhead and track circuit voltage and shall comply fully with EMI and EMC.
- 2.12 The machine shall be equipped with pneumatically operated brake blocks acting on all wheels. It shall be possible to haul the machine in both directions at the same speed.
- 2.13 While working on double line sections, the machines, RIV/RGM shall not infringe the adjoining track and it shall be possible to permit trains at full speed on that track. Minimum spacing of track is 4.265m.
- 2.14 The machine should be capable of producing good longitudinal profile of the railhead continuously.
- 2.15 The machine should be capable of grinding operations on plain track and curves, track in tunnels, track on bridges having guard rails without removing the guard rails, and track on platform lines. It should also be possible to grind track on sharp curves having check rails without removing the check rails and with a minimum of 20 modules. Each of these 20 modules should have full, independent angle and lateral shift capability and it should be possible to grind without any special setup or mechanical adjustments. The change in operation to grind switches and checkrails shall be possible to implement from the operator control station seamlessly while grinding open rail. Performance of this module should be same as on plain track and Bidder should specify number of stones/modules having this flexibility.
- 2.16 The machine shall also be capable of grinding, if required, only one of the rails of the track as in the case of curves.
- 2.17 The machine shall be capable of grinding profile of UIC 60 Kg rail section, 52 Kg rail heads in 72/90/110 UTS strength and Head Hardened rails inclusive of fish plated joint, insulated joints and welded joints in long welded rails and short welded rails laid on pre- stressed concrete sleepers, steel sleepers, composite sleepers and wooden sleepers. It shall also function effectively on rails having wheel burns, shelling etc. The number of grinding stones and grinding units of the machine shall be such as to carry out controlled grinding of all rail corrugation defects and also defects of long wave length to produce a smooth cross-sectional profile without creating any sharp edge between the rail table and gauge face. The grinding result should not feature any facets or edges between facets and shall have a smooth contour of rail head.
- 2.18 Large window shall be provided in both cabs of the machine at low level to ensure good visibility for the operator controlling working and driving of machines to observe the track features and to operate the controls based on the features/obstructions being approached and cleared Facility of driving the machine for travelling purpose shall be from both the cabins. All travelling and grinding control shall be housed in the air-conditioned cabins.
- 2.19 Diesel tank fuel capacity of the machine should not be less than 21,000 lts. Bidder should mention the fuel storage capacity and average fuel consumption of machine.

2.20 The Bidder shall ensure that the offered RGM and RIV shall be capable of modular upgradation at a later stage and shall have such computer hardware and software which shall facilitate easy upgradation.

3 Working Mechanism of Rail Grinding Machine

The working mechanism of the machine shall be equipped with:

3.1 Rail grinding mechanism

3.2 Control system for rail grinding mechanism

3.3 Optical rail profile measurement system and its transfer to onboard computer. Machine should be equipped with system to measure rail profile at maximum grind speed (not less than 18 kmph) and storage of rail profile data of at least 200 km of track length.

3.4 Library of proposed rail profiles for various rail sections and locations, in the onboard computer. To develop library of target profiles for various rail sections on different route, Contractor of machine will design the target rail profiles for all the locations where it will be deployed to work after commissioning of the machine. The system should be equipped to store data of rail profile before grinding, its target profile and rail profile after grinding in an integrated way so that it could be retrieved for any given location of track.

3.4.1 The rail template design study shall be done by the Contractor and shall be completed within the Contract Period. The study shall be initiated after adequate GMT has moved over the rail and wear trend is visible. Man-days considered necessary for completing this study shall be estimated and submitted with the Bid.

3.4.2 The Contractor shall submit the name of the Agency to be engaged for this study. The Agency shall have the credential of undertaking minimum 3 studies during the last 5 years.

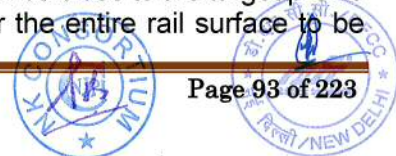
3.4.3 The rail grinding machine should be provided with the necessary software and hardware system to store a library of desired railhead finalized as per the rail study and to calculate on real time basis the amount of rail grinding to be done.

3.4.4 The Contractor shall ensure that the Specialist Manufacturer shall provide technical support and services for software maintenance and upgradation during the Defect Notification Period and subsequently as and when proposed by the Employer.

3.5 Electronic/computerized rail profile data processing system and software plug-ins to grind the existing rail profile to a selected target rail profile shall be provided. Machine should be equipped with required hardware and software to capture, store and process rail profile data from other measuring devices of rail profile, design of target rail profile from the data of existing rail profile, quantitative assessment of metal removal per meter of rail to achieve target rail profile, recommended grinding pattern (angle setting of individual grinding module) to achieve a target rail profile from a given rail head profile, comparative picture of target profile and profile achieved after grinding on real time basis, quantitative assessment of deviation of ground profile from target profile.

3.6 The grinding mechanism should be electric driven, drawing power from an on-board diesel generating set.

- 3.7 All the components of the machine must be robust and capable of continuous operation up to 8 hrs. in one spell under the field working conditions. They must be shielded against heavy heat accumulation in the work area and metallic dust generated at the work site.
- 3.8 To achieve the target profile with smooth curvatures, with minimum points of singularities, the Rail grinding machine shall have a minimum of 72 grinding modules (36 per rail), which can be configured in various configurations to achieve different target profiles.
- 3.9 Each grinding module shall be controlled by a hydraulic/pneumatic cylinder for its up/down movement.
- 3.10 The machine shall be equipped with an inbuilt mechanism to stop the grinding and lift the grinding stones/carriages when the operating speed falls below a certain minimum speed to avoid metallurgical damage due to heat accumulation. The minimum speed, at which the grinding shall stop automatically, shall be as per Contractor's design but it shall be mentioned in the offer.
- 3.11 Each grinding module shall comprise of a ring-shaped stone and a grinding motor with suitable positioning mechanism to control the stone position, to achieve the target profile by the various grinding module configurations. Each individual module should have a fully adjustable angle range of +70 degrees to gauge to -20 degrees to field, independently controlled from the operator station in the cab. Each grinding module spindle angle shall be accurate within $\pm 0.25^\circ$ (plus/minus one quarter of a degree) of the designed spindle axis positioning angle. Each module contains only one grinding motor with individual, independent tilt cylinder and must have the capability of being positioned by the control system independent of any other grinding motor. The tilting cylinders should not be shared with adjacent modules and must be independent for module. Grouping of two or more modules is not allowed.
- 3.12 At the work location, the prevailing temperature may be higher than the specified maximum temperature of 55°C. The peak load on the grinding motors, under the most demanding conditions shall not be more than 85% of the continuous load rating of the motor, at the prevailing temperature conditions. The Contractor shall furnish the peak load for the motors at various locations and the continuous load ratings of the motors under the operating conditions, as per the manufacturer's catalogues.
- 3.13 The grinding motor power shall be as per the Contractor's design to achieve the output parameters laid down below and may vary with the total number of grinding motors provided on the machine (not less than 72). However, the total grinding power provided on the machine (number of motors x continuous load rating of each motor) shall not be less than what is required to power the required number of grinding motors.
- 3.14 The machine shall be capable of removing, a minimum of 20 sq. mm material from each rail (40 sq. mm for both the rails) per pass, from the rail top of a 60 kg. UIC (90 UTS) rail section, with top surface work hardened to BHN 315 to 380, while operating at a speed of 15 kmph. While assessing the machines performance, the test rail profile (after grinding) shall be close to the target profile and the metal removal shall be fairly uniform over the entire rail surface to be



ground.

3.15 The capacity of grinder regarding depth of grinding per pass, from 60 kg 90 UTS work hardened rail top while grinding uniformly over full width and gauge faces at various working speeds, shall not be less than as mentioned below:

| | | |
|---------|---|---------|
| 18 Kmph | : | 0.13 mm |
| 15 Kmph | : | 0.20 mm |
| 10 Kmph | : | 0.25 mm |

3.16 While achieving the above progress rate, the overall combination of grinding stones pressure, RPM and travel speed should be such that no chattering or uneven removal of the material occurs at high speeds nor there are any metallurgical changes or bluing of the rail top at the minimum operating speed.

3.17 The rail grinder must be capable of bi-directional grinding i.e. in both the directions on the same track without loss of metal removal capacity or productivity, while grinding both rails simultaneously or either rail independently.

3.18 Provision shall exist for operator to select the direction of rotation of the motor to contain the spark inwardly as default setting with built in can't in the grinding heads and one end of the grinding head to touch the rail.

3.19 To ensure Gauge Face correction without flattening the root curve, all of the grinding modules shall have the ability of attaining spindle axis orientation with respect to the rail axis, up to 70° on the gauge corner and 20° on the field corner. At all angles, the grinding effort must potentially be 100%.

3.20 While the machine is operating at full grinding load at the maximum working speed, the minimum life of each stone shall not be less than 5 hrs. grinding time.

3.21 Each module shall be provided with a stone stop mechanism to prevent accidental contact between the rail and grinding motor shaft chuck when the stone has completely worn out, to prevent damage to rail or the shaft.

3.22 Machine driving controls must be at both extreme ends of the machine, irrespective of driving direction.

3.23 The unit must be capable of travelling and grinding under the following track conditions:

- a) Maximum grade 3%
- b) Maximum curve 1 in 8½ turnout

3.24 The unit must be capable of grinding a variety of profiling and re-contouring patterns depending on varying rail wear conditions. Such pattern changes and adjustments should be made instantly from an onboard central control panel.

3.25 The unit must have the following controls/display the following operating data at the operator's console:



- a) Start/stop buttons for individual motor and master stop button (to stop all grinding motors).
- b) Current meters for various grinding modules and motor grinding power control.
- c) Grinding Module/Grinding carriage up/down control.
- d) Operating speed monitor and control.
- e) Stone condition monitor.
- f) Deviations in motor spindle angles.
- g) Any other data monitor/control required for proper operation and control of the working, depending on the Contractor's design.
- h) Angle setting of different grinding module.

3.26 There shall be computer controlled monitoring of input and output of different electrical/electronic devices with the facility of display of input/output so as to monitor the functioning of electrical/electronic devices.

The computer controlled functions may be as per the Contractor's design, but as a representative illustration, the following functions shall be computer controlled:

- a) Auto horse power-Automatic adjustment/sharing of Power/load in between engines if one is down.
- b) Carriage Raising and lowering.
- c) Module raising and lowering.
- d) Pattern data input from Rail Profile measurement units.
- e) Storage of Profiles.
- f) Grinding pattern selection and down loading to grinding controls.

The computer controlled system shall have the facility of System diagnostics in operator's cabin (at least in one cab) which should be able to do following:

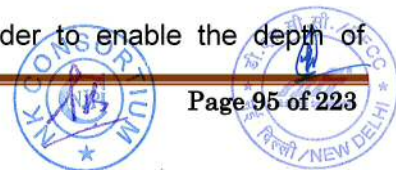
- a) Detection of short circuit and open circuit conditions and measurement of amperage in connection to control devices.
- b) Diagnostics modules shall be provided for troubleshooting of various electronic printed circuit boards used up to card/board level fault finding.
- c) Communication between various sub systems used in the system shall be provided as a diagnostics feature.

3.27 The on-board computer will, monitor the following items and maintain a log:

- a) Grinding Motor performance (amps)
- b) Stone usage
- c) Grinding Motor idle amp
- d) Stone spark time
- e) Motor life
- f) Performance monitoring
 - Quantitative assessment of metal removal from each km of track to achieve target profile.
 - Percentage deviation of ground profile from target profile.
 - Grinding speed and no of grinding passes, quantum of work done in pass km.
 - History of existing rail profile, target profile and grinding pattern followed for a given km of track.

3.28 The rail grinder must be capable of automatic adjustment of grinding patterns from the operator's cab. The Contractor shall furnish details of all possible number and patterns subjected to minimum of 50 patterns. The on-board computer must be capable of storing all these grinding patterns and changing from any of these patterns to any other within the length of the grinding consist.

3.29 The machine shall be equipped with line recorder to enable the depth of



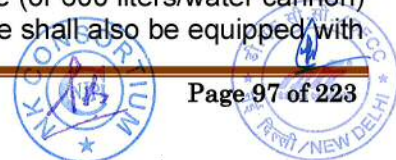
irregularities to be recorded before and after grinding operations.

- 3.30 It shall also be possible to record the grinding length vis-à-vis time on a print out to obtain information on the machine output. The system shall be able to produce performance parameters and progress of work such as grind length, speed of grinding, no of passes done, pattern used, pre/post Grind Quality Index (GQI) etc. in a way that should facilitate its transfer to pen drive at the end of day's work.
- 3.31 The grinding method must ensure the complete re-profiling of the railhead by excessive metal removal. The grinding must be done by rotating grinding stone and not by any cutting tools or abrasive blocks.
- 3.32 All the grinding stones shall be equipped with an automatic vertical control and locking device preserving the stone from dropping into pitch corrugation.
- 3.33 All the grinding units shall be so designed that it can be lowered or raised from grind cabin. Lowering and raising of grinding units should be automatic, electronically operated, which can be applied either on one rail or on both rails simultaneously.
- 3.34 The machine shall be equipped with Rail Grinding Gauge for Board Gauge (1676 mm), with four different patterns (a) Tangent track (b) The high rail in mild curves (c) The high rail in sharp curves (d) Low rail in both mild and sharp curves, because worn rail profiles are not always centrally located with respect to the vertical axis of the rails.
- 3.35 To ensure minimum vibration of the rotating grinding stones, a self-centering system for holding the stones shall be provided.
- 3.36 The grinding trolley shall be designed for raising and lowering operation from grinding cabin.
- 3.37 The minimum grinding electrical power per grinding stone shall be 25 Horse Power.
- 3.38 The rail grinder must be equipped with an obstacle sensing/detection system with manual lifting of the grinding carriages through controls from operators' cabin before approaching the obstacle and restarting of the grinding process after the clearance of the obstacles. The Contractor shall specify the distance left underground after the clearance of the obstacles at various operating speeds. This distance shall not be more than 12 m for an operating speed of 15 kmph.
- 3.39 The rail grinder must be capable of setting down or picking up grinding stones/carriages in curves.
- 3.40 Grinding carriages should be capable of being raised and lowered and locked into position on curved track up to curvature equal to 1 in 8½ turnout.
- 3.41 The grinding motors must be centered over the grinding spot at all intended grinding angles. To ensure proper positioning and angle of the grinding module, the support structure must be equipped with pivot to permit the angular adjustment of the motor/stone in relation to the rail and provision for its horizontal movement for centering of the stone over the area with adequate force to



produce desired grinding power.

- 3.42 The grinding motors shall be controlled through suitable starter control for starting/stopping of motor.
- 3.43 Grinding patterns must be balanced and not changed with curve elevation of the track on which the machine is operating. The rail grinder must be equipped with a system to maintain a positive pressure and constant reference to the gauge face of the rail evenly for minimum 24 modules to be used for switches and curves with check rails.
- 3.44 The rail grinder must be equipped with a vertical rate of correction feature to restrict the grinding in corrugation valleys, while smoothening the crests. For maximum grinding effort on rail running surface variations, the unit must be equipped with selective vertical stability control. The Bidder shall furnish the details of the mechanism to achieve this.
- 3.45 The unit must be capable of grinding any worn rail profile to shapes within plus or minus 0.30 mm of the selected target profile.
- 3.46 Metal removal rates must not vary more than 25% between grinding of rail with hardness ranging from 280-380 BHN.
- 3.47 The surface finishes after the grinding shall be that corresponding to RMS value of 12 microns roughness.
- 3.48 The rail grinder must be supplied with adequate lighting to perform grinding at night safely and efficiently.
- 3.49 The machine shall be equipped with suitable spark arresters to prevent sparks from flying around and be a potential fire hazard. The spark arresters shall be suitably designed to withstand the heat generated at the work spot and the flying metal sparks. Detail design of the spark deflector along with maintenance requirement shall be submitted during design approval stage.
- 3.50 The control of spark shall be such that there is no need to put any restriction of movement of any train including train carrying inflammable products on the adjacent track located at a track center of 6 (six) meters. The design shall also be ETCS 1 and 2 compliant.
- 3.51 The machine should have adequate water capacity to prevent and fight fires by wetting down the ground, and to carry on grinding irrespective of terrain or dry weather conditions. A minimum 20000 liters water storage capacity should be available on the machine. There shall be separate arrangement of 55000 liters storage of water container in the rail grinder consist by way of a separate wagon for use during prevention of fire. It should be possible to connect the water storage on the attached wagon with the machine storage and use it for arresting fire as and when required. The visibility requirement of the machine shall not be obstructed on this account.
- 3.52 The machine shall be equipped with two water cannons (one in front and another in rear with) of capacity up to 1200 liters per minute (or 600 liters/water cannon) throughout with a reach of 40 meters. The machine shall also be equipped with



separately controlled sleeper and ditch spray, for front and rear.

3.53 There should be an installed, integrated back up of the following critical sub-systems to ensure maximum availability and minimal chances of disruption of rail grinding machine operations:

- a) Water system/pumps
- b) Hydraulic pumps/motors
- c) Air Compressors

A suitable by-pass mechanism should be installed and integrated to main system to operate the rail grinding machine with backup assembly.

3.54 Optical Rail Profile Measuring System of Rail Grinding Machine:

3.55 The grinding machine should be provided with a set of optical rail profile measuring system integrated with the onboard computer both in front of the machine as well as rear of the machine. The system should be able to capture rail profile both ahead of and behind the grinder for real time comparison of rail profile before grinding and after grinding.

- a) The profile measurement system, in a real-time basis, shows the actual rail profile ahead of work and after the work and difference between the measured profile and selected target profile. The system should save the captured rail profile data along with input location data such as milepost, curve-data, grinding, speed patterns used etc.
- b) It should be provided with the necessary software and hardware system to store a library of desired railhead profiles (templates) and to calculate on real time basis the amount of rail grinding to be done. The Contractor shall be responsible for software maintenance and up gradation during warranty and subsequent working life of the machine (minimum 15 years).
- c) It should give:
 - (i) Best/optimum pattern to use for grinding.
 - (ii) Number of grinding passes needed in order to achieve a predefined acceptance envelope.
 - (iii) Speed at which to grind.

4 Diesel Engine/Electric Generator of Rail Grinding Machine

4.1 The machine shall be powered by diesel engine(s) preferably indigenous, with proven record of service in tropical countries with wide service network in India. Robust construction and low maintenance cost are of particular importance. Adequate allowance shall be made to provide adequate reserve power to take care of the working of machine under most adverse climatic conditions, heavy grinding requirements on steep gradients, and to provide backup power in case of failure of one of the engines. Furthermore, the grinding power should be on a common buss to ensure grinding with all grinding modules may continue in case of an engine / generator failure. The Contractor shall furnish the details of power requirement for working under normal conditions as specified in clause 3.9 and total power provided on the machine.

4.2 High speed diesel oil to Indian Standard Specification shall only be used.



- 4.3 Sight glass type fuel measuring gauge shall be provided on the fuel tank.
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 - 4.5 Sight glass type fuel measuring gauge shall be provided on the fuel tank.
 - 4.6 High speed diesel oil to Indian Standard Specification shall only be used.
 - 4.7 Sight glass type fuel measuring gauge shall be provided on the fuel tank.
 - 4.8 For starting the engine, storage batteries of well-known make shall be provided. The engine shall be push button start type or key type.
 - 4.9 Since the engine is to work outdoor under extreme dusty condition, the air intake system shall be designed suitably so as not to allow dust through air intake system.
 - 4.10 There is likelihood of dust deposition over the engine body and surrounding area over the lubricants spill-over. These should be easy to access for daily cleaning and routine maintenance. In case, air cooled engines are proposed by the Contractor, maintenance equipment for cleaning and maintenance of the air cooling fins shall be provided by the Contractor along with the machine.
 - 4.11 The engine parameter monitoring gauges like temperature, rpm, and lube oil pressure shall be direct reading type mounted on the engine backed up by electrical/mechanical gauges in the operator's cabin showing the absolute readings along with safe limits suitably coloured. There shall be audiovisual warning (safety mechanism) to the operators in case of any of these parameters exceeding the safe limit, and engine shut down circuit in case of operator's failure to respond.
 - 4.12 The diesel engines shall be coupled to the electric generator(s) of a continuous rating to suit machine- operating requirements. Suitable cooling arrangement for the generator shall be provided. The electric generation parameter monitoring gauges shall be provided like wattmeter, voltmeter, ammeter, frequency meter etc. Generator shall have over voltage protection.
 - 4.13 The grinding motors shall be controlled through suitable starter control for starting/stopping of motor.
 - 4.14 Effective measures shall be made for noise control of the DG set and the RGM and the Bidder shall furnish the noise level in different conditions of working measured following an International Standard.
- 5 Cooling System of Rail Grinding Machine**
- 5.1 The cooling system shall be efficient and designed for a maximum ambient temperature of 55°C. Bidder must note that the machine shall be working under extreme dusty conditions and the cooling mechanism should be maintainable under these conditions.
 - 5.2 There should be an installed, integrated backup of the following critical sub-systems to ensure maximum availability and minimal chances of disruption of machine operations:

- a) Water system/pumps
- b) Hydraulic pumps/motors
- c) Air compressors

A by-pass mechanism should be installed and integrated to main system to operate the machine with backup assembly.

6 Brakes (RGM and RIV)

- 6.1 The RGM and RIV shall be fitted with the airbrakes and provision shall be made to attach camping coach/crew rest van and separate water storage container as a consist/formation. The brakes shall be protected from ingress of water, grease, oil or other substances, which may have an adverse effect on them. The brake lining shall be suitable for high ambient temperature of 55°C. The force required for operating the brake shall not exceed 10 kg at the handle while applying by hand and 15kg on the pedal, when applied by foot. In addition, mechanical brakes shall also be provided for use in an eventuality of failure as well as for parking.
- 6.2 The RGM and RIV shall be equipped with suitable air brake valves so that while working in train formation, RGM and RIV can be broken by the traction vehicle. In addition, the machine shall also be equipped with suitable air brake system in the driving cabins so that the attached wagon or camping coach compatible with IR system while being hauled by the machine, can be braked.

7 Safety Mechanism:

- 7.1 The RGM and RIV shall be provided with electric horns/ hooters facing outwards at each end of the machine at suitable locations to warn the workmen of any impending danger at the work spot or from oncoming train. These electric horns/hooters shall be operated by means of push buttons provided in the cabs.
- 7.2 The RGM and RIV shall have a UV and Temperature based fire detection system that will alert the operator. There shall be an arrangement that when the fire extinguisher is activated, the engine automatically shuts down.
- 7.3 There shall be arrangement to prevent dust from the grinding process from escaping into the air. A suitable and efficient “dust collection system” shall be provided on the machine.
- 7.4 There should be arrangement for water spray through nozzles at suitable locations to prevent track fires.
- 7.5 The grinding carriages should have non-flammable shields and guards so as to avoid damage due to sparks, grinding dust and flying debris.
- 7.6 There shall be arrangement for flasher lights at both ends similar to the performance specification given in clause 9.4 of Section 9.1.
- 7.7 Safety equipment like jacks, pullers, tinfoor and other such equipment specific to the machine for restoring failed units of the machine during working, shall be provided on the machine. The Bidder should submit the list of safety equipment provided.
- 7.8 Machine shall be provided with emergency backup system to wind up the machine in the event of failure of prime mover or power transmission system of the machine.

8 Hooks and Buffers:

- 8.1 The RGM and RIV shall be fitted with transition CBC coupling and buffers of IR design on both the ends for coupling it with other vehicles for running it in train formation. Attachment with IR standard locomotives, wagons & coaches should be possible.

9 Electric Equipment and Lighting:

- 9.1 The electrical equipment to be provided on RGM and RIV shall conform to relevant standard specifications and shall be suitable for Indian climatic conditions. The machine shall be equipped with Twin beam headlight assembly conforming to the performance parameters as detailed in sub-clause 9.1 of Section 9.1 , at each end and with two front and rear parking lights, which can be switched to red or white according to the direction of the travel. Powerful pressurize floodlights shall also be provided to illuminate the working area sufficiently bright for efficient working during night. The flasher lights as per performance parameters given in sub-clause 9.4 of Section 9.1, at both ends, shall be provided on the machine to give indication to the train arriving on other line.

10 Chassis and Underframe:

- 10.1 The chassis of RGM and RIV shall be of standard welded steel section and of steel sheets, so as to permit transportation of the machine in train formation without endangering safety of the train. The under frame shall be constructed with rolled steel section and/or plates and shall be designed to withstand a maximum static squeeze test load of 100t without any permanent distortion. The under frame shall be sufficiently robust for safe travel of the machine in train formation and not necessarily as last vehicle.

11 CABINS of RGM AND RIV:

- 11.1 The RGM and RIV shall be equipped with fully enclosed air conditioned and pressurized cabins with safety glass window at both the ends. It shall be possible to have a clear view of the track ahead while driving the machine in both the directions from the cabins at either end. The cabin layout shall be such that, before leaving the machine, the operating staff has full view on both the sides, to avoid any danger to them from trains on the adjacent tracks.
- 11.2 The gauges, instruments and controls shall be suitably located in the operator's cab so that they can be observed without undue fatigue to the operator.
- 11.3 The operator's cabin shall be ergonomically designed to have easy access to all controls. The operator shall have a full view of the working area from the operating seat to have a full control over the work.
- 11.4 Screen wipers preferably operated by compressed air or electricity shall be provided on the windscreens.
- 11.5 Suitable number of fire extinguisher (dry chemical type) shall be provided in all the vehicles.
- 11.6 The RGM and RIV shall be provided with well-defined space for keeping the tools and spares required for one week of operation and onsite repair of the machine to attend the breakdowns and other working requirements.

12 Tools, Measuring instruments and Instruction Manuals:

- 12.1 Each RGM and RIV shall be supplied with a complete kit of tools required by the operator in emergency and for normal working of the machine. The list of tools to be provided shall also include all tools necessary for maintenance and repair of the entire machine including specialized equipment, like hydraulic jacks, welding equipment, wheel truing shoes, refractometer, power tools, air hoses/wands, etc. All special tools shall be listed and catalogued illustrating the method of application.
- 12.2 Two contact based rail profile measuring equipment shall be supplied by manufacturer along with machine suitable for making all measurements as detailed in this specification.

- 12.3 Bar gauze with appropriate template of proven make/brand.
- 12.4 Digital inclinometer of proven make/brand.
- 12.5 Rail hardness measurement equipment of proven make/brand.
- 12.6 Rail roughness measuring equipment of proven make/brand.
- 12.7 Detailed operating manual, maintenance and service manual shall be provided in English Language and as detailed in Clause 16 of Section 8 of this Bid document.
- 12.8 The manufacturer shall also supply circuit diagrams of electrical hydraulic, pneumatic and electronic circuits used on the machine. Trouble shooting diagram/table shall also be supplied. In addition, the Contractor shall provide dimension drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc., main features such as type, RPM & discharge etc. of items like hydraulic pump-motors, and the Contractor shall furnish the details of such other bought out components/assemblies.
- These shall be in English language only.
- 12.9 The Bidder shall along with his offer, submit the list of tools, manuals, circuit diagrams and other technical literature/drawings to be supplied along with each machine as above, for operation, servicing, maintenance and trouble shooting. The list can be modified to suit the Employer's requirement, while examining the offer.
- 12.10 The firm shall provide detailed technical drawings and specifications of wheels and axles used on the machine.

13 Spare Parts:

- 13.1 The expected life of the components shall be advised along with their condemning limits.
- 13.2 The Bidder is required to include the price of supply of 3000 grinding stone in six lots of 500 nos. each for the grinding requirement of two years.

14 Operators:

- 14.1 The number of operators and allied staff for working of the RGM and RIV under normal condition shall be indicated, specifying their duties and minimum qualifications.

15 Inspection of the RGM and RIV:

- 15.1 This shall be read in continuation with the ITP detailed in Section 8 of this Bid document.
- 15.2 Following arrangements shall be made by the Contractor/Manufacturer at the inspection premises for carrying out inspection of the machine by inspecting officials:
- a) Machine to be stabled on straight & level BG track. The length of the track should be at least 10 m more than buffer to buffer length of machine.
 - b) In order to check Maximum Moving dimensions in cross section, a Sturdy frame of IR Max Moving Dimensions shall be provided by the manufacturer and passed over the machine holding it perpendicular to track, centre aligned with track centre. Adequate arrangements shall be made to the satisfaction of inspecting officials.
- 15.3 The following documents shall be provided to the Inspecting Officials at least 4 weeks in advance of the date of inspection.
- a) One copy of complete technical literature in English language, including operation, service and field maintenance manuals/instructions and complete electrical, hydraulic and pneumatic circuit diagrams, trouble-shooting charts, component drawings/ description and other relevant technical details as a reference documents for the inspecting Officials.

- b) Cross section of the machine super imposed on IR maximum moving dimensions envelope shall be provided to IO in advance.
- c) Manufacturer's Internal Inspection Report.
- d) Manufacturer's quality certificate and/or test reports for bought out assemblies/ sub-assemblies to be provided to IO, containing serial number wherever applicable.
- e) Contractor will incorporate amendments/further clarification in the above documents to the satisfaction of the Inspecting Officials keeping in view the Inspecting Officials' comments, if any.

16 Issue of Provisional Speed certificate

Detailed in clause 25 of Section 8 of this Bid document

17 Acceptance test of Rail Grinding Machine: The Site Acceptance Test shall consist of:

17.1 Dimensional test of the loading gauge, maximum moving dimensions, buffer heights, clearances etc.

17.2 For the purpose of metal removal capability of the machine (clause 3.11), 5 sites shall be selected. At each site measurement of both left and right rail shall be taken.

- a. At each site, the machine shall grind a length of at least 500 meters to ensure that the stones are not heated up.
- b. The profile of the rail shall be close to the desired profile.
- c. The rail hardness shall be measured and recorded.
- d. To assess the material removal capability of the machine (clause 3.10), at each site, on the test rail, 5 X-sections shall be selected on both rails. These X-sections shall be at least 2 meters away from any weld/fish plated joint and not in heavily corrugated rail.
- e. The X-sectional area shall be recorded, at each X-section, before the grinding, and after 1 grinding passes. The working speed, while grinding shall be maintained as specified.
- f. The average material removal per pass for the site shall be the average of material removal per pass at 5 X-sections.
- g. The average material removal per pass at the specified speed at each of the 5 sites for both left and right rail separately shall be more than that specified in clause 3.10.

17.3 For the purpose of depth of metal removal capability of the machine, 5 sites shall be selected for carrying out tests at the speeds mentioned. At each site measurement of both left and right rail shall be taken:

- a. At each site, the machine shall grind a length of at least 500 meters to ensure that the stones are not heated up.
- b. The profile of the rail shall be close to the desired profile.
- c. The rail hardness shall be measured and recorded.
- d. Points shall be chosen at 5 locations across the X-section, one towards gauge face side, three in the middle of rail top and one towards non-gauge face side such as to cover full width of rail head, at 5 rail-sections on both rails at each of the 5 sites.
- e. The working speed, while grinding shall be maintained as specified. The depth of metal removed shall be measured by measuring the depth of cut before and after each grinding pass. Measurement to be done with Contact based Rail profile measurement Device with or better precision/accuracy.
- f. The average of the 25 observations at each site for each rail shall be worked out. The average depth of metal removal per pass for the site shall be the average depth of material removed for all 25 test points.
- g. None of the average depth of metal removal per pass for a site, out of 5 selected sites for both rails should be less than as specified for the respective grinding speed.

17.4 The machine will also be operated at suitable locations in working mode for continuous 5 hours to ensure the machine's continuous working capability for this type of work and test the life of the grinding stones.

17.5 Should any modifications be found necessary as a result of the tests, these shall be carried out by the Contractor at his own expense.

18 Rail Head Profile Inspection and Analysis System

FUNCTIONAL REQUIREMENTS

The working mechanism of the system shall be equipped with:

- a) Optical Rail Inspection & Analysis System based on Laser System.
- b) Image Acquisition System to collect and display top of rail (rail head) Images.

These systems should have due integration between them so that the complete system as a whole works as an ideal system on pre/post grind Rail Inspection Vehicle.

RIV and its components should be reliable, rugged and capable of working satisfactorily in the harsh environment of heat, dust, vibration, shock, water, wind, humidity, fog, high voltage traction, electromagnetic effect etc.

19 Optical Rail Inspection & Analysis System based on Laser System

- 19.1 Rail head profile measuring system should be capable of measuring the head profile of rail with an accuracy of 0.15 mm or better and output format acceptable on Rail grinders (preferably in CSV files with all independent X, Y coordinates). In the software of Rail profile measuring system there should be the capability to analyze the measured rail profiles with respect to number of predefined profiles and find out the linear differences between two superimposed profiles and area difference between those two profiles. There should be capability to store measured rail profiles of 10,000Kms and transfer the data on Compact Disc or external portable hard disks via USB ports, and it should also be possible to take an average of measured profiles of 1000 mt. or so.
- 19.2 Numbers & orientations of the cameras on the system should be such as to record the head profile of the rail in the region of rail top from 70 deg. on the gauge corner to 15 deg. on the field corner.
- 19.3 Such rail head profile recording should be possible in all weather conditions. System shall be capable of recording accurately under all conditions of light. The recording should be possible even during the night time.
- 19.4 There should not be any need of manual calibration in case of change in the intensity of sunlight.
- 19.5 System should have in-built protection system to absorb voltage fluctuation and should work on 220V + 10%, 50 Hz AC supply. System should be contact less and it should be based on laser technology. System should be protected from all health hazards & comply with the relevant regulations in this regard.
- 19.6 CCD cameras, laser source, transducers and all other parts of the system must be at least 102 mm above the running rails.
- 19.7 Arrangement for fixing the system should be such as to permit recording on level crossings, curves with check rails. A drawing showing mounting arrangement of the system should be submitted along with the offer.
- 19.8 The profile measurement system in a real-time basis should show the actual rail profile and difference between the measured profile and the selected predefined profile.
- 19.9 The system should save the captured rail profile data along with input location data such as milepost, curve-data.



- 19.10 The captured images should be transferred to the system software through a specially designed interface that should allow real time management and analysis of the profile data. System should then overlay the actual (measured) rail profile of each (left and right) rail with the desired profile (template) to produce a dynamic difference profile and the amount of metal to be removed by grinding.
- 19.11 System should have the ability to perform both pre- and post- grind analyses. The system should examine the measured pre- or post-grind profiles and determine if the rail is within tolerance or if additional passes are required to achieve the desired profile.
- 19.12 Systems main window should have multiple view ports to display the pre and post-grind profiles (right and left rail) and the calculated difference between profiles. In addition, a pre- and post- grind list box should display data, such as the total number of passes needed to achieve a profile, the predefined pattern numbers associated with the passes, and the speed at which to grind.
- 19.13 System should have post-processing routines that allow the user to review captured data and adjust parameters in order to evaluate changes in grinding philosophy. In order to achieve this, the system should save the captured rail profile data along with track location data, curve data.
- 19.14 Overall the system should provide the railway the ability to effectively establish a rail grinding program, monitor the status of the grinding program and adjust that program accordingly, based on actual data collected.

20 Image Acquisition System to collect and display top of rail (rail head) Images:

- 20.1 This system captures blur free images of the rail surface in real time, concurrent with rail profile with sufficient resolution to detail pitting and surface cracking on the top of rail surface.
- 20.2 System operation should be flexible to permit operators to control the update rate to monitor and to freeze and store images of the top of rail surface at any time, day or night.
- 20.3 The system should utilize its own light source unit to illuminate the rail head and a high-resolution CCD digital camera to capture the rail head images.
- 20.4 The system should be able to capture at least one snap of rail @ every 1 to 3 meters of track while moving at around 40KMPH speed.
- 20.5 Internal temperature and moisture controls should allow the system to be used in a wide range of climates. Onboard health monitoring should ensure that the operator always knows that the System is operating at its peak efficiency.

Broad parameters of the system are as under:

- Camera Resolution: Min 13MP
- Sampling Rate: Up to 30 Hz
- Operating Speed: Up to (50 km/h)
- Environmental Range: -5°C to 55°C)

- 20.6 The system should have facility to synchronize the chainage in the field with respect to route data tape containing the information regarding TP along with their chainage. This will facilitate recording during night.
- 20.7 System should be self-diagnostic. It should display error codes pinpointing the exact hardware & software problem. Operator should be able to repair the system normally during the run with plug-in type of modular arrangement.

20.8 During field trial, a curve of approximately 1 Km length will be selected & real wear will be measured with this system at varying speeds and also by a hand-held device. The accuracy of measurement of the system at each corresponding location should be verified by mini proof reading.

21 Acceptance Tests:

21.1 The system after installation will be run in a block section. The data collected and analysis made will be verified by the inspecting officials and shall comply with the ITP values finalized in advance.

21.2 During field trial, a curve of approximately 1 Km length will be selected & real wear will be measured with this system at varying speeds and also by a hand-held device. The accuracy of measurement of the system at each corresponding location should be verified by Contact based Rail profile measuring equipment/mini prof reading.

21.3 Since the DFCCIL track is new, it may not be possible to test the full capability of the machines over DFCCIL network, therefore, the RGM will be deployed over IR network and the time taken for acceptance test may be more.



Section 9.3 Self-driven Recording and Measurement Cars

This General Technical Specification of Recording Cars covers the supply of the vehicle for the equipment covered under the following particular specification.

1. Track Recording Car (TRC) (Particular Specification Section 9.3.1)
2. OHE Monitoring Car (ORC) (Particular Specification Section 9.3.2)
3. Inspection Vehicle (Particular Specification Section 9.3.3)

1 General

- 1.1 The Vehicle shall be called as Track Recording Car (TRC) when used for measurement of Track and OHE parameters partly, OHE Monitoring Car (ORC) when used for measurement of mainly OHE Parameters and track parameters partly, Inspection Vehicle equipped with facilities for visual inspection of rail network of DFCCIL by officials.
- 1.2 All the vehicles shall preferably be identical except for measuring equipment and layout which are specified other clauses and in the particular specification.
- 1.3 The specification covers the requirement for design and manufacture of the vehicle as per this technical specification and applies to all the vehicles. RDSO specification for self-propelled OHE recording cum test car (NETRA) No. TI/SPEC/OHE/NETRA/0140 is attached at Specification No.9 Vol III which is for guidance only and the Contractor shall develop its own design adopting the latest International standards including the designs followed in its last supply for which the client certificate is submitted (refer sub-factor 3.2(e) (iii) 8 and 9 and shall be finalized during design approval stage. In this regard, the Contractor shall be submitting the approved drawings of the said manufacturing, if required, and developing the Specification to be approved during design approval stage.
- 1.4 The vehicle shall be suitable to comply with the SOD, MMD, track structure, OHE parameters and climatic conditions as given in Clause 2.5 Section 8 of Vol II and fit to work on DFCCIL and IR network.
- 1.5 The vehicle is 4 axle/8wheeler, self-driven, air conditioned, both end left hand driving with the following features
 - a) Two numbers under-slung mounted, Diesel Engine, one per bogie
 - b) Either of Hydrostatic/Hydrodynamic/Diesel-Electric transmission. In case of DETC, Driving both axles of each bogie and one axle of each bogie with hydrostatic/hydrodynamic/combination of both
- 1.6 The vehicle shall be designed to work at a maximum speed of 100 Kmph, however the performance/oscillation test shall be conducted for working over DFCCIL at 110 kmph.
 - a) The Bidder shall submit the simulation test for riding and oscillation of the vehicle at 110 Kmph as per the track structure of DFCCIL for oscillation analysis. The Bidder shall also submit the hauling capability characteristics of the vehicle with both bogies and one bogie in service.



- b) The Bidder shall submit the capacity calculation of each of the Diesel Engine and Traction System which shall have the capacity such that when working together, it shall be able to deliver the following output

- On level
Self-Driven – 110 Km/h
+ when connected additional one number coach with a gross weight of 65T –
100 Km/h

The Bidder shall submit the speed potential of self-driven vehicle at 1:150 and 1:100 gradients based on the speed-tractive effort characteristics.

- c) The period for continuous running shall be taken as 20 Hrs. at 100 km/h to design the thermal rating of the traction equipment.
- d) The payload shall be 5 Tonne.

1.7 The radiator shall either be mounted under frame or if it is not possible to accommodate, the same shall be mounted on the roof with strengthened structure and load not coming directly on the roof and following the MMD.

1.8 The layout of facility inside the vehicle shall be as per the particular specification. The attached sketch with each of the section is only for guidance and the Bidder is at liberty to develop its own design and submit preliminary design during the Bid stage but without any compromise on the facilities as specified. However, the Employer may ask for modification changes during design approval.

2 Design features of the Vehicle

- a. Good aesthetics
- b. High comfort levels
- c. High standard of quality for staff amenities such as lounge, office, sleeping and resting berths, washroom, kitchen, air conditioning, low noise, good illumination, etc.
- d. Maintenance free or minimum maintenance
- e. Low life cycle cost
- f. Low weight
- g. Flush level/ smooth exteriors and interiors.
- h. Use of interchangeable, modular components
- i. Labeling of parts, danger boards, do's and don'ts if any
- j. High reliability
- k. Fire and smoke detection
- l. Use of fire retardant and environment friendly materials and in case the design warrants for use of other category of material, the same shall be indicated in the Bid document.
- m. Maximum possible commonality of structure, components, equipment and sub-systems in the different types of cars

The Bidder shall submit compliance on each of the above parameters giving how its design achieves the above features.



3 Recording car body

- 3.1 The Bidder shall submit the International Standard or Specification to which the car body is proposed to be manufactured. The Recording Car structure shall be designed so as to withstand the load specified for the material used in accordance with the stated specification.
 - 3.2 The structure of the Recording Car body, including shell shall be suitable for severe testing and recording of parameters with services under 150% overload conditions with no fatigue or permanent deformation or failure.
 - 3.3 Cabs at both the ends of the Recording Car shall have streamlined design to give an aesthetically appearance and minimize air drag.
 - 3.4 The body shell shall be of integral lightweight construction consisting of separate assembly groups for under frame, sidewalls, roof and end walls; joined together to form a tubular structure.
 - 3.5 These assembly groups shall be made from the rolled sections or pressed plates and plain sheets, which are suitable for welding. The car body shall be made by spot / resistance welding or as suitable and internationally acceptable welding procedure for quality and standard of steel to be used in the manufacture of the car.
 - 3.6 The car body structure shall be designed to make effective use of metal in providing the required strength and stiffness. Portions of the roof, side frame, and under-frame shall be designed to form a girder to carry the longitudinal and vertical shear, and bending loads resulting from the specified vertical loads. In selecting the type and thickness of material to be used, the Contractor's design shall optimize strength, durability, and weight.
 - 3.7 The Body Bolster shall be fabricated from pressed sections and shall have suitable pads on which lifting slings may be placed. The material of body bolster should be decided by the manufacturer based upon design and strength considerations.
- 3.8 **Materials**
- a) All materials used in the construction of the coach shall be of the specified quality and shall comply with the most recent issue of the relevant International Standards specification. The list of standards followed shall be submitted during design approval stage.
 - b) All the materials to be used for interiors, paneling, furnishing, lighting, ventilation, etc. must comply with requirement for fire prevention, protection of passengers in case of fire and from fire -side effect and shall comply with the international standards. The design philosophy in this regard shall be submitted at the design approval stage.
 - c) At the same time, no materials are permitted within passenger compartments, which contain asbestos, toxic material or that may splinter or will create sharp edges when broken.



3.9 High Tensile and Corrosion Resistant Car Body

- a) The Car body structure, including sheathing shall be constructed of lightweight, high tensile corrosion resistance steel similar to IRS M-41 with thickness chosen to avoid any wavy/undulating/bulges in the external paneling and giving a smooth finish.
- b) Side wall and pillars: The material of body pillar shall IRS M-41 or as per any other International Standards to the Car body is generally manufactured. Pillars shall be continuous from sole bar to cant-rail, except below window openings, and shall be braced by longitudinal members between adjacent pillars. Bracing being designed to act as integral part of the exterior sheeting.
- c) The weight of the Recording Car shall be kept as low as possible consistent with adequate strength to meet the loading without exceeding stresses and deflections specified values for the structure.

3.10 Water drainage

Adequate drainage shall be provided in all body-structure members, and elsewhere as necessary to preclude water entrapment. Enclosed structural cavities shall be vented to prevent accumulation of condensate. In areas where water might be ingested, corrosion-resistant drain pans and drain lines shall be provided and shall be arranged to divert the discharge clear of all equipment and structure. Means shall be provided to prevent clogging of drain lines and drain holes. Any enclosed structural cavities of the steel members shall be treated with a rust-inhibiting coating. Interior floor should be capable of being washed with a hosepipe. There should be no location where water may stagnate.

3.11 Surface finish and flatness

All exterior non-corrugated surfaces shall be free of ripples and buckling. The surfaces of flanges and webs of all structural members shall be straight and flat, and free of ripples, buckling, dents, gashes and other surface imperfections.

3.12 Requirements for strength of recording car body

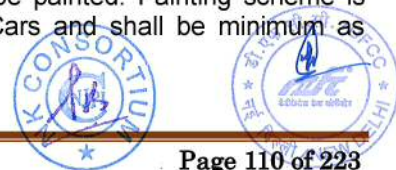
- a) The mechanical strength of the Recording Car body structure shall comply with the requirements of UIC 566.
- b) The Car body, and any equipment mounted on, beneath, or within shall be designed to withstand the fatigue loads that the car body structure will encounter in service during its design life. The fatigue life assessment of body structure shall be carried out using proven standard techniques and shall be submitted during a design approval stage.

3.13 Jacking pads

- a) There shall be a minimum of two jack pads on each side sill to facilitate the safe lifting of the Car. It should be possible to roll the bogies under the car without removing any equipment or structure. The bottom of all jack pads shall have a non-skid surface to provide frictional resistance against incidental horizontal loading between the jack pad and jack head.
- b) Suitable carjacking pads should also be provided at the front end for lifting the car with the bogie during re-railment.

3.14 Corrosion Protection

- a) The exterior of the Recording Car body shall be painted. Painting scheme is important for the life cycle of the Recording Cars and shall be minimum as specified in sub-clause 4.5 Section 8 Vol II.



3.15 Roof and floor Construction.

- a) Roof Structure: Equipment mounted under the roof suspended from the roof structure shall be bolted to the framing members. The framing members shall reinforce in sub-assembly to accept the equipment load.
- b) The Contractor shall ensure adequate water drainage from the roof such that no water is discharged into the vicinity of passenger doorways. Rain gutters shall be provided over windows and doors. The Roof equipment arrangement design shall not permit accumulation of water at all in standing or running condition.
- c) Floor construction: The floating floor shall be constructed so that all applicable noise, vibration, strength and fire endurance-rating requirement are met. A multiplayer hard wearing, non-slip, fire retardant floor covering having high abrasion resistance, waterproof and sealed, resistant to staining and easily cleanable using conventional floor cleaning methods and suitable cleaning agent should be provided.
- d) The floor construction shall be such that it does not permit water to seep through the floor and cause corrosion to floor / underframe component. The non-skid floor structure shall be designed so as to minimize the life cycle cost of the floor over its designed value.
- e) The openings in the flooring for the passage to pipes and cables shall be constructed as to prevent any seepage of the oil/water/dust and in addition give effective protection against the spread of any fire originating beneath the body.
- f) Adequate drain holes for floor water drainage at each doorway, drain pipe at one meter apart in the whole area of the engine room and floor under the seats and at points where water is likely to accumulate should be provided. Stainless steel drain pipes having a top end of bell mouth type fitted with stainless steel mesh should be provided to prevent water from spreading on the underside of the coach structure or dripping on to the running gear.

3.16 Ventilation

- a) Brushless DC Fans with stainless body and low noise shall be provided to ensure ventilation and for comfort during a partial failure of air conditioning.

3.17 Doors

- a) Doors, steps, handrails, etc. shall comply with UIC 646
- b) Recording Car shall have four body side doors, two in each of cabs. An Additional door on each of the side walls will shall be provided. It should be possible to remove or carry the material through these doors.
- c) All door openings shall be true to specified dimensions and perfectly square with rounding of corners. The openings shall be tested for size and squareness with templates so that doors open and close freely and when closed shall be reasonably weather and dust proof. Single leaf inward opening hinged or sliding doors with locking arrangement shall be provided in the driver's compartment and shall have a clear opening of 920 mm. The door leaves shall slide on roller bearing carriers suspended from the top rail and shall work in retaining guides on the door sills. Each leaf shall have a window opening with twin glass shutters.
- d) Latches shall be fitted on all doors so as to secure them from inside in the closed position.



- e) Wherever hinged doors are provided on the side walls, they shall be of inward opening type and will give an opening of 750 mm approx. Rainwater gutters of suitable design over the doorway shall be provided.
- f) Anti-slip of stainless body footsteps shall be provided at all body side doors. The edges shall be protected with metal threads. A wearing plate shall be provided on all top footsteps. Any other suitable arrangement can also be considered. The distance between the adjacent footsteps should approximate be 200 mm.
- g) The Light shall be provided at each of the footstep for easy landing during night. The step lights shall be so provided that it illuminates nearby area as well
- h) Door hand holds:
Door hand holds of stainless steel tubes or chromium plated steel tube, with malleable cast iron brackets shall be provided on either side of all body sides and doors shall be fitted so as to clear the side walls sufficient to prevent injury to the knuckles. Hand holds shall also be within the car profile so that mechanized car washing is not hindered.
- i) The door sill shall be constructed from or equipped with a slip proof profile with excellent wear resistance and drainage effect for rainwater.
- j) Door locks: All doors shall be fitted with reliable locks to be operated from outside and inside. Hasps for external padlocking shall also be provided on all doors opening out of the car.
- k) Double sealed glass windows of modular design shall be used in the air-conditioned coach. The outer glass shall be laminated and toughened safety glass, which does not fall on breakage. This should be indicated in the layout of the car for approval.
- l) Windows shall preferable be of wide view and true to dimensional square and of uniform width. The window opening shall be flush mounted and in no way, shall exceed 2 mm over or under the specified dimensions and shall not be out of square by more than 2 mm.
- m) Two suitable emergency openable windows, shall be provided on each side of the coach.
- n) Equipment mounted under slung are having adequate clearance from the rail or provided with protection cover to prevent damage by flying ballast or other obstructions.

3.18 Roof

- a) The roof shall be designed to form a satisfactory chord to the superstructure considered as a girder, and to take a concentrated load of 4 men standing, close together at any point. The structure shall consist generally of two main longitudinal members running from end to end of the car, braced at frequent intervals along their lower flanges, and rigidly connected to the arch bars, and to the grab pillars by rigid transverse members. At partition and semi bulkheads, the sills shall be attached to vertical pillars within or forming part of the partitions or semi-bulkheads. The construction throughout shall be absolutely watertight and shall permit easy renewal of corroded sheets.
- b) Roof Ventilators: The roof ventilators of a better design shall be provided and they shall not violate the schedule of Dimensions.

3.19 Driving Cabs

- a) Two driving cabs shall be provided, one at each end, with complete operating & driving control with dashboards to facilitate operation from either cab. The Driver's seat shall be on the left side. Adequate leg space shall be provided for the driver when he is seated. The general layout and arrangement of equipment in Driver's cab shall follow UIC CODEX 651 with respect to dimensions, safety features, furnishing, lighting, ventilation, noise level, field of view, driver's desk, seats etc. Spotlights shall be provided at suitable locations. The cab shall be ergonomically designed for better view and comfort and also the various panels/equipment meant for Driver shall be so laid that they are easily readable and Driver is not required to move physically for any operation during run.
- b) Foldable cushion sheet shall be provided in each of the driving cabs for 2 persons in addition to the Driver. It is optional and to be decided at design stage.
- c) The driving cab for Inspection Carriage of each end shall be designed incorporating the seating arrangement for DFCCIL officials as shown in the sketch attached to 9.3.3.
- d) All controls, brake handle, hand brake, Dead Man's device for horn and indication lamps/meters shall be within easy access and view of the Driver.
- e) Two numbers, 110 V sockets for hand signals in each cab, four numbers of amber color flashing light, one at each door top, shall be provided to flash when a push button is pressed provided at the driver's desk. This is required to, alert or exchange signal with the station staff.
- f) Head Light (performance parameters as given in sub-clause 9.1 of Section 9.1), Flasher Light (performance parameters as given in sub-clause 9.4 of Section 9.1), search lights and marker lights at both ends of the cab shall be provided and shall be provided.
- g) OHE voltage sensing device in both the cabs shall be provided of non-contact type. The indication LED lamp shall glow driver's desk when OHE is live.
- h) Full width single piece Stone proof lookout glass with Sun Screen shall be provided at the end wall of each Driver's compartment and these shall be glazed, clear, colorless polycarbonate with operating parameters equivalent to ICF Specification No. ICF/MD/SPEC-159 (latest revision).
- i) Provision of wind screen Wiper arm and blade Assembly with electrically or pneumatically operated of proven make.

3.20 The facilities to be provided in the Recording Car (excluding Inspection Vehicle) shall be as described briefly in the following Clauses.

- a) Material Cabin: Two numbers of material, cabin shall be provided suitably located having adequate space and proper locking arrangement for the storage of costly equipment and fittings in one and housekeeping items in the other. The Bidder shall identify the necessary tools and equipment necessary for the daily upkeep of the Vehicle of which few are listed below:
 - One number Dry cum Wet portable vacuum cleaner of 1kW or more capacity suitable for undertaking vacuum cleaning inside of the vehicle.
 - One number dry hand-held vacuum cleaner of 500 W capacity suitable for undertaking vacuum cleaning of small areas.
 - Two numbers chargeable LED flood light torch.



- b) **Air Conditioning Equipment:** The recording car including driving cabs shall be fully air-conditioned with adequate capacity with high energy efficiency standards. The design calculation shall be submitted along with the Bid. The air conditioning unit shall be roof mounted with 75% redundancy, meaning thereby that 3/4th of the compressor capacity shall be sufficient to maintain the temperature under the specified conditions. The Contractor shall also submit the layout, control, capacity, and protection system, etc. of the roof mounted air conditioning unit along with the Bid. The performance parameters shall be such that it should be able to maintain a temperature of 23-25°C with maximum relative humidity of 40-60%.
- However, the instrumentation of recording car should be capable of performing satisfactorily up to the following maximum temperatures: metallic surface temperature under Sun: 75° C max. and in shade: 55 °C max. The air conditioning equipment should therefore be capable to perform satisfactorily under such a high metallic surface temperature.
- c) **Instrument Room:** Instrument Room shall be air conditioned and well-furnished to keep on board computers, monitors, DVD, Printer & Plotter, UPS and other interface equipment, storage of Hard Copies, Reports and other such requirement. The Technical specifications of all the equipment to be provided in the instrument room shall be furnished along with the Bid. Suitable ergonomically designed good and of durable quality furniture shall be provided to meet the requirement.
- d) **Conference Room:** Conference Room shall be air conditioned having adequate space to accommodate a cushioned sofa (minimum 5 seats) with center table and latest HD-LED 19-inch TV monitor with 02 USB ports. It shall have well illumination, including night lamps, 02 mobile/Laptop charging points and one power point.
- e) **Staff Cabins:** One air-conditioned cabin with four cushioned berths equivalent to IA configuration shall be provided. The Cabins shall have separate entry and have windows on one side. In addition, three folding berths shall be provided at a suitable location without a separate cabin.
- f) **Lavatory:** Two number of Western Style WC, bio toilet, with separate overhead Tank, with standard and aesthetic wash room fittings shall be provided. The WC shall be provided with an exhaust Fan and hot water geyser. The flooring in lavatories shall be provided with stainless steel or ceramic tiles.
- g) **Multi pin Mobile Charging points** shall be provided as follows:
- Two numbers in each driving cab
 - Two numbers in Instrumentation Room
 - Two numbers in lounge
 - Two numbers in each two and four berth cabins
- h) **Kitchenette:** A kitchenette shall be provided with exhaust fan on one of the windows. Windows for cross ventilation shall also be provided. Kitchenette shall be provided with cooking range, LPG cylinder, a refrigerator, microwave oven, cooking utensils and complete dinner set. Details shall be finalized during design stage. Cooking range with LPG cylinder need not be provided in vehicle other than Inspection carriage.
- i) **Communicating doors:** Each driving cab shall have three independent entry, two from outside and one from inside the car. It shall be possible to isolate the cabins using sliding doors with locking arrangements.

- j) The equipment fixed to the under frame shall be secured properly by providing extra metallic chains of adequate strength to safeguard the equipment from falling in any unforeseen situation and to perform efficiently.

4 Noise Parameters

4.1 The Recording Car and measuring equipment shall be so designed and built that specified noise level is not exceeded. The equipment design and their mounting arrangement shall ensure the generation of noise and vibration to bare minimum. The design of the vehicle shall have an adequate attenuation of air-borne and structural-borne vibrations along potential paths from the sources to the passenger area and to wayside receptors.

4.2 The Contractor may propose car exterior and interior noise level standards better than those specified herein provided that this does not cause significant weight penalties.

4.3 Interior Noise Level

a) Interior noise criteria apply to measurement within an empty and stationary car with doors and windows closed.

b) Auxiliary Equipment Noise with Car Stationary
With all auxiliary equipment operating simultaneously at maximum capacity, the noise level in the car shall not exceed 70 dB (A) at any point along the car centre-line 1600 mm above the floor and not less than 600 mm from the end of the vehicle.

c) Noise level in Driver's cab
The general layout and arrangement of equipment in driver's cab shall follow UIC CODE 651 OR (latest edition) with respect to dimensions, safety features, furnishing, lighting, ventilation, noise level, field of view, drivers desk and seats. Spotlight shall be provided at suitable locations.

4.4 Exterior Noise Levels

The exterior noise levels, as measured on a dry track shall conform to the values as under. During the tests, all windows and doors shall be closed and all propulsion and auxiliary equipment shall be running at maximum levels.

a) Train Stationary
With Recording Car stationary and all systems operating simultaneously under normal conditions, the noise level measured at a location 15m horizontally from the track centerline on a horizontal plane passing through the axle centerlines shall not exceed 65 dB (A) at any point along the length of the vehicle on either side.

b) Train Moving with Recording Car moving on grade with clean smooth rails at all speeds from 0 to 100 km/hr. and whilst accelerating or braking with all vehicle systems operating simultaneously under normal conditions, the noise level measured on either side, at 25 m from the track centerline on a horizontal plane passing through the axle centerlines, shall not exceed 80 dB (A).

5 Fire Performance

5.1 The Recording Car stock shall be designed to minimize the risk of a fire starting and to prevent the fire propagation through the use of fire barriers in the floor and in the walls at the sides and ends and fire-resistant equipment housings.



Flammable materials shall be well contained and protected. Design features for fire mitigation shall be submitted.

- 5.2 All non-metallic and furnishing materials such as artificial leather seat covering, flooring material, GFRP paneling, cushioning material, etc. shall satisfy the requirements of resistance to the spread of flame and deterioration in visibility due to smoke etc. as per UIC 564-2 OR Class A or superior International Standards.
- 5.3 A reliable automatic fire/smoke detection system shall also be provided on the car. The system should not cause any discomfort or undue alarm to the travelling staff. The design of the system shall be got approved during the design stage.
- a) Fire prevention in Recording Car shall be suitably provided as per latest UIC standard or EN 45545 or RDSO's Specification No. RDSO/PE/CP/EMU/0001 Rev.0 of Aug.'2003 (Amendment No.1 of July'2006) and with the latest revision. The standard to be followed shall be finalized during design stage and shall be applicable for all P&E covered under this clause.

5.4 Interior Finish & Furnishing

- a) The Contractor shall propose world-class vehicle interiors, which incorporate a modern aesthetic approach with considerations to optimize staff comfort, safety and security as well as to minimize noise in the Car.
- b) All interior surfaces must be finished with good blending and good slow ageing properties to provide a pleasant, high quality interior and for ease of cleaning and maintenance. Provisions shall be made to prevent any squeaking, rattling or drumming. Items such as rubber strips and other items shall be integrated with panels as far as possible.
- c) All interior panels shall be of glass fiber reinforced panels GFRP. All internal GFRP surfaces shall have solid surface top (paint less) and be smooth finished. The panels shall be resistant to water and aggressive cleaning chemicals for graffiti removal, high temperatures, UV-light and radiant heat. The panels shall be resistant against kicks, punches and scratching. No cracks shall occur.
- d) Areas around fasteners shall specially be considered. Exposed materials and surfaces shall withstand the daily use of various cleaning agents (alkaline or acid detergents, petroleum solvents and mechanical action of the brushes) without losing colour or noticeable deterioration of the surface. The panel should have a durability without blistering, scratch, dent, cracks, dis-colour, lose their gloss level or any form of colour deterioration.
- e) The interiors should not have visible screws/allen screws. The fastening devices, fixings and securing screws shall not be visible from within the cars. All the interior fittings shall have anti injury features and should not have sharp and pointed edges. Rounded corners or coves shall be provided wherever mutually perpendicular flat plane surfaces abut. Metallic kicking strips with radiused transitions must be provided in the interiors of the car body, such that no moisture can penetrate.
- f) Gaps between all interiors-lining panels, seat, shell, etc. shall be minimized. The effects of the thermal expansion shall be taken into account and all unsealed gaps shall not exceed 1mm in depth where feasible. Suitable cushioning at panel joints



shall be provided to suppress noise. All the joints of interior panels and flooring shall be so sealed that there are no cavities or spaces where insects such as cockroaches etc. can hide and breed.

- g) Materials used shall comply with the relevant UIC specifications. Where UIC specifications do not exist, the Contractor shall submit relevant specification of proposed material for approval. Materials and substances classified as prohibited and restricted shall not be used.
- h) The berth covering should be stain resistant, easily cleanable, fire retardant material in pleasing colour and pattern. The cushioning material should also be fire retardant. Material should be as per the latest UIC standard. The berth covering should give a service life of at least 10 years.
- i) Equipment cupboard for housing equipment, for which access from the Car is necessary, may be provided at the car body ends.
- j) The car manufacturer before undertaking manufacture should make 3-D model drawings on Uni-graphics, CAD software version NX 4 and submit them for approval of the interior-furnishing scheme at design approval stage.

5.5 Exterior and Interior Colour Scheme

Exterior and interior colour scheme of Recording Cars shall be finalized at the time of the design approval stage.

5.6 Cattle Guard

Cattle guard shall be provided at the driving ends of each unit. The cattle guard shall have enough strength so as not to collapse on line in case of collision with stray animals, like cows etc. Cattle guard shall preferably be designed with tubular pipe structure and fastened to the body such that under impact the fasteners does not experience shear stress.

5.7 Piping and Pipe Fittings

- a) Seamless stainless-steel pipe bright annealed to ASTM A 269, Gr.304, which can be bent cold, shall be used. The layout of piping shall be designed to keep all pipes, especially the brake cylinder pipes, as short and straight as possible. Bends should be used throughout, but where elbows have to be used, they shall be of round type. Where the pipes themselves are bent, their internal area shall be maintained uniformly.
- b) Double ferrule pipe fitting consisting of the body, front ferrule, back ferrule and nut shall be provided. The body and nut will be of carbon steel to ASTM A- 108 Grade II with electro cobalt zinc plating with chrome passivation. The front ferrule and back ferrule will be made from Stainless Steel to ASTM A 276 TP 316 SS and performance property conforming to ICF specification no. ICF/MD/SPEC-166 with latest amendments.
- c) All pipes shall be adequately clamped to the frame assembly with proper clamps. Flexible hose connections conforming to spec. SAE 100R1 only shall be used.

5.8 Elastomers

- a) All elastomeric parts shall be of neoprene, unless otherwise required. The elastomer shall be compounded and cured to perform satisfactorily in the temperature range specified in this specification. The elastomers shall have high resistance to ultraviolet radiation, weather, washing fluids used, salt deposits and



the longest possible life consistent with the other characteristics specified. All the elastomeric parts shall be resistant to Ozone, oxidation, heat, oil, grease, salts and acids. The resilient mounts shall be of natural rubber. Synthetic rubber compounds may be substituted for natural rubber only when approved for a specific application.

- 5.9 The structure shall withstand end buffing load of 202 t (divided equally between two buffers) without and permanent deformation and stresses remaining below the yield point.
The vertical load of 4t/meter runs uniformly distributed shall be taken.
A combination of load under 2.1 and 2.2 shall be taken.
- 5.10 The fatigue life assessment of body structure shall be carried out using proven standard techniques and shall be submitted by the Bidder.
- 5.11 The prototype test result not be more than 3 years old and having same mechanical structure with squeeze load shall be required with strain gauge stress analysis under tare and loaded condition shall be submitted during design approval stage.
- 5.12 The vehicle shall be fit to attach with different types of rolling stock working over IR and DFCCIL either for the purpose of hauling or attached dead.
- 5.13 Details offered above are for the purpose of guidance only and the manufacturer shall design the product with improved features towards easy operation, handling, durability, maintainability, aesthetic, availability of spare parts in India, etc.
- 6 Diesel Engine, Transmission & Gear Box, Brake System, Air Compressor, Buffers and Couplings, Wheel Sets, Bogie, Suspension, etc.
- 6.1 Fuel efficient diesel engines of adequate capacity to deliver the performance as specified of reputed and proven make shall be provided, one number for providing traction to two wheels of each of the bogie. Exhaust emission shall comply to 3.10 of Section 9.1. All technical details of the engine shall be submitted along with fuel and lubricating oil consumption at different output in litre/hours with calculation to prove the adequacy of capacity.
- 6.2 The Bidder may select any of the diesel hydro-static or dynamic or combination of both or diesel electric transmission best suited for delivering the performance. Details of the transmission system selected shall be submitted and shall be of proven and reputed make.
- 6.3 The Brake system shall consist of UIC/RDSO approved Air Brake system suitable for this application. The Bidder shall submit brake schematic diagram, working principle, brake power diagram, calculations for ED, dimensions, type of brake block shall be preferably be from India. The brake system shall also include parking brake, dead-man handle and vigilance control etc.
- 6.4 The center buffer transition with screw coupling shall confirm to RDSO specification No. 56-BD 07 along with side buffer arrangement to RDSO's drawing number SK-98145.



- 6.5 Axle shall confirm to RDSO's drawing No. IRS R-43/92 or equivalent International Standard.
- 6.6 Wheel and wheel profile shall confirm to RDSO's Drawing No. IRS 19/93 and SK-91146 respectively or equivalent International Standard.
- 6.7 The Bidder shall submit the schematic of wheel, bogie, suspension, transmission, axle box arrangement during Bid stage.

7 Electrical

- 7.1 Electrical power supply is required for illumination, battery charging, search lights, control circuits, instrumentation, Information Technology, air conditioning, etc. The electrical system shall be designed integrating the sources of generation and battery capacity. The loads shall be classified as essential and others and power supply circuits designed for reliable working with redundancy for essential loads.
 - 7.2 The color code for the selection of wiring shall be as per the Indian standard. All wiring shall be in a flexible metallic concealed conduit. All plugs and sockets shall be of fire retardant material, rugged, and robust to give desired trouble-free service during the life of the vehicle. The relevant IS in this regard is given below but the Contractor may propose any other international standard and shall follow the same on all vehicles.

| | |
|------------------------------------|----------|
| Switches for use on Railway Stock: | IS: 6925 |
| Three pin plug and socket outlets: | IS: 1293 |
 - 7.3 During the period when the vehicle is parked in the shed, a single/three phase 230/415 V socket shall be provided with inbuilt charger for charging the battery, working of air conditioner and supply to instrumentation and IT equipment for working with the data during the parking period of the vehicle.
 - 7.4 The battery system is required for the cranking of the Diesel engine and storage of power for supply to essential loads of the coach. The battery shall preferably be flooded type tubular battery.
 - 7.5 The audio and call bell communication shall be provided with different compartments. The details to be finalized at the time of design approval.
 - 7.6 All lamps provided in the vehicle shall LED base with properly designed luminaire. Lights shall be provided for illumination of foot step, flood light at both ends for illumination of trailing route, if required for inspection or recording etc.
- 8 The Bidder shall submit the layout of the preliminary design, 3D modelling and vehicle interior with provisions of facilities and the governing specification of the major items along with the Bid in compliance to the above specification. The design shall be finalized at the design approval stage to comply with the specification.



9 EMI/EMC REQUIREMENTS

- 9.1 The measuring instruments, processors, sensors performance shall not be affected due to EMI/EMC interference arising due to working under 25 kV or 2x25kV, 50Hz, OHE system, Electronic signals generated due to the inverters and vehicle control systems shall not affect the measurements in any way.
- 9.2 Equipment should be suitable to work in a 25kV ac voltage environment, EMI protection and adequate protection against accidental falling of 25 kV wire on the equipment and safety of operating personal on board should be ensured It should meet the requirement specified in standard towards immunity and emission shall be governed as per EN
- a. EN 61000,
 - b. EN 50121



Section 9.3.1 Track Recording Car (TRC)

This specification shall be read in continuation of the General and Technical specification given in Section 9.3.

The recording car mounting with the equipment necessary for measurement of track and OHE parameters shall be called a Track Recording Car and shall be termed as TRC in this document. TRC shall be equipped with measuring all specified track and OHE parameters over DFCCIL/IR network.

Principles/methods used for the measurements as indicated in each of the following clauses are only suggestive and the Contractor should employ state-of-art technology capable of high accuracy and precision in measurement and recording. All corrections/compensations due to bogie, body and pantograph oscillations should be built into the measurement methods for giving better accuracy/precision in measurement and recording.

1 General (to be provided both in TRC and ORC)

- 1.1 The TRC and ORC should be able to measure and record the required parameters in the speed range 20–110 kmph, when running in self-propelled mode or coupled to a train.
- 1.2 The TRC and ORC shall be self-contained and completely equipped with all measuring/recording facility and there shall be no dependence on external sources.
- 1.3 The measurements shall be made under live or non-live condition of the OHE, during the day and night without any degradation in the measured performance.
- 1.4 The on-board diagnostic system shall comply to EN 13848-1 and 2 for Track Geometry and provisions as applicable for other parameters.
- 1.5 Contact-less measurement system employing state of the art technology with laser illumination or equivalent system shall be acceptable conforming to environmental standards. The system shall be designed according to electromagnetic compatibility, shocks and vibrations and shall have no moving parts, completely sealed and rugged construction.
- 1.6 There shall be a provision for automatic sending of recorded data from the on-board computer to the OCC/IMD through internet and GSM-R. Necessary software at OCC for the purpose shall be provided. The system shall generate two types of the reports, i.e. for Priority-1 and Priority-2 faults. The Priority-1 report shall have all major abnormalities needing immediate attention and priority-2 shall have the rest of the abnormalities. An alert message (SMS) for priority-1 faults shall be generated by the on-board computer and shall be sent to the nominated mobile numbers. Limits as well as classification of faults into priority-1 and priority-2 shall be decided at the design approval stage.



- 1.7 The TRC/ORC shall be fitted with instrumentation such as transducers, sensors, load cells and strain gauges, etc. as required, but such fitment shall not materially affect the static/dynamic performance of the TRC/ORC. The transducers shall be properly protected against mechanical, environmental and electrical interferences.
- 1.8 The videography cameras shall have a high resolution high frequency suitable for capturing of images at the specified speeds. The cameras and other equipment shall be protected from ingress of dust and water with best industry practice ingress and shall not be lower than IP 65 protection. Details of IP65 compliance certificate shall be submitted along with the explanation of design features during design approval stage. The measuring equipment mounted underneath shall also be protected from flying ballast.
- 1.9 With the ambient temperature of 50⁰C and instrument box protected with IP67, the design for heat evacuation from the box is important for the reliable functioning, and therefore, the Contractor shall submit the steady state temperature attained inside and the margin available. The box shall be designed with effective thermal conditioning system.
- 1.10 The Bidder shall note that the OHE installed is called “High Rise OHE” with contact wire height of 7.54 meters. A pantograph for functioning in High rise OHE with a panto-pan width of 2032 mm has been developed as per RDSO specification and shall be mounted on the roof of ORC only for the purpose.
- 1.11 The laser technology shall be acceptable conforming to environmental standards according to EN 60825-1/ANSI Z 136.1 i.e. the application shall provoke no damage to human beings. The system shall be designed according to electromagnetic compatibility, shocks and vibrations and shall have no moving parts, completely sealed and rugged construction.
- 1.12 The system shall provide an effective cleaning system of the optical windows.
- 1.13 Camera devices shall be equipped with optical interferential filter tuned on the laser emission frequency to minimize the interference of the sun or the other lighting sources. Camera device shall be of full digital type and it shall include FPGA devices to elaborate acquired images already on board of the camera.
- 1.14 The communication between roof/under-slung mounted and interior/ control room components are made by an Ethernet Network and physical connection is made by optical fiber. All cables on the bogie/body of TRC which are connected to ground level shall be put in a metallic grounded protection pipe.
- 1.15 The system shall be precise and shall not require frequent calibrations. The Contractor shall submit the calibration schedule, reason thereon, and it should be possible to train DFCCIL personal to take up such responsibilities.
- 1.16 The Bidder shall submit a detailed scheme of the proposed system with technical details, including, dimensional requirement and performance report of the same system supplied and commissioned over worldwide Railways.

- 1.17 All processed information shall be made available in the instrument/recording room of the TRC/ORC. The connections from the measuring equipment to the instrumentation room inside the cab shall be rigid enough to avoid any failure due to poor connectivity due to vibrations caused during movement. Minimum 4 (four) independent workstations with all hardware and software facilities shall be made available for continuous monitoring of the measurement and recording of data. Adequate number of 21-inch flat, thin LCD based VDU shall be provided at the workstations. The number and architecture of the hardware for the work stations shall be submitted with the Bid which will be finalized at the time of design approval.
- 1.18 The latest and newer industrial quality digital and analogue hardware, modular design, capable of withstanding the service and climatic conditions and vertical & lateral accelerations of up to 0.8 g at coach floor level and up to 1.0 g at the Measuring Frame/Sensor Beam fixed to the Bogie shall be provided. Axle box mounted accelerometers shall be capable of withstanding the acceleration in worst condition of running. Transducers/Sensors used shall be of rugged quality and well protected against flying objects, debris, shocks, vibrations etc. and shall be properly secured.
- 1.19 A patch panel or other suitable method shall be provided to enable monitoring the signal of any transducer /Sensor and power supply to facilitate calibration/trouble shooting. Facility and equipment for monitoring of individual transducer, conditioned output of the signal and the frequency/voltage/wave pattern of the power supply by the operator, shall be provided. An automatic self-diagnostic method shall be available for detection of any hardware failure and mapping of the errors recorded. Alternatively, a diagnostic feature enabled in the computer.
- 1.20 A system of indicating the functioning of transducers in the form of dancing lights or on separate VDU shall be provided.
- 1.21 The system shall be provided with good quality UPS of proper rating and reputed make. The entire system will be powered via this UPS, with back up time of at least 60 minutes.
- 1.22 System shall have facility to automatically pause the recording in case of TRC's movement in reverse direction. The system shall also be able to correctly measure the reverse movement and compensate for the same on forward movement of TRC, so as to restart the recording from the point where recording was paused.
- 1.23 The system shall be capable of storing all parameters data and exception report on the basis of predefined limits in separate files for 3000 Km of track and OHE monitoring, recording and video files. An additional mirror image disk of the same capacity shall also be provided to guard against possible loss of data in case of hard disk crash. Option to record or not to record various types of data shall be selectable by the operator through user interface.
- 1.24 The System shall be capable of on line (during recording) processing, analysis, storage, reporting and printing of the recorded data/reports. During recording the digital reports and analogue chart shall be displayed on separate VDUs and

printed on separate printers. Exception report and analogue report shall be printed during recording. Option to take or not to take the print of exception report and analogue report shall be available to user.

2 Special layout features

- 2.1 The layout of TRC/ORC shall be suitability designed consisting of both end driving cabs, a four-berth cabin with sleeping berths, equipment rack, workstations, conference room, pantry, WC, etc. as per the sketch No 1 and 2.
- 2.2 The layout of ORC shall be suitability designed for continuous physical view of the OHE with seating provision of minimum two persons on a hydraulically operated one number of workstation console with transparent roof as shown in the sketch No. 2 of ORC.

3 Positioning and Localization System (to be provided both in TRC and ORC)

- 3.1 The system requires robust and accurate measurement of speed, distance, clock, direction, synchronization with the help of event marker.
- 3.2 GPS mapping data of permanent location of the track, bridges, culverts, level crossings, OHE masts, portal, over laps, TSS, SP, SSP, ATS, location of signal and balise, Railway Stations, etc. shall be made available by respective system Contractor of WDFC. The data shall be used and incorporated in the software once, thereafter used for routine recording, so that accurate position of the affected location is marked automatically. Automatic calibration of location must be possible using the telegram from TPWS balise on the ground.
- 3.3 Beside this there shall be a provision for manual entry of route features with manual calibration when necessary by means of dedicated keyboard.
- 3.4 All processed results shall be presented with reference to the specific mast location on the track and kilometer rage. It should be possible to initialize the reference kilometers by the operator at any stage.

4 Diagnostic Kit for ETCS level-1(to be provided both in TRC and ORC)

Both the recording cars namely TRC and ORC shall be equipped with diagnostic kit for ETCS level -1 for continuous monitoring of balise and TPWS equipment being provided by STP-5A Contractor.

The system shall carry out the measurement in compliance with the following subsets of UNISIG standards for the ETCS:

- a. Subset 085 for the frequency analysis of the signal coming from the Eurobalise;
- b. Subset 026 for the decoding and verification of the information content of the telegram coming from the Eurobalise; and
- c. Subset 036 for the part of analysis and verification of the irradiation lobe.

The Equipment shall be complete in all respect and shall confirm to the standards of TPWS equipment provided by the Employer in all respect.



5 RECORDING AND PRESENTATION OF TEST RESULTS (applicable for both TRC and ORC):

- 5.1 The software for Recording of data and its presentation shall be user friendly and not requiring exceptionally high skill. It should be menu driven.
- 5.2 All measured and recorded data shall be converted from analogue to digital form: classified, analyzed and stored on an On-Board microprocessor based data acquisition, and analyzer system. It should be possible to generate suitable reports involving simple logic from the database.
- 5.3 It shall be possible to print out all or any of the parameters in juxtaposition as a function of distance or mast location without any classification, if desired. Normally the data shall be required to be printed after classification and analysis as specified.
- 5.4 Software shall be able to process and analysis of all parameters covered under clause 5.6 of EN 13848-2: 2006(E) and as applicable.
- 5.5 Data output and Storage shall be minimum as per clause 5.7 and 5.8 of EN 13848-2:2006 (E) and as applicable.
- 5.6 The exact format for presentation of reports over computer monitor and plotter/printer shall be mutually decided during design stage when the mock data presentation scheme is submitted. However, it shall not be different as detailed in clause 3 of Section 9.3.1.

6 Testing of TRC and ORC

- 6.1 The TRC/ORC shall be tested as per the ITP approved during design stage. It will consist of Factory Acceptance Test, Routine test, Commissioning and Site Acceptance Test and the ITP shall be finalized at the time of design approval. The ITP shall be finalized separately for the measuring and recording system, vehicle and combination of equipment mounted on the vehicle.
- 6.2 The ITP shall include conformity of the measurement of all parameters as described above.
- 6.3 It should ensure compliance with clause 6 of EN 13848-2: 2006E as applicable,

7 Integrated Track Monitoring System shall consist of the following sub-system

The measurement and recording of track and OHE parameters shall be sufficiently in details so that physical inspection and measurement shall not be required by staff.

- a. Track Parameters recording system;
- b. Half Rail profile and wear Measurement System;
- c. System for measurement of acceleration for detection of track surface defects, track geometry defects and riding as per Clause C1 and C2 of A2 Measurement methods given Annex A of EN 13848-1:2003 (E);
- d. System for identification of any obstacle in Maximum Moving Dimensions (MMD) envelope of DFCCIL and Indian Railways and measurement of distance of the nearest body. The maximum reach shall be worked out based on the typical OHE and Track layout attached;

- e. System of Video Recording;
- f. System of Video vision and recording with condition monitoring of Track components and balise; and
- g. Switch Geometry Parameters.

8 Salient Technical features of the Sub-Systems

8.1 Track Parameter Recording System

- a. Inertial principle of measurement based on No-contact Opto-inertial using lasers and high speed digital camera measuring technology shall be used for the measurement of vertical and lateral profiles of both left & right rails with appropriate correction for roll and yaw;
- b. The measurement system shall be certified by an International Accredited Certification Organization according to EN 13848-1 and 2 and certificate to this effect shall be submitted with the offer;
- c. Laser Technology shall be IEC 61508 SIL2 safety complied.
- d. System shall have the ability to record track irregularities having wavelengths in the range of 3.0 m to 100 m in steps of 1m. Speed independent band pass filters shall be used for the same; and
- e. Sampling distance for recording shall be 0.25 meter.

8.2 Half rail profile and wear measurement system

- a. The same LASER contac-less sensors being used for recording of track geometry parameters shall be used in this sub system for measurement of rail profile and wear;
- b. The system should have the facility to store both rail profile at user selectable interval in the range of 0.25m to 5.0m with least count of 1 mm; and
- c. The rail wear and other parameters should be measured/calculated at every 0.25m and stored in a separate file in ASCII/Binary file.

8.3 System for measurement of acceleration on pivot and axle box of TRC

- a. System shall have the ability to record vertical and lateral accelerations on both sides of axle box and pivot of TRC and test vehicle in the user selectable band pass filter in the frequency range of 0.3 Hz to 48hz up to a maximum speed of 110 Kmph;
- b. System shall have the facility to select sampling frequency for measurement of all accelerations in time domain in the range of 100 Hz to 1000 Hz in steps of 50 Hz.; and
- c. System shall have the facility to record and store all accelerations in space domain on user selectable distance in the range of 0.20m to 0.60m and least count of 1.0 mm.

8.4 System for identification of any infringement in Maximum Moving Dimension (MMD) envelope of IR and DFCCIL

- a. The system shall have the facility to measure at one end of the TRC;
- b. The system shall be able to scan the MMD envelop at every spot of less than 80 millimeters at maximum recording speed of 100 Kmph. The accuracy attained in the measurement shall be submitted by the Bidder;
- c. The system shall measure and record positions of structures within a rectangular shape of 15m of base and 10 m of height;
- d. The system shall have the facility to upload the standard DFCCIL and Indian Railway Maximum Moving Dimension envelop in the system;
- e. The system shall be able to evaluate the deviations of the measured envelop with respect to the standard MMD envelop. It should also be able to plot the actual profile at selected location;



- f. The deviations of any obstacle w.r.t standard IR and DFCCIL MMD envelope shall be stored and printed with details and location (chainage of obstacle in terms of last Kilometer and meter); and
 - g. The system shall be capable of displaying the video of clearance envelop on separate VDU and store the overlapping image of measured and standard MMD envelop along with obstacle.
- 8.5 System for Video Recording of track at both ends of the vehicle
- a. The system shall have the facility to videography at both the end of the TRC.
 - b. HD Resolution Video camera shall be provided. Resolution of the captured view shall not be less than 1280x720 pixels;
 - c. The system shall be capable to acquire, store and print the image at track features with location of track feature e.g. Level Crossing, Curve Start, Curve End, Bridge Start, Bridge End, station etc. Using preloaded track feature location file. Option to print the image at track features shall be user selectable; and
 - d. System shall have the capability for storage of images with localization index at least at every 2.0 meter at maximum recording speed of 110 Kmph.
- 8.6 System for Track Vision and Video recording of track components for condition monitoring
- a. System shall be capable to identify, store and print image and description of the defects in both left and right Rail, Fastenings, sleepers, Ballast and balise;
 - b. System shall be capable to store image and description of defect with location in separate files for each component of track i.e. Rails, Fastenings, Sleepers and Ballast; and
 - c. Defect information shall be stored in ASCII or database format. The images shall be stored in JPEG format.
- 8.7 Switch Geometry Parameters
- a. System shall be able to measure Vertical, Gauge side and Field side wear.
- 9 Parameters to be recorded**
- 9.1 Track Parameter Recording System: The System shall be capable of measuring / recording the following parameters.
- a. Absolute vertical profile of left and right rail on two user selectable band pass filters in the range of 3 m to 100 m in steps of 1m;
 - b. Unevenness of left and right rail on two user selectable chords in a range of 2 m to 20 m simultaneously with actual chord length being an even multiple of sampling distance. While recording on chord, only one band pass filter is to be selected for acquiring the vertical profile in the range of 3 m to 100 m in steps of 1m;
 - c. Absolute lateral profile of left and right rail on two user selectable band pass filters in the range of 3 m to 100 m in steps of 1m;
 - d. Alignment of left and right rail on two user selectable chords in a range of 2 m to 20 m, simultaneously with actual chord length being an even multiple of sampling distance. While recording on chord, only one band pass filter is to be selected for acquiring the lateral profile in the range of 3 m to 100 m in steps of 1m;
 - e. Gauge (measured 14mm below rail table) at every sampling point;
 - f. Super elevation or Cant at every sampling point;
 - g. Twist on two user selectable bases in a range from 2 m to 20 m from cross level and from dynamic cross level (difference of left and right rail absolute profiles). Option to select either of the methods shall be available. Individual defect will be represented as the amplitude from the zero line to the peak value;
 - h. Curvature at every sampling point. (To be measured in degrees. Degree is defined as $1750/R$, where R is the radius of the curve);

- i. Marking of 24 route features through route feature information file and dedicated key pad by punching single key assigned for each feature during recording along with distance;
- j. Speed of recording;
- k. Distances for relevant features; and
- l. The accuracy of measured track parameters in terms of repeatability and reproducibility shall be in accordance with the limits laid down in European code EN 13848-2. The reproducibility shall be tested and confirmed in the speed band of 40 to 110 Kmph as per the limits laid down in European code EN 13848-2.

9.2 Half rail profile and wear measurement system

- a. Half Rail Profile of both rails (left & right) for rails used over DFCCIL network;
- b. Vertical and lateral rail wear of both rails (Left & right);
- c. Horizontal rail wear of both rails (Left & right) for different type of rails being used on Indian Railways;
- d. Angular rail wear of both rails (Left & right);
- e. Marking of 24 route features through route feature information file and dedicated key pad by punching single key assigned for each feature during recording along with distance;
- f. Speed of recording;
- g. Distances for relevant features;
- h. The accuracy of wear in terms of repeatability and reproducibility shall be measured in terms of SD of sample to sample variation for a block of 200 m and the 95 percentile values shall be within the limits given below
 - i. Lateral wear (Horizontal gauge side wear) 0.2 mm
 - ii. Vertical wear 0.2 mm
 - iii. 450 internal rail profile wear 0.2 mm
 - iv. Rail roll over $\pm 0.5^\circ$
 - v. Lip flow 0.3mm

9.3 System for measurement of acceleration on one pivot and axle box of TRC/ORC

- a. Vertical and Lateral acceleration on bogie pivot of TRC in a band pass of 0-16 Hz or 0-8 Hz. Option to select either bands shall be available;
- b. Vertical & lateral acceleration at axle box level on both sides of axle on a user selectable band pass filter in the frequency range of 0.3 to 48 Hz.;
- c. Marking of 24 route features through route feature information file and dedicated key pad by punching single key assigned for each feature during recording along with distance;
- d. Speed of recording; and
- e. Distances for relevant features

9.4 System for identification of any obstacle in Maximum Moving Dimension (MMD) envelope of DFCCIL and IR

- a. It should be possible to get the albedo image of the obstacle. For each point measured, it should be possible to obtain information on its reflectivity in the way to make an off-color image of the measured object. Albedo range shall be 10%-100%;
- b. Location of obstacle infringing MMD envelop of IR;
- c. Description and Dimension of infringing obstacle with reference to some coordinate system;
- d. Image of MMD envelop showing obstacle with location;
- e. Setting distance of Mast, signals, tunnel, bridge etc.; and
- f. Position of rails and determination of track center

9.5 System for Video Recording of track at both ends of the vehicle

- a. Image of view with description, location and speed at track feature.



9.6 System for video recording of track components for reporting their status

- a. The system must be able to gather and process gray levels high resolution images of the rail top surface;
- b. All collected images and laser profile must be associated with localization information and all information integrated for analysis;
- c. Laser triangulation sub-systems must be calibrated so that automated measurements can be performed;
- d. Minimum System Performance required at maximum speed of 120 Kmph
 - i. Track Inspection Longitudinal Sample Step 1 mm or less
 - ii. Rail Inspection Longitudinal Sample Step 0.5 mm or less
 - iii. Track measurement longitudinal Sample Step 5 mm or less

- e. Automatic detection of defects and abnormalities in the following items of track component.

Rails

- i. Linear Defect – minimum thickness of 1 mm and length 50 mm.
- ii. Area Defect – like flaking, wheel burns, shelling, squat etc.
- iii. Rail corrugation – when the defect is visible
- iv. Joint Gap Measurement – estimation of minimum 1 mm and maximum 8 mm
- v. Weld detection – excess welding material more than 3 mm

Sleepers

- i. Crack Detection including originating from the fastener
- ii. Sleeper misalignment and spacing management
- iii. Sleeper level check arising due to broken sleeper, rolling and presence of objects on the sleeper

Fastenings – Detection of standard fasteners including switches, crossing, bridges etc. used over WDFC, EDFC

- i. Missing
- ii. Loose, rotation or deformed and measurement of proper tightening

Ballast and Others

- i. Profile
- ii. Excess or deficiency
- iii. Detection of axle counters, dancing sleepers, foreign objects, SEJ, Switches and Crossing, Level Crossings etc.
- iv. Base plate crack check and vegetation check
- v. Excess of mud/dry mud

ETCS Level 1 Balise as per UNISIG

- i. Correct positioning of Balise
- ii. Installation height and deviation of the distance along Z axis
- iii. Rotation of the balise along all axis and twisting to be recognized
- iv. Type of balise mounting system to be recognized
- v. Damages on a balise, its mounting and cracks

9.7 System shall measure the following parameters

- i. Guard Check Gauge
- ii. Guard Face Gauge
- iii. Switch passage width
- iv. Groove width
- v. Check Rail Height
- vi. Frog flangeway gap width and width and depth



The Switch Geometry Parameters reproductivity shall be: Resolution ≤ 0.1 mm and Reproducibility ± 0.6 mm

The System shall be able to reconstruct 3D image of the switch from real time profile acquired.

The system shall have feature to have manual checks on the measured switch to verify the status.

10 OHE Parameters measurement and Recording

The OHE parameters to be measured and recorded shall be provided as detailed in sub-clause 1.1 of Section 9.3.2 i.e. Non-contact measuring system of Geometry and thickness of OHE Contact wire covered under sub-clause 1.1(a) to (d) for stagger of the contact wire, height of the contact wire, gradient of the contact wire and contact wire thickness.

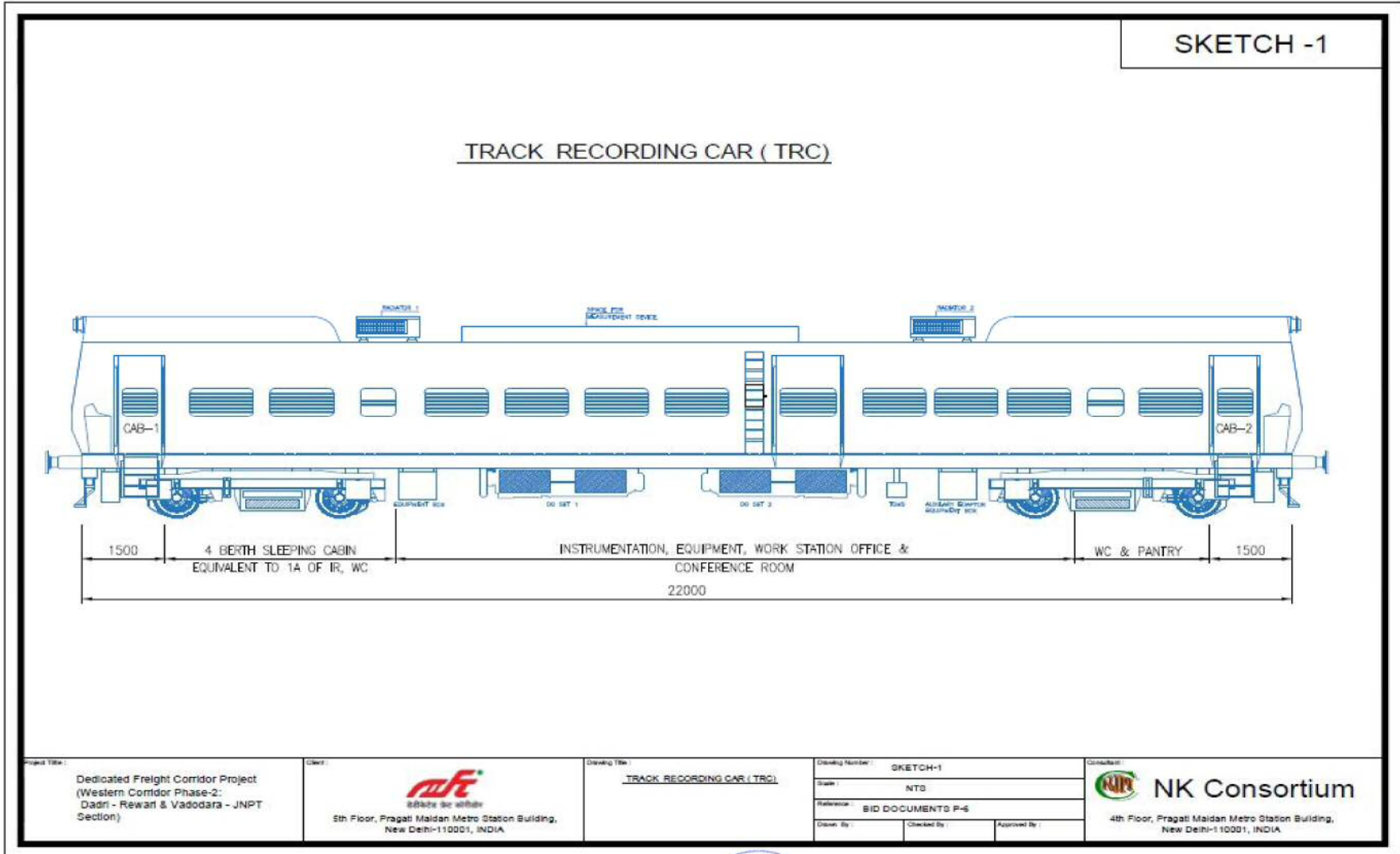
11 Supplier Experience

The eligibility criteria for Track Recording Car (TRC) is given in Sub-factor 'Specific Experience in Manufacture and Supply of Key Machines' vide sub-clause no. 3.2(e)(iii) (8).

In case the qualified Specialist Manufacture is not the manufacture of the Measurement and Recording systems as per clause 4,7 and 10 above, then he shall choose a single manufacturer of the requirements whose systems as per sub-clause 4, 7 (a), 7(c), 7(d), 7(f) and 10 above had been integrated together in at least one such self-propelled car by the qualified Specialist Manufacturer during the last 5 (five) years with documentary evidence/client certificate submitted.

The references for the measuring systems as per clause 7(f) – track element condition system – must refer to a system capable to acquire digital images and having functionality for automatic detection of the track defects.





Section 9.3.2 OHE Recording Car (ORC)

This specification shall be read in continuation of the section 9.3 of this Bid document

The recording car mounted with the equipment necessary for measurement of OHE parameters shall be called OHE Recording Car and termed as ORC in this document. ORC shall be equipped with measuring equipment to measure all the OHE parameters of DFCCIL/IR electrified network and the track parameters as detailed.

Principles/methods used for the measurements as indicated in each of the following clauses are only suggestive and the Contractor should employ state-of-art technology capable of high accuracy and precision in measurement and recording. All corrections/ compensations due to bogie, body and pantograph oscillations should be built into the measurement methods for giving better accuracy/precision in measurement and recording.

All measurement systems using cameras to inspect elements of the OHE infrastructure must have a proper illumination system allowing the correct measuring both during day and night. No degradation in the measuring performance is allowed between day and night.

The measurement, recording and videography of track and OHE parameters shall be sufficiently in details so that physical inspection and measurement shall not be required by staff.

1 The parameters that the OHE Recording Car is required to measure, record and monitor are detailed as follows:

1.1 Non-contact measuring system of Geometry and thickness of OHE Contact wire

- a. Stagger of the Contact Wire:
Stagger is defined as the distance of the contact wire from the center- line of pantograph, measured transverse to the track. (Suitable compensation shall be made for transverse oscillations of the locomotive/OHE Monitoring Car which affect the center line of the pantograph from the vertical). The system employed should enable measurement of stagger of two contact wires simultaneously (at the overlaps and turnouts) up to a limit of ± 500 mm. The stagger of contact wire may be measured using any non-contact measurement method.

The accuracy of stagger measurement should be minimum ± 10 mm and resolution of 1 mm, referred to track center and the sampling distance for stagger measurement shall be 200 mm.

- b. Height of the Contact Wire:
The height of the Contact Wire is the vertical distance from its underside from the rail level and it varies from 4500 mm to 7570 mm. The height measurement should be corrected for car-body movement. Height of contact wire may be measured using any non-contact measurement methodology. The OHE Monitoring Car shall be able to measure heights of both the contact wire of main line OHE and of turnout OHE to ensure a gap of 50 mm at support points at obligatory structures (out of run OHE to be higher than the main line OHE). This is essential to avoid pantograph

entanglement with OHE. Continuous measurement of the main line and Turnout OHE is required in such locations. The accuracy of height measurement shall be minimum ± 10 mm with resolution of 1 mm compared to track center. The sampling distance shall be 200 mm.

c. Measurement of Contact Wire Thickness

Thickness implies the diameter of Contact Wire. The cross-section of new contact wire over DFCCIL is given at attachment No. 10. The diameter of new contact wire over IR network of cross section 07 mm² is 12.24 mm and condemning limit is 8.24 mm. Provision for measurement of diameter of contact wire of size 150 and 193 mm² shall also be made in the system. The accuracy of contact wire thickness measurement should be minimum ± 0.2 mm. Sampling distance should be 10 mm.

d. Gradient (slope) of the Contact Wire

The gradient of the contact wire is the rate of change of height expressed in mm/m of distance. This may be calculated based on variation in height of contact wire and distance travelled. Alternately, Contractor's design can also be considered, subject to meeting the requirements. The accuracy of gradient (slope) of the contact wire measurement should be minimum ± 0.5 mm per meter of 50-meter base.

1.2 Measurement of Setting Distance (Implantation)

The Setting Distance is the distance measured from center line of track to the inner face of traction mast. This varies in the range of 2100 mm to 5000 mm. The System should be able to measure the setting distance in accuracy level of ± 10 mm. The System should be able to have Data storage of at least 50 lakhs masts with facility to transfer it for printing of reports. It should be possible to measure the setting distance of the portal when TRC/ORC moving on track covering the portal.

The system shall be similar to as detailed in clause 7(d) of Section No. 9.3.1

1.3 Contact Force:

Continuous measurement of the contact force between the pantograph and the contact wire, which may differ from the upward force of the pantograph, due to oscillations of the contact wire, shall be made by suitable transducers installed on the pan of the pantograph. Force sensors shall be small and lightweight so as not to affect the aerodynamic uplift and current collection property of the pantograph. The Bidder shall provide the measurement range of pantograph contact force, vertical acceleration (to identify hard points and impacts with mast location), transversal acceleration, longitudinal acceleration and shall be finalized at the design approval stage.

a. Loss of Contact:

The quality of the current collection is measured in terms of loss of contact between the Pantograph and the Contact Wire, as indicated below:

- i. The number of times the contact is interrupted, while the OHE Monitoring Car is in motion
- ii. The duration of contact loss and its intensity for which the contacts have been interrupted while the OHE Monitoring Car is in motion.
- iii. Normal static pressure setting of Pantograph is at 7.00 kg/cm² -
- iv. The threshold value of Contact Loss is 4.5 kg/cm² pressure of Pantograph.

The contact losses, locations and their duration are to be measured and recorded continuously while the OHE Monitoring Car is in motion. Contact loss ratio shall be calculated by dividing the sum of the total Contact loss duration with total duration of recording. However, the format of data analysis shall be finalized at design stage.

b. Pantograph acceleration:

The vertical acceleration of pantograph as well as its vertical displacement shall be measured continuously when the OHE car is in motion. The lateral acceleration as well as the horizontal sway of the pantograph pan, with reference to the central line of the pantograph in static condition shall also be measured continuously. It should also measure the wind speed.

- 1.4 Body lateral and vertical acceleration as provided in TRC vide sub-clause 7c of Section 9.3.1.
- 1.5 System of Video Recording provided in TRC as per sub clause 7e of Section 9.3.1.
- 1.6 System of Track Recording Parameters as detailed in Clause 7(a) of Section 9.3.1 and suitably using it for computing the roll angle of the vehicle to measure the absolute parameters of the vehicle in both stationary and dynamic condition.
- 1.7 The accuracy of measured OHE parameters in terms of repeatability and reproducibility shall be made using the same methodology as described in European code EN 13848-2.

2 OHE Vision System and Videography of the OHE

- 2.1 The systems installed on OHE and inspect and record gray level high resolution images of all the components and parts of the OHE with real time automated processing of the gathered images at the specified speed.
- 2.2 The system shall perform continuous acquisition of longitudinal images of the OHE and transversal images in correspondence of the steady arm/electric must in order to be able to view properly all elements of OHE.
- 2.3 The Contractor shall develop a library of standard fittings, mountings such as catenary, contact wire, insulators, cantilevers, automatic tensioning device, droppers etc. of OHE.
- 2.4 Acquisition of transversal images shall be made by precise real-time identification of OHE mast. The OHE mast position will trigger the acquisition for transversal images which must be synchronized with mast position. It will perform also automatic detection of steady arm along the track.
- 2.5 OHE mast detection system for the triggering of transversal images.
- 2.6 The system must consist of
 - a. Longitudinal Inspection System which inspects and compare the infrastructure that reside in the vertical plane along the track longitudinal axis such as Catenary and Contract Wire, Droppers, fixed points, insulators and any change on the infrastructural devices.
 - b. Transversal Inspection System which takes high resolution images, inspects and compare Cantilever, line hangers, insulators etc.
 - c. OHE mast detection system.

- 2.7 The Bidder shall offer the best of the technology in terms of Field of view, pixel of sensor, camera sensitivity and illumination system.
- 2.8 All collected images and laser profiles must be associated with localization information and from that time on all defects and objects must consequently localized.
- 2.9 The system shall be chosen to have desired transverse and height resolution, HD camera, illumination system.

3 Minimum inspection functionalities of the system required are:

- 3.1 The system installed on the roof shall inspect and record gray level high resolution images of all the components and parts of the OHE such as cantilever assembly, dropper, contact and catenary wire, insulators, clamps, etc. It should be able to detect breakage of insulator, mis-alignment of cantilever or its part, dropper hanging, ATD movements.
- 3.2 It should be possible to give away the system of manual inspection of OHE and measurement made shall be sufficient to identify defects in all probability of the following components with a resolution of 2 mm.
 - a. Steady arms vertical and transversal angles
 - b. Position of longitudinal insulator
 - c. Position of transversal insulator
 - d. Detection of broken insulator or missing insulator parts
 - e. Droppers detection and curvature evaluation, broken or bulged dropper detection
 - f. Incorrect Dropper tensioning
 - g. Fixed point detection, curvature and asymmetry evaluation
- 3.3 All collected images in association of the measurement above shall be integrated for correct interpretation of the measured data and image with time & space.
- 3.4 It should be possible to view the recorded images in slow motion.

4 OHE Voltage measurement:

The system shall measure in all environment conditions, the OHE voltage that can be processed on board from a sensor installed on the roof of the vehicle. The voltage shall be measured at real time processing of acquired sensors signals. The voltage measurement shall also be analyzed for average and peak voltage.



- 5 ORC shall be provided with the measurement and videography equipment as provided in TRC vide sub-clause 7a, 8.1 and 9.1 namely track Parameters recording system and sub-clause 7e, 8.5 and 9.5 namely system of video recording.

6 Supplier Experience

The eligibility criteria for OHE Recording Car (ORC) is given vide Sub-factor ‘Specific Experience in Manufacture and Supply of Key Machines’ vide sub-clause no. 3.2(e)(iii) (9).

In case the qualified Specialist Manufacture is not the manufacture of the Measurement and Recording systems as per clause 1, 2 above and clause 4 of section 9.3.1, then he shall choose a single manufacturer of the requirements whose systems as per sub-clause 1.1, 1.2, 1.3, 1.4,1.6 and 2 above and clause 4 of Section 9.3.1 had been integrated together in at least one such self-propelled car during the last 5 (five) years with documentary evidence/client certificate submitted.

The references for the measuring system as per clause 2 -OHE vision system and videography of the OHE – must refer to a system capable to acquire digital images and having functionality for automatic detection of the OHE defects.

7 RMITIS

The ORC shall also be supplied with two numbers of roof mounted infrared thermal imaging system to be called RMITIS in this document. This is meant to be installed on the roof of the locomotive and the thermal imaging system shall scan the OHE system, current collection with snap image of any flashover etc. The specification of the system is attached as Annexure 1 to this Section of the specification.



Annexure 1

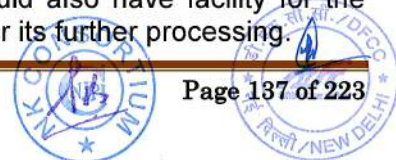
TECHNICAL SPECIFICATION FOR ROOF MOUNTED INFRARED THERMAL IMAGING SYSTEM (RMITIS) FOR ON LINE LIVE SCANNING OF 25 kV and 2x25 kVA AC OHE SYSTEM

1 General

- 1.1 This specification covers the requirement of the roof mounted infrared thermal imaging system (RMITIS) for monitoring, measurement and storage of locations with
 - a. Hot spots i.e. high temperature due to kink etc. in 25 kV and 2x25kV overhead contact wire
 - b. Scanning of entire 2x25kV overhead equipment system including contact wire, catenary, fittings & jumper etc. for higher temperature as compared to set temperature
 - c. Identification and recording of pantograph flashovers during current collection, while carrying out live line recording.
- 1.2 RMITIS shall be capable & suitable for mounting on roof of the electric locomotive and monitoring should be possible at speed up to 100 kmph.
- 1.3 The Contractor shall study the environmental conditions and ensure design for safe and reliable working in such harsh environmental condition.
- 1.4 A 230 V AC or 110 V DC source shall be provided from the locomotive to the control unit of the RMITIS to be installed inside the cab of the locomotive.
- 1.5 It should have display facility to show the infrared images on the spot. The on-board image analysis and storage facility shall be available. Analysis and recording arrangement should be light weight and easy to use preferably less than 1.5 Kg.
- 1.6 Mechanical arrangement to install camera on the roof of train is to be provided by Contractor. Mechanical fitting should allow user to install/ un-install camera quite easily vide bolting/clamping/other rugged fixture etc.
- 1.7 Required Installation provision over the roof of Locomotives/ Tower wagon should be arranged by the Employer on few nominated locomotives.

2 Technical Requirement

- 2.1 The infrared imaging system shall be suitable for monitoring, measurement and storing temperatures of hot spot for the following applications:
 - a. Scanning of entire 25kV overhead equipment system including contact wire, catenary, fittings & jumper etc.
 - b. Detects heat build-up on /bus bars/isolator's etc.
 - c. Detects hot spots in Overhead transmission/power lines etc.
 - d. Detect pantograph flashover during current collection, record and store images with traceability
- 2.2 The system should be menu driven and user friendly, so that the user can take different measurements including focus etc. The setup menu should provide the facility for the adjustment/ selection of the emissivity, background temperature, auto range, time, date etc. It should also have facility for the storage of the scanned images in the field and for its further processing.



- 2.3 To geographically localize the hot spots, flash overs above normal temperature shall user selectable and possible to integrate with GPS data. GPS route mapping data of WDFC section of DFCCIL shall be provided by the Employer for correlating hot spots and its location on the line.
- 2.4 The Processing software should capture images with temperature above user defined limit and should not log undesired images scanned during the run. The report generated at the end of the recording run should have provision available to generate Above Normal Temperature report of only those points, which needs to be attended by maintenance staff; clearly indicating the nearest mast location number and corresponding temperature value.
- 2.5 The system should have the facility of capturing an image frame as soon as predefined alarm gets triggered. Image should be captured as a function of alarm as soon as temperature within entire field of view (FOV) increases beyond predefined limits.
- 2.6 System should be fully monitored & controlled from the Laptop (to be supplied by Contractor with applicable software loaded) installed inside the locomotive. At least 30 m of interface cable from camera to laptop is to be provided by Contractor. Images/videos/data should be transmitted from camera to laptop without any loss due to length of cable.
- 2.7 Laptop should be with at least i5 processor of latest generation with HDD of more than 500 GB. Weight of laptop should be less than 1.5 KG.
- 2.8 Real time 16-bit image streaming shall be available for signal/ Temperature Linear & Radiometric image.

3 Detection of Arc

- 3.1 Electric Arcs detection system shall allow the detection and the measurement of the characteristics of the electric arcs generated between pantograph and contact wires of the overhead lines at any speed up to 160 Kmph.
- 3.2 It should comply with standard EN 50317, Railway applications. Current collection systems. Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line
- 3.2 Non-contact based technology, Optical/UV, with a couple of optical boxes for each pantograph shall be provided
- 3.3 It should measure the optical ultraviolet radiation emitted by the copper of the wire during the electrical arc, by means of photomultiplier tubes with response time of the order of less than 1micro-second.
- 3.4 The measurement shall be made in the appropriate range 220-225 nm, while the system must be insensible at wavelengths higher than 330 nm in all environmental conditions.



- 4 Software for camera control, fast data transfer and thermograph analysis shall be provided by the Contractor. Besides, standard functions, following functions shall also be available in the software.
 - a. Extensive image analysis (spots, profiles, areas etc.)
 - b. Electronic zoom function (continuous up to 4x or more)
 - c. Radiometric calibration routine (Calibration, emissivity etc.)
 - d. Display of isotherms
 - e. Movable cursor spot measurement.
 - f. Vertical/ horizontal line thermal profile

- 5 Application requirement
 - a. GPS & other hardware connectivity live status indication should be available on screen.
 - b. Automatic filtering of GPS data should be available to ensure data portability.
 - c. Resultant report should include fault id, GPS location, Max. temp., nearest pole/ mast no., railway division, railway section along with embedded thermal image
 - d. Thermal image tagged in resultant report should open up automatically by click on report icon.
 - e. Thermal image should be saved along with relevant data like GPS location, Max. temp., nearest pole/ mast no., Division, section etc.
 - f. Application should have option to filter the report based on division, section, date & time

- 6 Hot spot cut off temperature should be easily defined by user in the application
Technical particulars of the infrared imaging system:



| S. No. | Item Description | Limits |
|--------|---|--|
| 1 | Detector type | Focal Plane Array (FPA), Uncooled Micro bolometer physical detectors 640 x 480 640 x 480 pixels without image enhancement etc. |
| 2 | Temperature range | -20°C to 120° C |
| 3 | Field of View | 25 x 19 |
| 4 | Minimum Focus Distance. | 0.5 m |
| 5 | Thermal Sensitivity | Less than 0.05°C |
| 6 | Spatial Resolution (IFOV) | 1.3 mrad |
| 7 | Spectral Range | 7.5 to 13 μm |
| 8 | Image Frequency / Refresh rate (Minimum) | 50 Hz full window 100 Hz @ 640 x 240 200 Hz @ 640 x 120 |
| 9 | Image Output | Should be available |
| 10 | Digital input | At least 1 no. |
| 11 | Digital Output | At least 1 no. |
| 12 | Emissivity Correction | User selectable from 0.1 to 1.0 |
| 13 | Accuracy | +/- 2° C or +/- 2% of reading |
| 14 | Focusing | Manual and automatic motorized focus |
| 15 | Measurement Mode | Spot, area, Isotherm, Delta T |
| 16 | Lens identification | Automatic |
| 17 | Storage | Images & Real time Radiometric video sequence |
| 18 | Power input. | Rechargeable battery pack |
| 19 | Battery charging input | 230 V, 50 Hz AC. and AC adopter 110/220 V AC, 50/60 Hz. |
| 20 | Environmental condition and EMI protection. | Equipment should be suitable to work in a 25kV ac voltage environment, EMI protection and adequate protection against accidental falling of 25 kV wire on the equipment and safety of operating personal on board should be ensured It should meet the requirement specified in following standard. (i) EN 61000-6-2:2001 (Immunity), (ii) EN 61000-6-2:2001 (Emission), |
| 21 | Battery backup time | Minimum 2 hrs. |
| 22 | Communication | Gigabit RJ45 connection (Built in) |
| 23 | Image analysis & report generation software | With compatible software and hardware for downloading on PC with windows 7 or latest |
| 24 | Operating Functions | Menu operated. |
| 25 | Mounting | Equipment shall be suitable for mounting on the roof of vehicle. Adequate locking arrangement to be provided to fix the equipment in desired direction. |
| 26 | Operating temperature range | -10° C to 50° C (Minimum) |
| 27 | Operating humidity Operating and storage | 10% to 95% non-condensing |
| 28 | Encapsulation/Enclosure | IP67 |
| 29 | Shock 25 g, | IEC 68-2-29 |
| 30 | Vibration 2 g, | IEC 68-2-29 |

7 Accessories: The accessories should include followings:

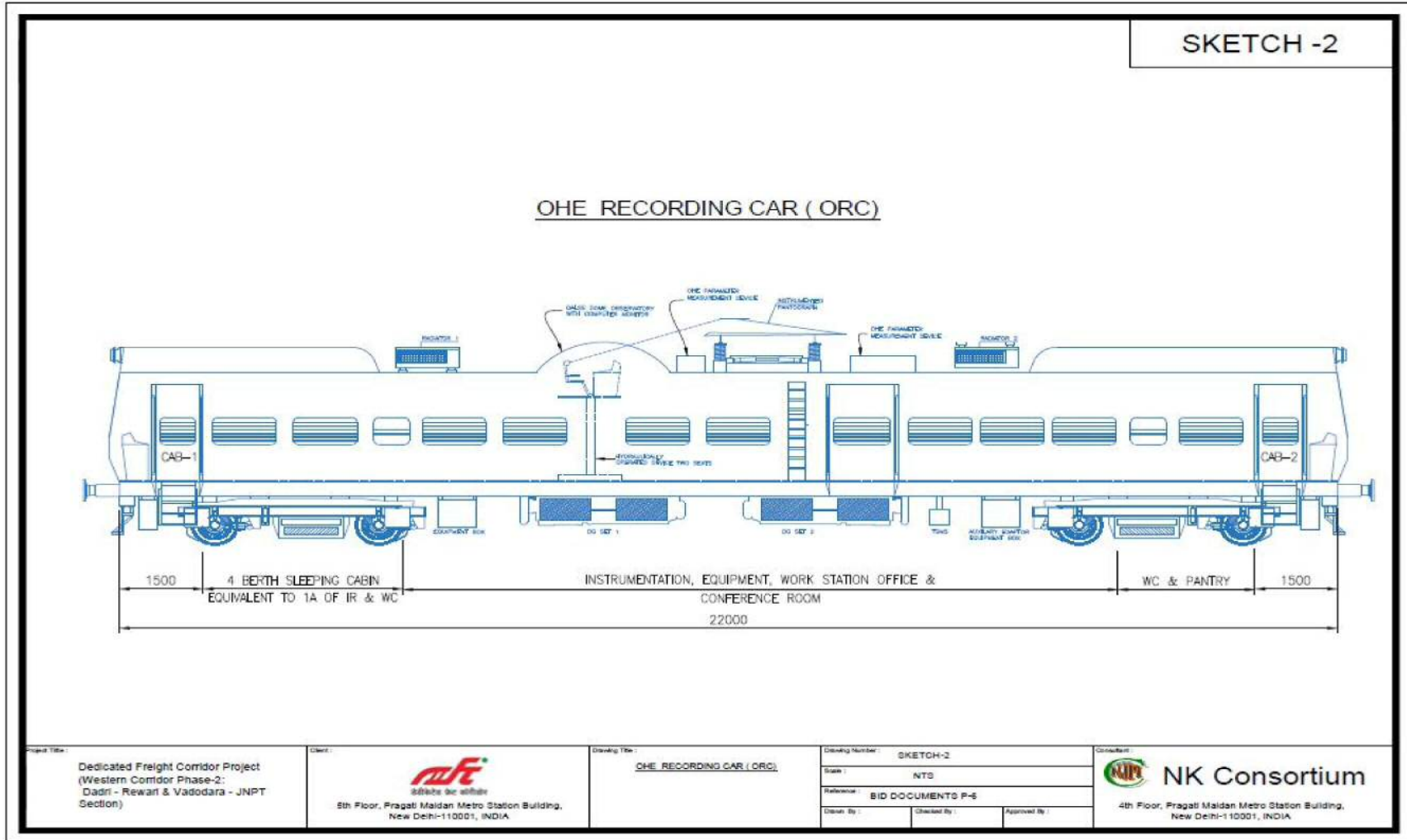
- a. Two set Battery with charger for at least 2 hrs. Back-up.
- b. AC power adopter to charge battery.
- c. User manual and operating instructions.
- d. Interface with GPS tracker to identify location of fault.
- e. GPS tracker.
- f. Carrying case
- g. Software CD



8 Installation, Commissioning & Trial

The manufacturer shall be responsible to install commission and carry out trials of the RMITIS on the line to the satisfaction of the Engineer. The Contractor shall arrange for necessary modifications in the software during trial for meaningful evaluation of the measurements.





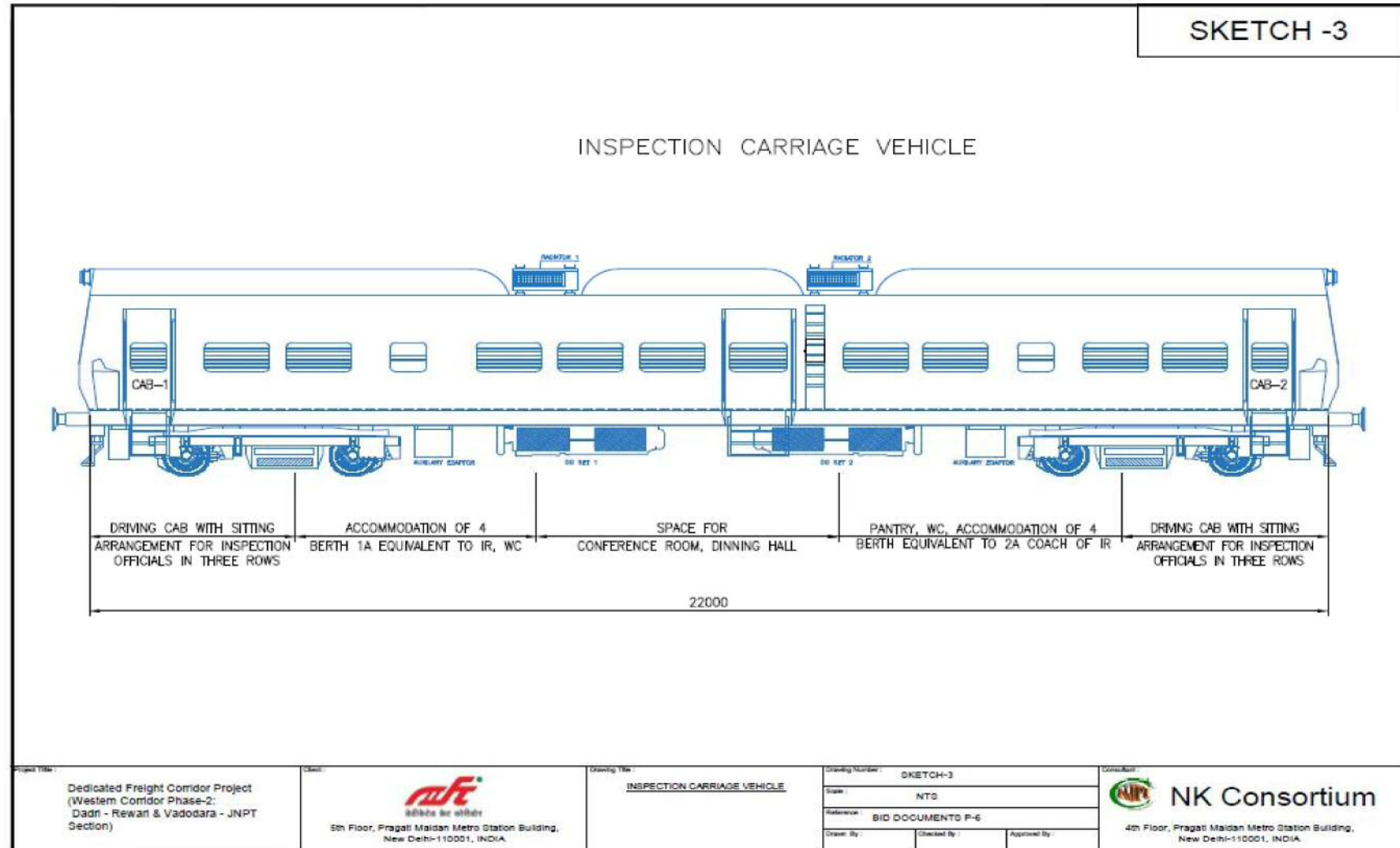
Section 9.3.3 Inspection Vehicle

The inspection carriage is meant for carrying out visual inspection of the section by Senior Officials. The carriage shall conform to the general specification as detailed in section 9.3 except for a few variations.

- 1 No provision for measuring equipment is required.
- 2 The layout will call for three rows of sitting arrangement including driver seat row, in both the driving cab to accommodate minimum 10 officials for window forward or trailing view inspection. Two folding sleeping berths shall also be provided in this portion of the vehicle.
- 3 The Rest of the on-board space to provide for
 - a. Lounge with sitting arrangement for about 10 officials. It shall also have a dining table, a flushed wash basin with mirror. One number executive work table with desk top computer.
 - b. One Cabin Sleeping accommodations 4 berths equivalent to IA cabin of IR coach on one side and another cabin with 4 berths sleeping accommodation equivalent to 2A cabin of IR coach on other side shall be provided. The furnishing shall be better and on lines of IA and 2A coach of Indian Railways.
 - c. Two nos. WC bio-toilet, with bath. The sanitary fitting of high standards and of reputed Brand.
 - d. One number kitchen and store room. Kitchen shall be provided with LPG, micro-wave oven, cooking utensils, dinner set for 12 officials and all related items, RO for drinking water supply etc. Stores shall have linen, blankets, towels, pillows, etc.

The layout and furnishing details shall be finalized at the time of design approval. However, a sketch No. 3 for guidance is attached to this section of the specification.

- 4 The lounge will be provided with 42" LED TV and firmly secured at suitable location. It should be possible to play the route information, driver view videography etc. One number desk top computer having system configuration Intel® Core™ i5/i7, DVDRW/8GM RAM, 1TB Hard Disc, Windows 10 Pro 64 BIT and 23" wide screed LED with HDMI Port with work table and chair
- 5 A driver view videography camera shall be provided on both side and it should be able to display the view in this TV. The video graphic camera shall have image resolution and pixel to ensure clear visibility to understand the sectional information and shall be similar to 7(e) of section 9.3.1.
- 6 The lookout window at driver's desk shall be wide and large, single piece covering the maximum front area so that the inspecting officials had a wide-angle view of the infrastructural assets.
- 7 Integrated flood light shall be provided at the bottom portion of each side for illumination of the track area for inspection during night time.



Section 9.4 Self-Driven Rail Bound Maintenance Vehicle

This General Technical Specification of Rail Bound Mobile Vehicle covers the supply of the vehicle for the equipment covered under the following description and particular specification.

- Rail Bound Mobile Vehicle for Civil Engineering works (Particular Specification 9.4.1)
- Tower Wagon 8 –Wheeler (Particular Specification 9.4.2)
- Bridge Inspection Vehicle (Particular Specification 9.4.3)

1 General

- 1.1 The Vehicle shall be called a Rail Bound Mobile vehicle (RBMV) when used for Civil Engineering works (Track Works), 8-wheeler Tower Wagon (TW) when used for Electrical Engineering works (OHE) and Bridge inspection vehicle (BIV) when used for bridge inspection and repair works.
- 1.2 The specification covers the requirement for design and manufacture of the vehicle as per this technical specification which is common for all the vehicles. The layout, equipment mounted and other maintenance equipment provided on each of the vehicle is given in the respective particular specification.
- 1.3 The vehicle shall be suitable to comply with the SOD, MMD, track structure, OHE parameters and climatic conditions as given in the Employer's Requirement and fit to work on DFCCIL and IR network.
- 1.4 The vehicle is 4 axle/8wheeler, self-driven with following traction features
 - a. Two numbers under-slung mounted, Diesel Engine, one per bogie
 - b. Diesel Electric 8-wheeler tower wagon consisting of an alternator, power rectifier, traction motors and control unit and all four-axle driven
 - c. Diesel Electric/Hydrostatic/Hydrodynamic transmission for Rail Bound Mobile Vehicle and Bridge Inspection Vehicle and minimum one axle drive of each bogie.
- 1.5 The vehicle shall be suitable to work at 100 Kmph with performance/oscillation test conducted at 110 kmph over DFCCIL network. The Bidder shall submit the hauling capability of the vehicle with single Diesel Engine (one bogie on traction) only and when both the Diesel Engine working (both the bogie on traction). The Bidder shall also be submitting the simulation test result of the vehicle at 110 Kmph as per the track structure of DFCCIL.
 - a. The capacity of each of the Diesel Engine and traction system shall be calculated and be submitted with the Bid document such that when working together shall be able to deliver the following output
 - (i) On level,
Self-Driven – 110 Kmph
+One number BFR loaded with gross weight of 65T – 100 Kmph
+Two number BFR loaded i.e. gross weight of 130T – Not less than 75 Kmph
 - (ii) Calculations for speed on various gradient and load shall be submitted during design approval stage.
 - b. The period for continuous running shall be taken as 8 Hrs. at 100 kmph for the purpose of thermal rating of Traction Equipment.



- c. The radiator shall either be mounted under frame or if it is not possible to accommodate, the same shall be mounted on the roof with an independent support structure and following the MMD.
- 1.6 The layout of facility inside the vehicle shall be as per the particular specification. The attached sketches with each of the section of specification is only for guidance and the Bidder is at liberty to develop its design and submit during the Bid stage but without any compromise on the facilities as specified. However, the final decision of the layout of facility shall be finalised at the time of design approval stage.
- 1.7 The Bidder shall note the DFCCIL general requirement while designing the equipment as follows:
- Good aesthetics
 - Comfort levels with laying of accessories not cause injury to the staff
 - Staff Amenities like resting, pantry etc.
 - Selection of items with minimum maintenance requirements
 - Longer periodicity between overhauls
 - Low life cycle cost
 - Low weight
 - Flush level/ smooth exteriors.
 - Use of interchangeable, modular components
 - Prominent labeling of parts and safety warnings
 - High reliability
 - Use of fire retardant and environment friendly materials and listing of such materials when it is unavoidable due to design constraints.
 - Maximum possible commonality of structure, components, equipment and sub-systems in the different types of cars.

The Bidder shall submit the design features in compliance to the above, giving reference to the clause/page no. of his Bid document.

- 1.8 All precaution shall be taken during the design and manufacturing of the vehicle such that
- No overhead part of the vehicle is at a height to cause any head injury to the travelling staff.
 - All metal sheet work shall incorporate suitable standard to ensure no sharp corners, avoiding sharp bending radius, lapping of surfaces etc. as per relevant standards.
 - Equipment mounted under slung are having adequate clearance from the rail or provided with protection cover to prevent damage by flying ballast or other obstructions.
 - Doors, steps, handrails, etc. shall comply with UIC 646
 - The complete vehicle shell surface shall be free from ripples and buckling and the size and dimensions selected accordingly.
 - The entire vehicle body shall have a streamlined design to give an aesthetically appearance with preference to flush mountings.
- 2 The mechanical design of the vehicle involving under-frame, superstructure, side and end walls, roof, body shell, headstocks, draw and buff gear, lifting pads, sole bar, body bolster, roof ventilation, air space, windows, doors, bogies, wheel, axles, axle boxes, suspension arrangement, brake system, Piping, corrosion protection, illumination, auxiliary power supply, Battery charger, speed indicator

and reorder, diesel engine, cooling system, alternator, traction motor, air compressor, etc. shall be guided as per RDSO specification No. SPEC No. TI/SPC/OHE/8WDETC/0092 Aug 2015 Chapter III, IV and V attached in VOL III. The thickness of the steel sheet used in the manufacturing of the shell shall be so chosen to avoid any wavy/undulating or bulges in final surface finish. This shall be finalized during design approval stage and also an item of stage inspection on the first so manufactured vehicle.

The hydrostatic or hydro-dynamic transmission system, when chosen by the Bidder for RBMV and BIV, then the power transmission system shall be guided as per RDSO specification No. MP-0.08.00.67 (Rev. -02) Jan 2009 Chapter III.

- 2.1 The structure shall withstand end buffing load of 202 t (divided equally between two buffers) without any permanent deformation and stresses remaining below the yield point.
 - 2.2 The vertical load of 4t/meter runs uniformly distributed shall be taken.
 - 2.3 A combination of load under 2.1 and 2.2 shall be taken for structural design.
 - 2.4 The mechanical strength of the vehicle body shall comply with the requirement of UIC 566.
 - 2.5 The fatigue life assessment of body structure shall be carried out using proven standard techniques and shall be submitted by the Bidder.
 - 2.6 The prototype test result shall not be more than 3 years old and having similar mechanical structure. A squeeze load with the strain gauze stress analysis under tare and loaded condition shall be submitted during the design stage shall be required if already done.
 - 2.7 The design shall ensure adequate water drainage from roof such that no water is discharged into the vicinity of the doorways/windows, etc. Rain gutter shall be provided over windows and doors. The mounting arrangement of the roof equipment shall not permit any water accumulation in and around.
 - 2.8 The vehicle shall be fit to attach with different types of rolling stock working over IR either for the purpose of hauling or attached dead.
 - 2.9 RDSO/ICF specifications referred for equipment is for the purpose of performance parameters. The manufacturer may design the product with improved features towards easy operation, handling, durability, maintainability, aesthetic, availability of spare parts in India etc. The Contractor shall submit the details of the design of the vehicle
- 3 Driving Cabs:**
- 3.1 Two driving cabs shall be provided, one at each end, with complete operating & driving control with dashboards to facilitate operation from either cab. Driver's seat shall be on the left side. Adequate leg space shall be provided for the driver when he is seated. The cab near to staff room shall be called Cab I.



- 3.2 The general layout and arrangement of equipment in Driver's cab shall follow UIC CODEX 651 with respect to dimensions, safety features, furnishing, lighting, ventilation, noise level, field of view, driver's desk, seats, etc.
- 3.3 Spotlights shall be provided at suitable locations for need base illumination and not to cause cross-reflection of the view ahead during night time.
- 3.4 The cab shall be ergonomically designed for better view and comfort and also the various panels /equipment meant for Driver shall be so laid that they are easily readable and Driver is not required to move physically for any operation during run.
- 3.5 The foldable cushion seat shall be provided in each of the driving cabs for additional persons depending on the space available.
- 3.6 The interior of the cab shall be done with stainless steel/glass fiber reinforced panels GFRP or any other International Standards followed for such application with high quality of aesthetic, flushed fittings, no sharp corners, no visible screw heads, stainless steel good quality of latches, hinges, handles, locks etc. shall be provided where required.
- 3.7 All controls, brake handle, hand brake, Dead Man's handle or Vigilance control device, switch for horn and indication lamps/meters shall be within easy access and view of the Driver.
- 3.8 The vehicle shall be equipped with push button inter-communication equipment between cabs, Inspection compartment, working hydraulic platform and crane.
- 3.9 Each driving cab shall be provided with one number 6 Inch TFT monitor connected with
 - a) One number 6-inch TFT monitor with two numbers of portable CCTV camera for viewing activity in crane area of RBMV for Civil engineering works.
 - b) One number 6-inch TFT monitor in each cab with two numbers of portable CCTV camera one for viewing activity in crane area and another of hydraulic platform area in 8-wheeler TW.
- 3.10 2 numbers, 110 V sockets for hand signals in each cab.
- 3.11 Head Light (similar to sub-clause 9.1 of Section 9.1), Flasher lights (similar to sub-clause 9.4 of Section 9.1), tail lights and marker lights at both ends of the cab shall be provided.
- 3.12 Non-contact type OHE voltage sensing device on the roof and indication in both the cabs shall be provided. The output shall be integrated on the driver desk.
- 3.13 Full width single piece Stone proof lookout glass with Sun Screen shall be provided at the end wall of each Driver's compartment and these shall be glazed, clear, colourless polycarbonate of proven make.

- 3.14 Provision of the wind screen Wiper arm and blade Assembly electrically or hydraulically operated of proven make to be provided.
 - 3.15 Two members of the stainless-steel body, low noise, brushless DC fan shall be provided with two speeds control.
 - 3.16 Two horns at both ends on the roof or front elevation with low and high tone shall be provided.
 - 3.17 Speed indicator and recorder with analogue and digital display of the speed, odometer, warning for over speeding, etc. shall be provided. Cab 1 shall be provided with a facility of speed recording continuously. The display unit shall be integrated with the driver's desk.
 - 3.18 An adjustable rearview mirror shall be provided.
 - 3.19 The driving cabs and the staff room shall be provided with air conditioned, comfortable temperature between 24-26°C at 40-60% RH. The details of the air conditioning system, capacity calculation, etc. shall be submitted with the Bid. Details on the above parameters shall be submitted along with the Bid.
- 4** The vehicle is meant for the maintenance of Track, OHE and bridge infrastructure over DFCCIL network. The vehicle shall be equipped with for facilities for such inspection and repairs. The provision shall generally consist of the following:
- a. Air-conditioned Cab and Staff room with facilities
 - b. Workshop with tool storage
 - c. Heavy and small material storage
 - d. Major provisions such as crane, hydraulic platform, Illumination etc.
- 5** Electrical
- 5.1 Electrical power supply is required for illumination, battery charging, search lights, control circuits, welding plant, air conditioning etc. The electrical system shall be designed integrating the sources of generation and battery capacity. The rating of the power supply, battery, etc. shall be selected accordingly.
 - 5.2 The color code for the selection of wiring shall be as per the Indian standard. All wiring shall be in a flexible metallic concealed conduit. All plugs and sockets shall be of fire retardant material, rugged, and robust to give desired trouble-free service during the life of the vehicle. The relevant specification in this regard is

| | |
|------------------------------------|----------|
| Switches for use on Railway Stock: | IS: 6925 |
| Three pin plug and socket outlets: | IS: 1293 |
 - 5.3 A one or three phase 230/415 V AC socket with suitable voltage converter shall be provided for working of air conditioning, lighting, hydraulic platform, crane, etc. by using a power supply from the fixed installation when the vehicle is parked for maintenance inside the depot.
 - 5.4 Stainless steel body, 110 V BLDC fans shall be provided in different areas as per the requirement with speed control features.



- 5.5 All light fittings for illumination inside the vehicle shall be flush mounted preferably the LED Lamps.
- 5.6 Sufficient numbers of mobile charging facility shall be provided to be decided at the design stage.
- 5.7 All metallic parts of the vehicle shall be solidly earthed at suitable locations.
- 6 Safety in Crane and Hydraulic Platform movement**
- 6.1 The crane and hydraulic shall have but not limited to the following safety provisions
- The cranes provided shall be of articulated boom type for lifting and positioning of materials
 - The crane movement shall stop if the safe load exceeds with audio indication
 - Height limitations for different stages shall be operated when working under OHE over DFCCIL network
 - Slewing limitations shall be operated to restrict movement only on one side to avoid accidental infringement of running line.
 - Hydraulic/Mechanical stability during lifting against overturning with safe working limit chart displayed prominently. Hydraulic stabilizer shall be provided to ensure the stability during the working of the crane. Crane Stability Index shall be governed as per IS 4573 or EN 12999
 - Creep speed control shall also be available with the staff working in the basket
 - Provision of battery operated with manual over ride stow the equipment in the event of main pump/engine failure.
- 6.2 All possible features of safety and control in operation shall be explored during design approval stage as per International Standards.
- 7 The Bidder shall submit the following along with the Bid**
- a. Layout of the vehicle with facilities for the respective section
 - b. Technical details of the Diesel Engine for traction and auxiliary purpose including calculation for its adequacy
 - c. Technical details of the transmission system chosen along with calculation for the adequacy.
 - d. Details of the Hydraulic platform, Cranes etc. along with the calculation for the adequacy
- 8 The Contractor shall submit the ITP based on International standards for the vehicle, major assembly such as hydraulic platform, crane, etc. to be followed for the inspection and will be finalized at the time of design approval. The decision of the Employer's in this regard will be final. The ITP shall be submitted for stage inspection, factory acceptance test, commissioning tests and site acceptance test.**



Section 9.4.1

Rail Bound Mobile Vehicle for Civil Engineering Works with MMU Equipment

This specification shall be read in continuation of the General and Technical specification given in Section 9.4

The vehicle shall be built in accordance with the Technical General Specification given at 9.4 and shall be equipped for the following facility to provide a maintenance friendly environment, efficiency multiplier tools, and cranes for civil engineering works associated with the track. A sketch no. 4 showing the general layout of the vehicle is attached with the specification.

Rail Bound Mobile Vehicle is meant to be provided at every Integrated Maintenance Depot for its quick movement to the spot requiring schedule and unscheduled track maintenance of the track. A sketch no. 4 giving layout attached to this section of the specification is for the guidance only.

The Bidder shall develop its own design and submit along with his Bid and to be finalized during design approval stage.

- 1 It is equipped with the following facilities.
 - 1.1 The vehicle shall be equipped with Mobile Maintenance equipment as detailed in this specification with suitable ergonomically design cubical, cupboards, pigeon box, etc. to fix the equipment, removal, free from vibration & rattling, identification tag and with security.
 - 1.2 Suitable racks in the store room to be provided to keep spares. Design to be submitted for approval at design stage.
 - 1.3 Crane for movement of 1 T of material in a radius of 15 meters (i.e. picking up from the center of the BFR wagon attached to it) and capacity not less than 20 t-m with knuckle boom (articulated boom) arrangement. The lifting capacity at different radius shall be furnished at the time of design approval. One number crane shall be mounted at each end of the vehicle i.e. total two number of cranes shall be provided in each RBMV. The procurement of crane by the Contractor shall comply sub-clause 11.15 of Section 8
 - 1.4 Staff room, Bio-WC, pantry for making tea and warming food, cushioned seating accommodation for 20 staff shall be provided. The staff room should be equipped with illumination lamps to maintain a uniform lux level of 80 lux, 4 nos. of mobile charging points, Stainless steel body low noise BLDC fan, drinking water dispensing system, etc.
 - 1.5 Open Storage space for minimum two rails of 13-meter-long, 10 no concrete sleepers, one number CMS crossing.
- 2 List of Mobile Maintenance Unit (MMU) accessories to be provided in the RBMV
 - 2.1 Following is the general requirement of each of the MMU



- a) Type of motive power used for operating the portable equipment shall be the same preferably diesel oil unless specified otherwise for use by chargeable battery power or using the 230 V from the DG set provided in the RBMV.
- b) It should be possible to carry each of the equipment by two persons and in exceptional cases by four persons of normal built. The Bidder shall indicate the weight of each of the machine if different what is specified in the particular specification of each equipment.
- c) Light weight Rail (Mono) cum Road Trolley shall be suitably designed to carry the tools to the desired location conveniently.
- d) The capacity, capability, fuel consumption per output, life in terms of output shall be indicated for each of the equipment.
- e) Each of the equipment shall be weather proof or otherwise specified

2.2 List of Equipment

- a) Abrasive Rail Cutter: Qty. 1 No. with two spare abrasive rail cutters; Chargeable Battery Driven, Average cutting time less than one minute, cutter dia. within 500 mm, weight not exceeding 20 Kg., without need of cooling oil. Robel make or similar.

Additional Details to be submitted with Bid: No. of cuts per full battery charge and per abrasive tool, Life in terms of number of cuts.

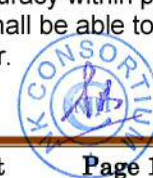
- b) Heck Saw Rail cutter: Qty. 1 No. with two number spare heck saw; Diesel driven, Average cutting time, length of the heck saw, Weight to be furnished. The machine shall work without any need of cooling oil

Additional Details to be submitted with Bid: No. of cuts per liter of fuel oil and per heck saw tool, Fuel Tank capacity, equipment life in terms of number of cuts.

- c) Drilling Machine: Qty. 1 No. with two spare drilling bits, chargeable battery Driven, Average drilling time for rail shall less than 1 minute and weight less than 20 Kg. Drill bit diameter of 40 mm. The machine shall work with any requirement of the cooling oil. Robel make or similar.
- d) Chamfering Kit: Qty. 1 set; it should be capable of chamfering and work hardening of sharp edges of the periphery of a fish bolt hole.
- e) Rail Tensor: Qty. 1 No.; Manual operated hydraulic pump suitable for Min. 600 kN of capacity enable pulling LWRs of up to 70 kg/m rail. It should be dismountable for carrying by hand and capable of distressing LWRs, compensating rail gaps and installing insulating joints.
- f) Horizontal Rail Bender: Qty. 1 No.; Manual operated hydraulic pump suitable to bend 70 Kg/m rail up to a minimum radius of 10 m.
- g) Rail Straightener: Qty. 1 No.; Manual operated hydraulic pump suitable to bend 70 Kg/m rail.
- h) Sleeper Space Adjuster: Qty. 1 No.; Capable of re-spacing and squaring of sleeper; Rated capacity of pushing force of about 8 t, weight not exceeding 15 Kg,



- i) Concrete Sleeper Breaker with grinder: Qty. 1 No.; capable of breaking the damaged sleeper into pieces for quick removal from its position; Diesel driven equipment imparting vibrational impacts through a drill bit/chisel.
 - j) Concrete Sleeper Drilling Machine: Hand held Diesel driven equipment for drilling hole of 10-22 mm diameter into a concrete sleeper.
 - k) Hydraulic extractor of ERC: Manually operated hydraulic extractor of minimum 10 T of extraction force on ERC, no damage to sleeper during extraction.
 - l) Set of Jacks: Qty. 2 Nos., one each of 10 and 15 t capacity; manually operated hydraulic track jack for lifting of track during maintenance work of maximum capability of 100 mm. Weight shall not exceed 15 Kg.
 - m) Two (2) nos. of manually operated lifting jacks for rail
 - n) Thermit Welding Equipment suitable for DFCCIL network and of proven make
 - o) Weld Trimmer suitable for DFCCIL network and of proven make
 - p) Gas cutting Equipment suitable for DFCCIL network and of proven make
 - q) Portable Diesel Driven Generator for Welding up to 5 mm electrode at 60% duty
 - r) Rail surface Grinder suitable for DFCCIL network and of proven make
 - s) Protection for temporary support of USFD cracks – 2 Sets
It shall consist of fish plates and rail clamps. The rail clamp shall be to use in pair suitable for securing the fish plate on top of concrete sleeper or off centered. There shall not be any obstruction for track machine working such as tamping, stabilizing unit, etc. The clamp shall be of ROBEL make or similar without infringement of any patent.
 - t) Off-track portable Tamping equipment consisting of two numbers of Tamper with Tamping tool with all accessories as necessary.
- 2.3 Communication Equipment: Two sets of Walkie-Talkie for communication within radius of 1 Km distance.
- 2.4 Light Weight Rail (Mono) cum road trolley: Qty. 2 Nos., Light weight (10 Kg), manually driven trolley on road and rail consisting of double flanged wheel for use on rail and nylon wheel for movement on road with provision to lift the nylon wheel when moving on rail. The size and capacity of the trolley shall be chosen such that the equipment offered dimensions and weight shall be transportable and moved by one person. Holding belts shall be provided to prevent the equipment falling due to movement on uneven surface.
- 2.5 Portable Track Measurement Instruments
- a) Electronic Toe Load Measuring device: Qty. 1 No., capable of measuring the toes load up to 2000 Kg. with electronic display. A mechanical device with lever arrangement to grip the toe and pull it. Measurement accuracy within plus minus 5%, rechargeable battery pack and one skilled person shall be able to measure the toe load of minimum 15 adjacent toes within one hour.



- b) Hand pushed trolley for measurement of Track parameters: Qty. 1 No., Capable for measuring track gauge, cross level, twist, travelled distance electronically and recording it on a handheld device. It should be possible to transfer the data to PC.
- c) Infra-red remote measurement of rail surface temperature

2.6 Safety and Protection Equipment

- a) Helmet: Qty. 20 Nos.
- b) Safety jacket: Qty. 20 Nos
- c) Audio-visual alarm system to warn the working staff about the approaching train.
- d) Protection screen: Portable, standard and proven design screen to be installed at work site to prevent inadvertent movement of personnel towards the train running track. It should be able to protect 10 meter working length.
- e) Safety Shoe: Qty. 10 pairs
- f) Safety gloves: Qty.10 pairs
- g) First Aid Box: Standard first aid box designed to care of the likely injury to the personal including stretcher.
- h) Rescue trolley for movement of rolling stock with damaged bogie.
- i) 2 No. fire extinguisher.
- j) One number stretcher of proven make

2.7 Single Pass Ultrasonic Rail Flaw Detector

- a. A portable and manual walking rail flaw detection system designed to inspect single rail with only one pass
- b. The equipment shall have aesthetic look, robust, light in weight and suitable for working on mains and battery.
- c. The equipment shall be capable of withstanding bumps and track irregularities during operation.
- d. The technology shall be based on Roller Search Unit (RSU) with minimum 9 (nine) transducer to cover the entire rail profile identifying defects in web, base, full rail web, full head and longitudinal cross-rail coverage.
- e. Software with A scan, B-scan, recognition engine and full audit capability. Color signal for various transducers.
- f. Rugged and tough Tablet with HD screen, GPS enabled defect tagging
- g. Tracking with GPS locations
- h. On Board hand test kit with wireless flaw detector software
- i. The equipment shall comply with the latest international standard applicable for ultrasonic flaw detection of rails.
- j. The equipment shall be supplied with all necessary accessories, on-board hand test kit, transport case, outrigger if required, rain and sun shield etc.
- k. Battery system suitable for working minimum 8 hours continuously with 50% screen intensity, auto cut off against deep discharge and over charge, indicate to display the condition of battery etc.
- l. A ITP as per international standard shall be submitted during design approval stage based on which the factory acceptance and Site Acceptance Test will be



conducted by the Engineer.

- m. The equipment shall be Sperry or Nordco or Vossloh make. The design/model offered shall be proven and minimum 10 (fifty) number in service with documentary evidence submitted of numbers in service.

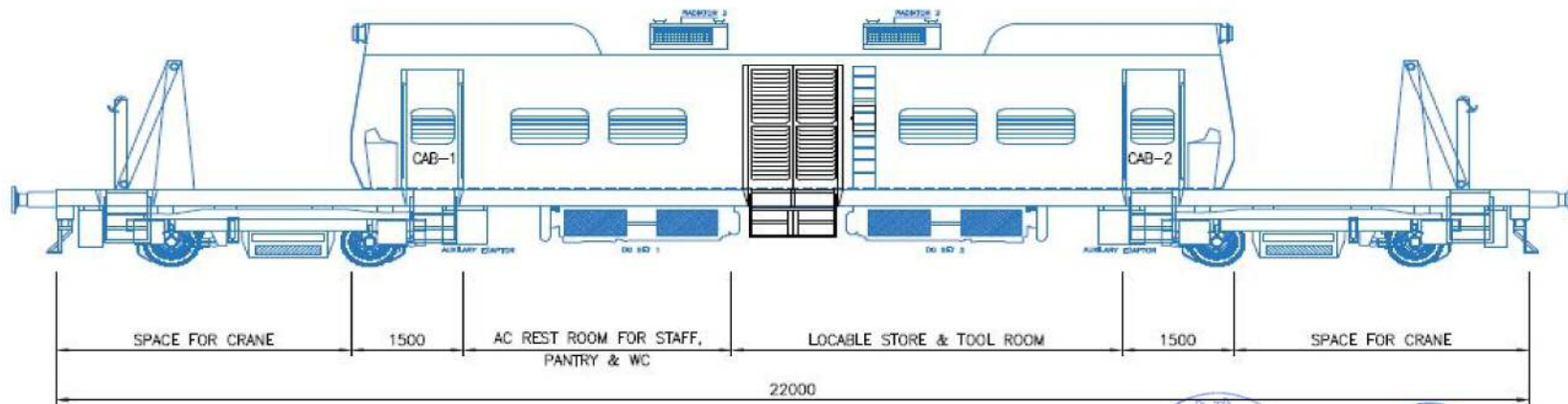
2.8 Illumination



The track maintenance is required during day and night time. It should be provided with LED lamp with luminary to provide sufficient illumination within a working distance of 100 meters. The LED luminary shall be mounted on suitable designed portal for general and focused illumination. A separate DG is provided for work site illumination to power the luminary.



SKETCH -4

RAIL BOUND MOBILE VEHICLE FOR CIVIL WORKS



| | | | | |
|---|--|--|---|--|
| <p>Project Title: Dedicated Freight Corridor Project (Western Corridor Phase-2: Dadri - Rewari & Vadodara - JNPT Section)</p> | <p>Client:  5th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> | <p>Drawing Title: RAIL BOUND MOBILE VEHICLE FOR CIVIL WORKS</p> | <p>Drawing Number: SKETCH-4 Scale: NTS Reference: BID DOCUMENTS P-6 Drawn By: _____ Checked By: _____ Approved By: _____</p> | <p>Contractor:  NK Consortium 4th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> |
|---|--|--|---|--|

Section 9.4.2 Tower wagon 8-Wheeler

This specification shall be read in continuation of the General and Technical specification given in Section 9.4

- 1** It shall be equipped with all possible maintenance friendly facilities necessary for OHE maintenance such as crane, hydraulic platform, inspection dome, efficiency multiplier tools, storage for spares, searchlights with fixing arrangement on hydraulic platform and cradle, catenary/contact wire drum, access opening for the catenary and contact wire exit with pulley support to roll in and roll out, one number high rise pantograph, etc.
 - 1.1 A general layout plan for guidance is given in sketch no. 5 attached to this section of the specification. The Contractor may develop design either as per this or suitably modifying but ensuring provision of all the features as asked for and the final decision on the design to be adopted shall be taken at the time of design approval stage.

- 2 Hydraulic operated lifting platform**
 - 2.1 A lifting and swiveling platform with hydraulically operated, fully mechanized, and adjustable for height and rotation shall be provided. The height of the platform when lowered, shall meet IR SOD and should be able to lift to the height of 7.4 meters from the rail level and support minimum 600 kg load. The minimum dimension of the platform shall be of 4.5-meter length and 1.5-meter-wide but shall be finalized during design stage to accommodate longer platform. The height of the collapsible railing shall be around 800 mm. The lateral reach of the hydraulic platform shall be around 3.5 meters.
 - 2.2 Control for lifting, lowering and swiveling shall be provided on the platform. The raising and swiveling of the platform shall be gradual and without jerks. In addition, two emergency stop switches shall be provided on each side of the platform to bring the TW to an emergency halt.
 - 2.3 Two search lights of adequate wattage, with LED lamp shall be provided on the platform for inspection of the overhead equipment during night working. Searchlights shall be capable of swiveling on universal joints type support and swiveling control shall be from inside of the observation dome. The search light shall be with IP 65 protection.
 - 2.4 It should be possible to lower down and swivel the platform manually to overcome the eventuality of the failure of the hydraulic system.
 - 2.5 Except space over and above the mounting of pantograph, observation dome and hydraulic platform, hydraulic support for the contact and catenary wire, the remaining roof shall be covered with a 2325mm wide fixed working platform at maximum possible height but within the maximum moving dimensions with collapsible railing as required. This fixed platform shall be provided with two approach ladders, one on each side to climb onto the roof of the vehicle. A raised platform on all sides shall be provided for the staff to move on the roof



to reach any location conveniently and safely. The approach ladder shall be designed with a mechanical lock to ensure a positive action of climbing and prohibits any unintended climb when OHE block is not taken.

- 2.6 The operator of the hydraulic platform shall have the option to select rotation in either side. Once the selection is made, it should lock and prohibit movement on the other side on which traffic block is not taken.
- 2.7 The operation of hydraulic platform and crane shall only be possible when OHE block is taken and sensed by OHE sensor and an interlock provided suitably.

3 Crane

3.1 One number, telescopic and hydraulic having knuckle boom (articulated type) crane shall be provided suitably located either on the roof or at one end or in the middle of the vehicle. The capacity and design to be worked out for the following functions

- a) Two persons with tools (Total 200 Kg) in a cradle with horizontal reach of 8 meters and vertical reach of 12 meters from rail level. The crane shall have the provision for remote control by the staff to control the height as required. The master-slave arrangement of operation, ensuring safety shall be developed and got approved at design stage. It should be possible to move the vehicle at a creeping speed up to 5 kmph while staff working on the cradle. The cradle shall be suitably designed of size for two persons to stand and work. It should be detachable so that also used for fixing hook to handle material. The design of the cradle shall have all possible measures to avoid any accidental slippage, falling etc. of the staff.
- b) A provision to replace the cradle with a hook to handle material with capacity of 1.5 T. at 10-meter radius with all possible swiveling and capacity not less than 17 t-m with knuckle boom design. It should be possible to lift 3T material from a distance of 5 m. The Contractor shall submit the lifting capacity at various radius and to be displayed at operator position for his immediate reference.
- c) The procurement of crane by the Contractor shall comply sub-clause 11.15 of Section 8.
- d) One hydraulically operated earth auger of suitable design and dimensions for drilling hole of 600 mm diameter and 3-meter-deep in the soil for erection of mast shall be provided.

3.2 The crane shall be structurally integrated with the underframe so that it should be rigid and upright without infringing SOD. Hydraulic stabilizer shall be provided to ensure the stability during the working of the crane.

3.3 There shall be a locking arrangement for restricted travel in case the crane to be operated without taking power block

3.4 There shall be a separate power pack for the operation of the crane and hydraulic platform.

3.5 The crane shall be provided with all mechanical safety norms.



4 Observation Dome

- 4.1 Observation dome shall be provided in the roof near the pantograph so as to observe interaction between the contact wire of the OHE and the pantograph. Two persons shall be able to sit comfortably in the observation dome. The upper portion of the dome shall be of polycarbonate /FRP, with reinforcement if required, for adequate strength and shall also be insulated for 25 kV. The arrangement shall be provided with adjustments, an unobstructed view of the contact between contact wire and pantograph of normal and high rise OHE is obtained by the persons in the observation dome without any strain. For this, it is essential to have a suitable ergonomic design hydraulically operated seating arrangement to raise and lower the seat by the person sitting over there from ground level. The chair provided in the observation dome shall have adjustable height, backrest with back and front adjustment just like in an automobile car.
- 4.2 Suitable design wipers shall be provided for observation of the pantograph/contact wire during heavy rains.

5 Pantograph

- 5.1 A high rise equipotential pantograph with 2032 mm wide panto pan mounted on insulators for live or non-live OHE shall be provided. The pantograph shall be procured from RDSO approved sources for High Rise Pantograph.
- 5.2 The pantograph shall be suitably graduated to enable manual measurement of stagger on either direction from track center and the markings shall be visible from the observation dome.

6 Contact and Catenary wire drums

- 6.1 Provision for mounting with rolling arrangement for one roll each of the contact and catenary wire inside the tower wagon as shown in the outline diagram shall be provided for the erection of new contact and catenary wire during the restoration of breakdowns.
- 6.2 Provision shall be desirable for rotating the contact wire drum by 180° for matching contact wire groove in either direction is possible so that it shall be possible to pay out the wire in either direction. Stands shall be provided with hand brakes to control the tension in the wires during the laying out process.
- 6.3 It shall be possible to lay-out wires in either direction.
- 6.4 The drums be loaded from a sliding door of adequate size on both sides. The sliding doors may be symmetric or non-symmetric as per the requirement of design. The laying out of the wire shall be from two of the openings of suitable size in the roof vertically above each of the drums. The openings shall be of suitable size to permit paying out of the conductors in any direction, when the vehicle is moving slowly at creep speed, without any obstruction, rubbing or scraping.



- 6.5 The Contractor shall seek mounting and rolling arrangement approval at the time of design approval. The drum size as prevalent for the OHE of DFCCIL is given in Attachment No. 11.
- 6.6 One option of 8-wheeler tower wagon for installing equipment is given in Sketch No. 5. In case, it is difficult to accommodate the contact/catenary wire drum with suitable arrangement for rolling out, the proposed option of the Contractor will be taken into consideration during design approval stage.

7 Efficiency Multiplier Tools

The efficiency multiplier tools, detailed below shall be of proven makes and specification either as mentioned or chosen by the Contractor be the best available in the market. The make and model shall be approved during the design stage.

- a. 2 Nos. hydraulic jacks of 5 t capacity of proven make and brand.
- b. One tifer 3t and two tifer of 1.5 t capacity of proven make and brand.
- c. Three pull-lift 0.75t, two pull-lift 1.5 t, one pull lift 3 t (Refer RDSO specification No. TI/SPC/OHE/TOOLPL/0990) RDSO specification is for guidance only.
- d. Electrically driven chargeable Battery-operated Cutting Tool with abrasive tool, for cutting OHE mast. Robel make or similar.
- e. Electrically driven chargeable Battery-operated Hand-held Drilling machine for size up to 20 mm hole of Robel or similar make.
- f. Communication Equipment: Two sets of Walkie-Talkie for communication within radius of 1 Km distance
- g. Tool Box – 5 Nos, consisting of all necessary tools for working on OHE.
- h. Two numbers of foldable Aluminum ladders, one number to attend the highest point of the OHE and another of half of that height.
- i. A workbench for the staff to attend minor repairs of parts with facility of small tool locker for issue to staff consisting
 - (i) Small drill working on 110 V DC,
 - (ii) Vice for holding parts
 - (iii) Files of different sizes,
 - (iv) Six sets of Box Spanners (6-36 mm), Ring Spanner (6-33 mm, Double end Spanner (6-36 mm), 2 Nos. Pipe wrench (18"), hammer 2 lb – 2 nos, 6 sets of screw drivers 6" and 12", cutting plier and chisel 6" – 2 sets.
 - (v) 6 Nos. of search light torch with chargeable battery and charging point.

8 Tools required for the operation and maintenance of OHE 8-Wheeler Tower Wagon and its sub-assembly

- a. Laser distance measurement – 1 No. Similar to FLUKE make
- b. Infra-red Thermometer – 1 No. Similar to FLUKE-561 make
- c. Multi-meter cum megger – 2 Nos.
- d. Safety and Protection Equipment
Suitable safety equipment and measures, including interlocks between various equipment, access doors and line equipment shall be provided to ensure.



- (i) Safety of men and
- (ii) Stability of the OHE Car while in operation.
- (iii) The interlocking and safety aspects designed to ensure the above aspects will be finalized at the time of the design approval stage.
- (iv) Helmet: Qty. 20 Nos.,
- (v) Safety jacket: Qty. 20 Nos
- (vi) An audio-Visual alarm system to warn the working staff about the approaching train.
- (vii) Protection screen: Portable, standard and proven design screen to be installed at work site to prevent inadvertent movement of the personal towards the train running track. It should be able to protect 10 meter working lengths.
- (viii) Safety Shoe: Qty. 10 pairs
- (ix) Safety gloves: Qty.10 pairs
- (x) First Aid Box: Standard first aid box designed to care of the likely injury to the personal including stretcher.
- (xi) Rescue trolley for movement of rolling stock with damaged bogie
- (xii) 2 Nos. fire extinguisher.

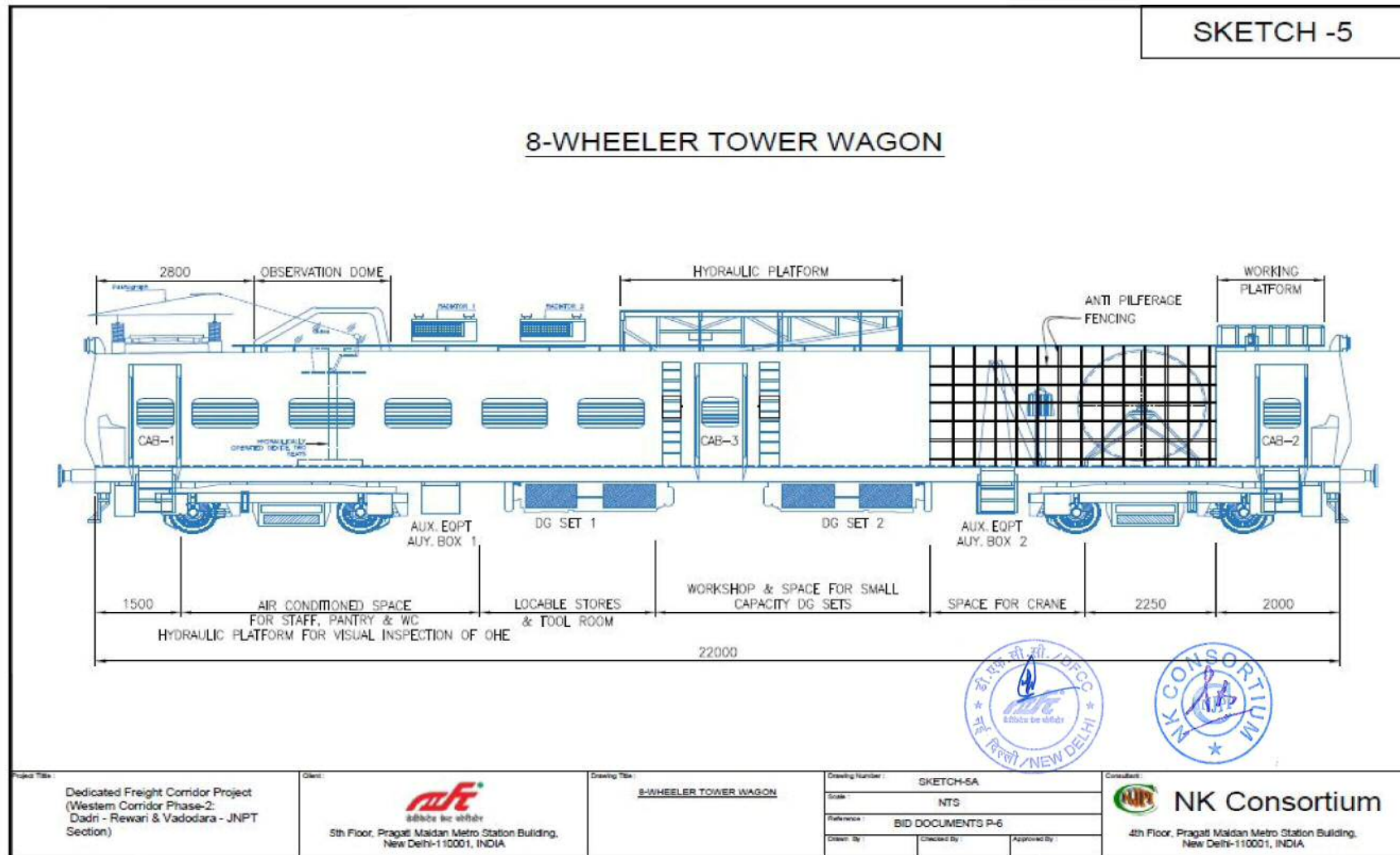
9 Stores of non-ferrous and small size ferrous item along with Tool room

- a. An ergonomically designed storage space for maintenance material shall be provided. The maintenance material which is of non-ferrous and other ferrous but small size shall be provided in this area. A space is earmarked in the sketch.no. 5.
- b. Storage space for all the tools, safety items as described above in an ergonomically designed pigeon holes with identifying marks
- c. The storage space shall be lockable from outside.
- d. Provision shall be made to carry 2 high rise OHE masts of 12 m lengths. It can be taken out from the vehicle through a suitable opening provided at the front and rollers for smooth movement.

10 Staff Facility

- a. The Driving cabs and Staff room as shown in the sketch no. 5 shall be air conditioned.
- b. One number Small Pantry with facility for preparation of tea and reheating precooked food.
- c. One Western Style Bio-toilet with wash basin
- d. Sitting accommodation for 10 staff and two numbers sleeper foldable berths.
- e. Inspection dome shall be provided in the space earmarked for staff facilities





Section 9.4.3 Bridge Inspection Vehicles

This specification shall be read in continuation of the specification covered under section 9.4

1. The bridge inspection vehicle is meant for the inspection of different types of bridges provided on the WDFC network. Sketch 6 is attached for the purpose of guidance only and the Contractor shall have his design approved during design approval stage to meet the requirement of different type of bridges. The Bridge Inspection Platform can either be accommodated in the middle or at one of the end of the Vehicle with driving cabs (air conditioned) to drive at maximum permissible speed of 100 kmph in both directions.
2. The Bridge Inspection Platform manufacturer chosen by the Contractor shall have supply experience of minimum 5 units of similar capacity during last three years for rail or road bridge inspection purpose. A documentary evidence supported by the Taking Over Certificate shall be furnished during design approval stage.
3. It should be provided with hydraulically operated Bridge inspection platform unit. The articulated booms shall be provided in such a manner so as to provide a versatile range of movement and each part of the bridge structure approachable to the maintenance staff. All movements of the bridge shall be hydraulically controlled. All booms/cables shall have adequate flexural and torsional strength and anti-corrosive treatment as detailed in Employer's Requirement.
- 3.1 The hydraulically operated lift provided for the working of staff to approach different parts of the bridge shall always be at horizontal level irrespective of boom position.
- 3.2 It should be possible to launch the bridge inspection platform within 4 minutes of its arrival at the bridge site.
4. It Bridge Inspection Vehicle shall minimum be provided with the following:
 - 4.1 Air-Conditioned Staff room for about 10 staff and non-air-conditioned Tool/Material (as per list given at the end) cabin of about 2/3 meters with ergonomically design cubicles.
 - 4.2 A Bridge Inspection Platform shall meet the following dimensional requirements:
 - a. Maximum Horizontal range 12 meters
 - b. Maximum Lowering depth 10 meters
 - c. Platform width 1.4 meters
 - d. Maximum Load on the platform 600 kg
 - e. Maximum load on the telescopic platform 300 kg
 - f. Rotation of platform 180°
 - g. Working height of pneumatic/hydraulic lift 4.7 m
 - h. Maximum lowering depth for pier inspection 30 meters



The dimensions of the working/telescopic platform, hydraulically operated and manual working ladder shall be decided during design approval stage considering any minor dimensional change.

- 4.3 The working platform shall have provision of 110 V socket for operation of hand tools and work lights. It should also be provided with emergency stop button including at ground control.
- 4.4 A provision shall be made in the driving cab to monitor the staff on the working platform through a video camera and a video screen in the driving desk.
- 4.5 The ground and radio remote control operation of the platform with master and slave arrangement shall be designed as per the safety standards applicable for such requirement.
- 4.6 It should be possible to retrace the movement of the platform manually or any other suitable system in place, if the hydraulic systems fails. A suitable hand pump shall be provided accordingly.
- 4.7 A two-way hand free communication system between the operator and the work platform shall be provided.
- 4.8 The unit shall be capable of moving at a creep speed of 0-5 kmph with lowered platform with hydraulic control. The creep movement shall not require the workman to come outside the platform. The operation of creep should be possible from the platform in its fully launched position.
- 4.9 The lowering of the platform shall not infringe with the overhead electric mast located by the side of the railway track.
- 4.10 The equipment shall be controlled through a proven electronic system which monitors and ensure minimum following safety features:
 - a. Overload protection: Warning signal when load reaches 90% of its capacity or over reach and cut off all movement safely till load/movement reaches to designed capacity.
 - b. Stability of the platform, boom, hydraulic lift etc. in all working conditions.
 - c. Safety harness and gear for the workman while working in the platform and pier units shall also be provided if other than what is listed from sl. No. 30 to 34 in the table.
 - d. Any other parameters as applicable to International Standards



Following tools and equipment shall be provided in the Bridge Inspection Vehicle: -

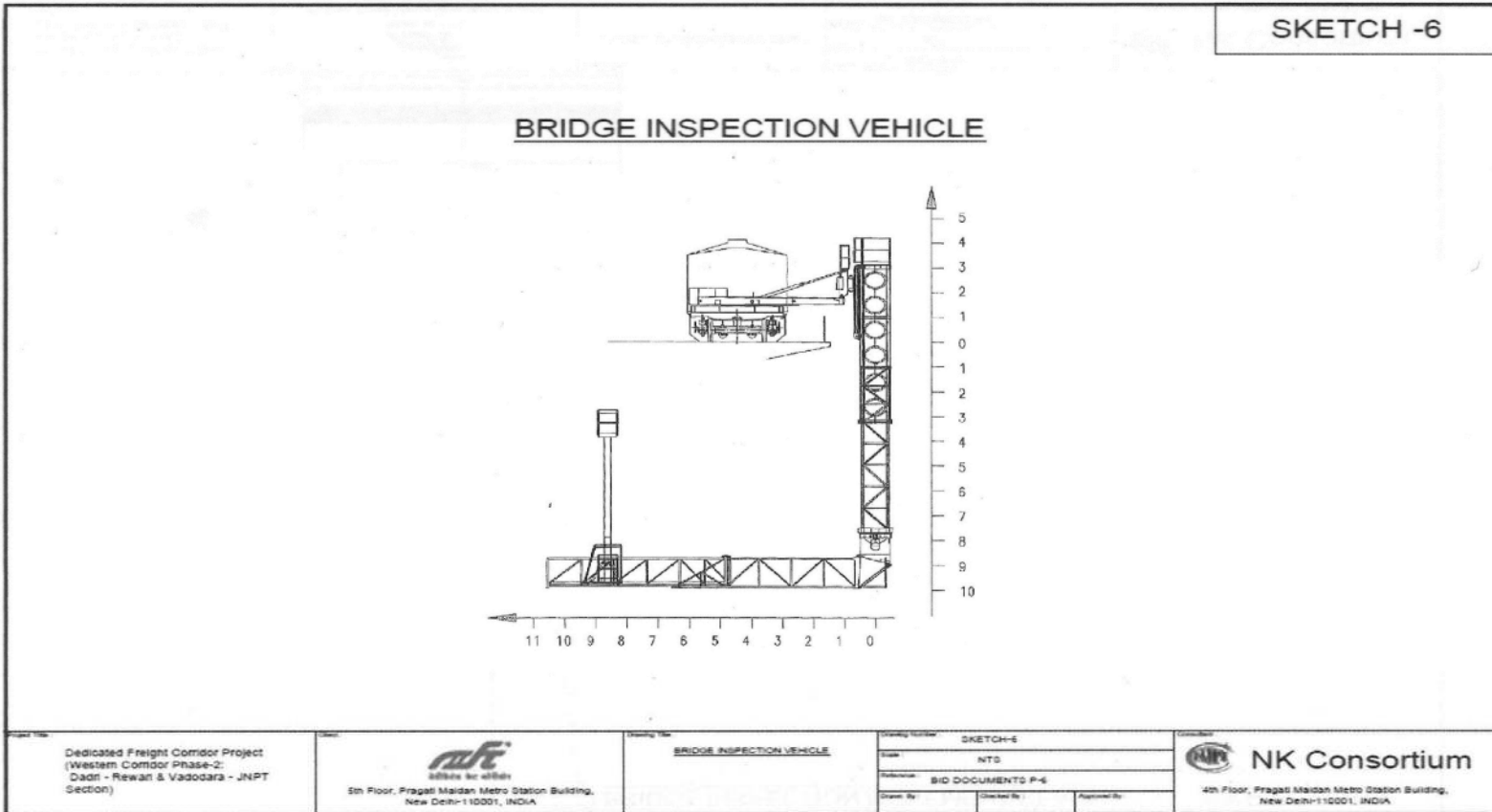
| Sl. No. | Tool/Equipment | Quantity | Purpose |
|---------|-------------------------------------|----------|---|
| 1. | Rivet testing hammer (110g) | 2 Nos | For testing looseness of rivets |
| 2. | Inspection cum chipping hammer | 2 Nos | For checking hollow pocket/honeycomb in masonry and concrete structure including PSC by tapping and for examining the extent of corrosion, adherence of paint on girders, and for removing loose scales |
| 3. | Elcometer (coating thickness gauge) | 2 Nos | For measuring thickness of paint, metalised coating, etc. |
| 4. | Pocket steel tape (3m) | 2 Nos | For measuring gap between girders or between girder and abutment, dimension of steel members, size of cracks, etc. |
| 5. | Straight edge (1m) | 2 Nos | For checking deformation/distortion/buckling of steel components, bulge of masonry structure, etc. |
| 6. | Metallic tape (30m) | 2 Nos | For taking measurements such as clear span, overall length of girders, etc. |
| 7. | Log line with 20 kg. lead ball | 1 No | For measuring scour depth, lifting/lowering of tools and tackles for examination purpose, etc. |
| 8. | Probing rod | 1 No | For checking firmness of ground and scour measurements |
| 9. | Calliper (inside) | 2 Nos | For measuring the thickness of steel sections, dia. of solid/ |
| 10. | Calliper (outside) | 2 Nos | Hollow pipes, dia of rivets/bolts/holes, etc. |
| 11. | Set of feeler gauges (0.1 to 5 mm) | 2 Nos | For measuring the width of fine cracks and cavity between parts or adjacent components |
| 12. | Mirror (10 x 15 cm) | 1 No | For inspecting parts in any awkward location by reflection method and to lit objects in dark location by directing Sun rays to facilitate inspection |
| 13. | Torch light (5 cell) LED | 2 Nos | Used along with mirror for identification of fine cracks in dark location; for safe passage through tunnels and other dark areas, etc. |



| Sl. No. | Tool/Equipment | Quantity | Purpose |
|---------|---|----------|---|
| 14. | Magnifying glass (100 mm dia.) | 2 Nos | For identifying very fine cracks in members/welds which may not be visible with naked eyes |
| 15. | Piano wire with Clamps and 2 Nos. 10 kg. weight | 2 Nos. | For measuring camber in PSC girders, etc. |
| 16. | Plumb bob | 2 Nos | For checking verticality of girder member / pier / abutment / trestles, etc. |
| 17. | Chisel | 2 Nos | For removing unwanted hard deposits like concrete, etc. for inspection / maintenance purposes |
| 18. | Steel scrapper | 2 Nos | For scrapping rust/dirt/paint for inspection, for pretreatment to dye penetration tests of welds, etc. |
| 19. | Infra-red Thermometer | 1 No | For recording temperature at the time of measuring camber, for the purpose of setting of bearings at the desired position |
| 20. | Spirit Level | 2 Nos | For checking gauge and cross level of track on bridges or at bridge approaches, for proper setting of girders on bearings, etc. |
| 21. | Binoculars | 1 No | For inspection of bridge components which are at inaccessible location, tall piers, arches in viaduct, etc. prior to closer examination |
| 22. | Current meter | 1 No | For measuring velocity of water |
| 23. | Echo sounder | 1 No | For measuring depth of water, for assessment of scour |
| 24. | Schmidt's concrete testing hammer | 1 No | For assessing the strength of concrete structure by NDT method |
| 25. | Concrete cover meter | 1 No | For assessing the cover available to reinforcement in existing RCC structures by NDT method |
| 26. | Dial gauge | 1 No | For measurement of deflections in case like load testing of arch/ steel / PSC bridges, etc. |
| 27. | Dye penetration kit | 1 No | For inspection of welded bridges |
| 28. | Magnetic crack detector | 1 No | |
| 29. | Welding gauges | 1 No | |
| 30. | Helmet | 10 Nos | For safety of the inspecting officials |
| 31. | Safety belt | 5 Nos | |
| 33. | Safety Shoes | 5 Pairs | |
| 34. | Safety Jacket | 10 Nos | |
| 32. | Fibre glass boat | 1 No | To facilitate access to bridge structure located in water, etc. |



II



Section 9.5 **Rail-cum-road Maintenance Vehicle**

- 1 This is the General Technical Specification and covers the following P&E: -
 - a. Rail cum Road Multi Utility Vehicle with MMU equipment (Section 9.5.1)
 - b. Rail Cum Road vehicle with crane for civil works (Section 9.5.2)
 - c. Rail Cum Road vehicle with crane for OHE works (Section 9.5.3)
 - d. PSI Equipment Testing Van – Road only (Section 9.5.4)
- 2 All vehicles shall be fit to work on the road as per vehicle manufacturer specification and on rail at a minimum speed of 50 Kmph in both the direction. A rear-view camera shall be provided to assist the operator for safe working in the reverse direction.
- 3 Minimum two brands with model of the vehicle manufacturer on which the Contractor intends to install the rail movement fixture shall be given for the Employer to choose any one during the design stage.
- 4 The Installation of rail movement fixture shall not interfere with the warranty clause of the road vehicle manufacturer. The Contractor shall ensure that the warranty certificate shall be given with indication of this provision.
- 5 Driving cab of the road vehicle shall be air conditioned including the space meant for staff.
- 6 The performance of the vehicle, except speed, on rail shall generally be same as specified by the vehicle manufacturer for the road. In case of difference, the same shall be specified.
- 7 The fuel used shall be High Speed Diesel Oil as per IS manufactured in India and shall comply with the latest environmental emission norms of GOI.
- 8 The movement of the vehicle on rail shall be counted by the axle counter for the purpose of signaling. The Contractor shall check the requirement of wheel profile required and ensure compliance during design approval stage.
- 9 The dimensions of the vehicle shall comply with the minimum moving dimensions of road, rail (IR and DFCCIL) and height gauge provided at the entrance of the level crossing gates of electrified track lines.
- 10 The tools mounted on the vehicle is in the scope of supply of Contractors. The Contractor shall provide a space/enclosure/fixing arrangement for the spares. The list of tools to be supplied and spares to be carried with the vehicle is given in the particular specification.
- 11 Front clearance from the rail shall be as low as possible, but not lower than 110 mm
- 12 Transmission from the road to rail wheel shall be selected as per the suitability of design with minimum possible energy loss, stability and maximum speed of 50 Kmph on rail.



- 13 The Contractor shall select the model which suits the desired function of tare and payload, mounting of equipment, BHP, Torque, engine speed, dimensions, wheel size, gauze etc. as given in the particular specification of each of the above vehicles. It may be noted that the particulars of the vehicle defined in the particular specification are for general guidance with freedom to the Contractor to select the best, but most importantly shall conform to the specific objective given in each particular specification.
- 14 Vehicle shall be equipped with all mandatory tools as per vehicle supplier guidelines and shall include one number spare wheel, fire extinguisher, etc.
- 15 The Contractor shall arrange for the registration of the vehicle with the Regional Transport Office with all dues paid also with the responsibility of the Employer for renewal when applied during the Defect Notification Period and later.
- 16 The Contractor shall submit the layout of the vehicle for rail and road movement with dimensions, Video clip of animation or actual to understand the transfer mechanism from rail to road and vice versa, cab layout, over board space for man, material, equipment etc. The contractor shall also submit the permissible speed limit if any, while negotiating curves of radius 2 degree above. There shall not be any speed restriction for curves 2 degree or less.
- 17 Hydraulic stabilizer shall be provided to ensure the stability during the working of the crane and shall comply with clause 6.0 of Section 9.4
- 18 Annual Maintenance Contract
 - 17.1 The Contractor is not required to undertake the AMC of these equipment. The Employer will enter directly into a contract with the nearest service center of the vehicle manufacturer.
 - 17.2 The Contractor shall arrange for the training of DFCCIL staff for maintenance and operation of additional fixtures provided to make it road cum rail vehicle. DFCCIL will be arranging for the maintenance of such parts at its premises.



Section 9.5.1 Rail cum Road Multi-Utility Vehicles with MMU Equipment

This specification shall be read in continuation of the specifications given in the section 9.5

1. Multi-utility vehicle is a rail-cum-road vehicle to work on road and rail with almost similar performance on Rail with the one specified on Road by the vehicle manufacturer. The vehicle shall be based on selected IMD or SIMD to attend unscheduled or breakdown maintenance.
2. There are four such vehicle under procurement with supply schedule of one number in Section A and three numbers in Section B. Two numbers of such vehicle shall be equipped with Hydraulic rerailing equipment, hydraulic rescue device and firefighting equipment as per the specification given herewith. One number of such vehicle equipped with hydraulic rerailing equipment, hydraulic rescue device and firefighting equipment shall be supplied in Section A and another one in Section B.
3. **Objectives of the Multi-Utility Vehicle**
It shall serve the following maintenance objectives
 - 3.1 There are four numbers of MUV under procurement and will be based at IMD/SIMD. The based IMD/SIMD shall be decided depending on maintenance strategy adopted for WDFC.
 - 3.2 The vehicle is meant for transportation of man and material with the necessary tools to the breakdown/derailment/fire site of its jurisdiction requiring immediate attention to Permanent Way/Rolling stock. A sketch no. 7 giving the layout of MUV is attached. The Bidder shall submit its proposed size and layout of the vehicle with or without hydraulic equipment covered under clause 2 above, with the specified facility during design approval stage.
 - 3.3 A sitting provision for 10 staff in two rows behind the driver's seat on cushioned seat shall be provided.
4. The tools shall be mounted on the rear portion of the vehicle in an ergonomic designed, durable and sturdy (preferably stainless steel) cabin/pigeon holes in the way that it is easily taken out/returned, fully secured, easily identifiable, etc.
 - a. Abrasive Rail Cutter: Qty. 1 No. with two spare abrasive rail cutters; Diesel Driven, Average cutting time less than one minute, cutter dia. within 500 mm, weight not exceeding 20 Kg., without need of cooling oil
Additional Details to be submitted with Bid: No. of cuts per liter of oil and per abrasive tool, Life in terms of number of cuts.
 - b. Rail surface Grinder
 - c. Chamfering Kit: Qty. 1 set; it should be capable of chamfering and work hardening of sharp edges of the periphery of a fish bolt hole.
 - d. Horizontal Rail Bender: Qty. 1 No.; Manual operated hydraulic pump suitable to bend 70 Kg/m rail up to a minimum radius of 10 m.



- e. Rail Straightener: Qty. 1 No.; Manual operated hydraulic pump suitable to bend 70 Kg/m rail
- f. Concrete Sleeper Breaker with grinder: Qty. 1 No.; capable of breaking the damaged sleeper into pieces for quick removal from its position; Petrol/diesel driven equipment imparting vibrational impacts through a drill bit/chisel.
- g. Hydraulic extractor of ERC: Manually operated hydraulic extractor of minimum 10 T of extraction force on ERC, no damage to sleeper during extraction,
- h. Thermit Welding Equipment
- i. Weld Trimmer
- j. Drilling Machine: Qty. 1 No. with two spare drilling bits; Diesel Driven, Average drilling time on rail and weight to be given with the Bid. Drill bit diameter of 40 mm. The machine shall work without any requirement of cooling oil.
- k. Additional Details to be submitted with Bid: No. of holes drill per liter of fuel oil and per drill bit, Fuel Tank capacity, Life of equipment in terms of number of drills.

I. Safety and Protection Equipment

- (i) Helmet: Qty. 10 Nos.,
- (ii) Safety jacket: Qty. 10 Nos
- (iii) Audio-Visual alarm system to warn the working staff about the approaching train.
- (iv) Protection screen: Portable, standard proven design screen to be installed at work site to prevent inadvertent movement of personal towards train running track. It should be able to protect 10 meter working length.
- (v) Safety Shoe: Qty. 5 pairs
- (vi) Safety gloves: Qty.5 pairs
- (vii) First Aid Box: Standard first aid box designed to care of the likely injury to the personal including stretcher.
- (viii) 2 Nos. of fire extinguisher.
- (ix) 2 Nos. fish plate for temporary securing of the USFD cracks along with clamps.

- m. 4 Nos. LED base battery powered lamps for general illumination at work site during night working and Two nos. of Battery operated LED base flood light torch.

5. The Hydraulic re-railing equipment, hydraulic rescue device and firefighting equipment shall be in accordance with the specification as given in Annexure 1, 2 and 3 attached at the end of this Section for equipping on two numbers of such vehicle.

5.1 The following criteria shall be applicable for the Contractor to select the equipment for supply:

(a) The Contractor may propose maximum of two sources for the supply of the equipment towards the specification as stated in Annexure 1, 2 and 3 which are having an experience of minimum supply of 5 such system during the last three years to any of the world Railways.

(b) The Bidder may propose the manufacturer which are already approved by Indian Railways such as:

- i. BEMCO Hydraulics, Belgaum, Karnataka
- ii. HOLMARTO Rescue Equipment, Netherland
- iii. LUKAS Hydraulic, Germany



The Employer shall examine the proposed sources and the Contractor may choose any of the manufacture which qualifies and acceptance of the Employer advised during design approval stage.

6. General specification of the vehicle
 - a. Average Mileage on Highway : To submit
 - b. Fuel : Diesel
 - c. Gear Shifting : Manual
 - d. Engine Displacement : (3500cc-4000cc) To submit
 - e. BHP and Torque : 120-140 HP @ 2400 rpm; 400-500Nm @ : 1300-1500 rpm.
 - f. Fuel Tank Capacity : More than 150 liters
 - g. Gross Weight : More than 16 t
 - h. Tare Weight : As per road manufacturer specification
 - i. Speed in the reverse Gear on rail : To submit
 - j. All necessary accessories as per the Road vehicle manufacturer
- 6.1 The rail wheel-axle assembly shall be hydrostatically driven and operated for lowering the vehicle on the rail. The Contractor shall submit the details of the assembly, new and condemned wheel diameter, axle, bearing etc.
- 6.2 Two of the vehicle which are equipped with hydraulic rerailing, rescue device and firefighting equipment shall require more space and the Contractor shall design the vehicle for BHP/Torque/Size etc. as per the requirement so as to ensure provisioning of user friendly layout of all related equipment. The specification of the hydraulic rerailing, rescue device and firefighting equipment is detailed in the specification given at annexure 1 to this specification.



Annexure – 1

Hydraulic Rerailing equipment

1. SCOPE OF SUPPLY

1.1. The scope of supply shall include design, manufacturing supply, and installation, testing, commissioning and proving of equipment. It includes all the concomitant accessories/ equipment as detailed in the specification and other concomitant accessories/ equipment, which the manufacturer considers essential to make the equipment fully operational, when installed and commissioned. It shall also include installation and commissioning of related equipment, training of personnel in operation and maintenance of equipment and supply of technical documentation.

1.2. One set of re-railing equipment shall consist of the following items.

| S. NO. | ITEM DESCRIPTION | QTY. |
|---------------|--|------------------|
| 1. | Pump set with petrol engine (refer clause 1.2.2) | 1 No. |
| 2. | Portable control table (refer clause 1.2.3) | 1 no. |
| 3. | Portable Hand pump (refer clause 1.2.4) | 1 No. |
| 4. | High pressure hose (as defined in clause 1.2.5) | 1 set |
| 5. | Rerailing bridges (refer clause 1.2.6) | |
| 5.1 | 4.4 mtr. length | 1 no. |
| 5.2 | 3.3 mtr. length | 1 no. |
| 5.3 | 2.2 mtr. length | 1 no. |
| 5.4 | 1.1 mtr. length | 1 no. |
| 5.5 | Bridge coupling for joining two re-railing bridges | 1 set |
| 6. | Roller carriage (refer clause 1.2.7) | |
| 6.1 | Roller carriage with integrated stainless steel Top plate and sliding plate | 2 nos |
| 6.2 | Traversing jack with integrated anchoring Cylinder (with duo traversing) | 1 no + 1 spare |
| 6.3 | Distance bar | 1 pair (2 nos.) |
| | Or Alternatively | |
| 6.1 | Roller carriage with removable top plate | 2 nos. |
| 6.2 | Displacing jack along with other accessories set | 2 sets + 1 spare |
| 6.3 | Counter support (Single and Twin) | 1 set + 1 spare |
| 6.4 | Distance bar | 1 no. |
| 6.5 | Any other accessories required in the system | 1 set |
| 7.0 | Lifting belt and step jack with accessories (Refer Clause 1.2.8) | |
| 7.1 | Lifting belt | 2 nos. |
| 7.2 | Step jack with claw | 3 nos. |
| 7.3 | Complete set of accessories to be used with step jack and lifting belt | 3 sets |
| 8. | Telescopic jacks (refer clause 1.2.9) | |
| 8.1 | Telescopic jack 600/300 KN. | 4 nos. |



| | | |
|-----|-----------------------------|--------------------------------------|
| 8.2 | Telescopic jack 600/300 KN | closed height 400mm ± 50mm 2 nos. |
| 8.3 | Telescopic jack 600/1200 KN | closed height 225 ± 25mm 4 nos. |
| 8.4 | Telescopic jack 600/1200 KN | closed height 400 ± 50mm 2 nos. |
| 8.5 | Multistage jack 750/800 KN | closed height 225 ± 25mm 2 nos. |

Note: if jack offered against 8.4 can be used as multi stage jack the requirement shall be for only 2 support sets suitable for using with jacks as at 8.4. In that case multistage jack at 8.5 with support sets may be mentioned as optional.

| | | |
|------|--|--------|
| 9. | Pulling Equipment (refer clause 1.2.10) | |
| 9.1 | Pulling jack | 1 no. |
| 9.2 | Holding rope | 1 no. |
| 9.3 | Pulling rope | 1 no. |
| 9.4 | Rail attachments suitable for track gauge (BG) 1676 MM | |
| 10. | Hydraulic tilting jack (refer clause 1.2.11) | |
| 10.1 | Tilting jack 200 to 250 KN | 1 no. |
| | Closed height 550 to 600 mm | |
| 11. | Distributor valve (Refer clause 1.2.12) | 1 no. |
| 12. | Axle pusher | 1 no. |
| 13. | Hose connector | 6 nos. |
| 14. | Tool box | 1 no. |
| 15. | First fill of Hydraulic oil, Lubricating oil & Fuel oil. | |

The above items will comprise one set of equipment.

- 1.3. Any other accessory/ equipment, which the manufacturer considers essential to make the equipment fully operational, when installed and commissioned and proved out.
- 1.4. A portable 6KW Generator for driving the emergency hydraulic pump and also suitable for electric supply. The details of the offered equipment shall be indicated.



2. BASIC DESIGN FEATURES:

2.1. Safety features:

Adequate safety devices to prevent bursting /failure of equipment in service must be provided. Full details of all the safety features provided should be furnished.

2.2. Specific Characteristic

- 2.2.1. The equipment should be capable of erection, re-railing and clearance of any rolling stock i.e. diesel or electric locomotives, passenger coaches, goods wagons including tank wagons and all other type of rolling stock of all gauges (BG/MG/NG)
- 2.2.2. The equipment should be suitable for working up to an ambient temperature of 55- degree C and 100% relative humidity.
- 2.2.3. The equipment should be tropicalized for use under Indian operating conditions. Under high humidity and high temperature conditions the material used for

manufacture of the equipment should not get corroded/rusted or develop fungus.

- 2.2.4.** The equipment should be of robust design and able to withstand manual handling while moving it from place to place on rough terrain. The equipment should not suffer any damage after being dropped from a height of not exceeding 2 meters.
- 2.2.5.** The petrol engine powered re-railing equipment shall be of a modern design, extremely reliable and robust, meant to be used at the site of accident and it is required to be light weight and portable. The equipment should be such that it can be transferred by minimum of manual labour.
- 2.2.6.** The equipment shall readily admit dismantling for repairs and adjustments and have features incorporated to protect the drive and control instrument to the maximum extent possible from heavy rain and dust prevalent in the area of operation.
- 2.2.7.** Adequate safety devices to prevent bursting /failure of equipment in service must be provided. Full details of all the safety features provided should be furnished in the offer.
- 2.2.8.** A sketch of each of the item indicating major dimensions and technical details shall be submitted.
- 2.3. Portable power operated hydraulic pump & petrol engine:**
- 2.3.1.** The hydraulic pump shall be of portable, double stage, radial or axial piston type capable of generating at least 300 bar pressure with suitable output to meet the maximum requirement of the jacks at a time. The pump should be tested at 30% higher pressure at the manufacturer's work. For speed of work, it shall be provided with a pressure by-pass valve and other safety valves as required to ensure safe working. Pump should preferably be inside the oil sump. In case, pump is not placed inside the sump it should be suitably protected from dust and damage from external hit by stone/ballast etc.
- 2.3.2.** The pump should be fitted with light weight petrol driven engine which should develop sufficient power required for driving the hydraulic pump to develop the working pressure & oil output as required as per design of the equipment. The engine should have an automatic speed regulation device.
- 2.3.3.** The petrol engine selected shall be proven and reliable in service in tropical countries. Light weight, robust construction and low maintenance costs are of particular importance.
- 2.3.4.** Total dry weight of the engine and pump assembly when mounted together on a skid should not be more than 60 Kg with a minimum hydraulic oil sump capacity of 40 liters.
- 2.3.5.** The fuel tank capacity of the engine should be sufficient for at least 2 hours of working in one fill.
- 2.3.6.** Operation of all the re-railing devices should be possible from the same pump unit through a multi-position valve. Details of the arrangement provided should be explained in the offer.
- 2.3.7.** Hydraulic circuit diagram of the equipment prepared in accordance with ISO R1219 shall be incorporated in the offer.



- 2.3.8. It shall also be mentioned that how cooling of the hydraulic oil pump is achieved.
- 2.3.9. The hydraulic system shall have automatic overload relief valve to overcome excessive pressure due to surges etc. In case of rupture of high pressure hoses and/or hydraulic pump failure, the equipment shall be provided with suitable locking arrangement.
- 2.3.10. It should be ensured that indigenously available hydraulic oil can be used.
- 2.3.11. To provide adequate quantity of hydraulic, lubricating and fuel oil as first fill during commissioning as well as “one time” after prove out. The quantity offered with brand name etc. shall also be indicated.

2.4. Portable Control Table

- 2.4.1. Portable one-piece control table should be provided. The control table should accommodate FOUR control valves (hand lever) for simultaneous/independent operation of lowering and lifting of FOUR jacks. The table should be suitable for lifting and lowering of four jacks including traversing / displacing and should be provided with pressure gauge, safety valve/s wherever necessary.
- 2.4.2. Control levers shall be of sufficient length to ensure extremely sensitive control of each lifting movement. A dead man’s control shall be available on the control block to ensure that each control valve goes to neutral position as soon as the same is released by the operator.
- 2.4.3. Suitable filter shall be employed in the control panel to protect all components from dirt.

2.5. Portable Hand Pump

- 2.5.1. The hydraulic hand pump shall be of two stage, portable type suitable for two connections for operation of two jacks with an oil container. The weight of hand pump with oil should be as low as possible to facilitate handling and should be indicated.
- 2.5.2. The hydraulic oil capacity of the hand pump shall be sufficient to operate two jacks at maximum capacity and stroke.
- 2.5.3. The hand pump is essentially required for operating two units at inaccessible and difficult location as such small size and low weight pump would be preferred.

2.6. High Pressure Hoses

- 2.6.1. High pressure hose pipes are to be fitted with suitable couplings and oil-retaining valves at both ends for easy connection and disconnection by hand without any loss of oil. The hose pipe should be capable of withstanding a test pressure equivalent to double the operating pressure. The high-pressure hoses should be wire braid reinforced hydraulic type. The hoses will be provided with dust caps.
- 2.6.2. The coupling points of hoses on the power operated hydraulic pump, the hand pump and all the re-railing devices shall be clearly marked and colour coded, for pressure and return lines.
- 2.6.3. The coupling should have safety valve which will be actuated if there is any sudden change of pressure in the system say due to bursting of hose so that jack under operation does not retract suddenly to avoid any damage. High pressure hoses should conform to DIN–EN853and SAE 100 R2 and of 10 M length each type (inclusive of couplings). The hoses will have to be tested at double the

operating pressure. The burst test shall be at double the test pressure. The hoses will be tested for impulse test also.

2.6.4. The coupling details should be explained in the offer.

2.6.5. A catalogue of hose manufacturer should accompany the offer which should indicate the relevant details of the hoses to be used. The minimum burst pressure of the hoses shall be at least four times the maximum operating pressure as required by SAE J517.

- (a) The number of high pressure hose pipes required to fulfill requirements indicated in (i) through (v) below will constitute a high-pressure hose pipe set.
- (b) Connections from power pack to control table.
- (c) Connections for simultaneous operation of 2 (Two) lifting jacks and 1(One) displacing /traversing jack.
- (d) Connections for operation of 2(Two) additional jacks through distributor valve connected to control table.
- (e) Connections for anchor pin (if required in the system)
- (f) Spare hose pipe as per scale shown in table below:

| S. No. | Description | Hose Pair | Single Hose |
|--------|--|-------------|-------------|
| 1. | If system design requires only use of hose pairs | 1(One pair) | - |
| 2. | If system design requires use of both hose pairs and single hose | 1(One pair) | 1 (One) |

- (g) To furnish the following information giving break-up of total no. of those pairs and single hoses required for each high-pressure hose pipe set (as defined in para 1 above).
 - I. Hose pipe pairs required as per design including spare hose pair ----- Nos.
 - II. Single hoses required as per design including spare single hose ----- Nos.

(h) Also required one complete high-pressure hose pipe set.

The hoses should be capable of coupling together to increase the length of hoses.

2.7. Equipment Required For Horizontal Displacement Of Vehicles

2.7.1. Re-railing bridges should be manufactured out of high quality light metal alloy in hollow body extruded construction designed to ensure culpability of one bridge with another to the following dimensions:

- i) Construction height not exceeding 200 mm
- ii) Width not exceeding 350 mm
- iii)

| Length | Weight | Qty. required (nos). |
|--------|---------|----------------------|
| 4.4 M | 180 kg. | 1 |
| 3.3 M | 135 kg. | 1 |
| 2.2 M | 92 kg. | 1 |
| 1.1 M | 50 Kg. | 1 |

iv) Bridge coupling for joining together two re-railing bridges - 1 set.

2.7.2. The section of the bridges should be so chosen that over a freely supported length of 1.0M capacity should not be less than 500 KN when fully supported the bridges should be able to take a load of not less than 1000 KN.

2.7.3. The load carrying capacity of the re-railing bridges should be tested at 1.25 times the stated capacity.



2.7.4. The weights of different sizes of the bridges are based on the length indicated and Max. height and Max. width. In case bridges offered are of lower height and/or width the weights should be correspondingly reduced.

2.8. Roller Carriage

2.8.1. Roller carriage should permit unhindered running on individual and coupled re-railing bridges during lateral transportation. It should be suitable for a load of 100T, with construction height of up to 115 mm. If Roller Carriage are suitable for use with a removable top plate, the construction height including the top plate should be within 140 mm. The sliding and pivoting top plate should enable to follow one circle which is described by the lifted end of the vehicle during horizontal displacement. The Roller carriage shall be equipped with four lateral guiding pins to assure a linear displacement of the rolling stock during traversing. Also, the system should be able to prevent unrolling of roller carriage during re-railing operation. The control of traversing shall be only from control table, so that during traversing process the rescue workers are outside the danger zone. It would be preferable if the whole traversing process is possible without any manual resetting under elevated load. Arrangement may be provided to couple two carriages through a distance bar with length adjustable from 800mm to 1500 mm.

Requirement would be as under:

- a) Roller carriage with integrated top plate/ sliding plate 2 nos.
- b) Duo traversing jack (Push / Pull capacity: 17T / 9T) 1 no. + 1 spare with integrated anchoring cylinder
- c) Distance bar. 2 nos. (1 pair)
- d) Any other accessory required for the system 1 set

Alternatively -

- a) Roller carriage with removable top plates 2 nos.
- b) Displacing jack (Push /Pull capacity : 12 T/ 6 T) 2 sets + 1 spare
- c) Counter Support (Single and Twin) 1 set + 1 spare
- d) Distance bar 1 no.
- e) Any other accessory required in the system 1 set

2.9. Equipment Required for Over-Turned or Capsized Vehicles

2.9.1. Lifting belt manufactured out of wire rope (galvanised steel) of suitable diameter with complete fittings certified for a lifting/carrying capacity of 35 to 40 tonne, with adequate factor of safety. - 2 nos.

2.9.2. Hydraulic step jack with claw having lifting point of the claw 125 mm above ground level, and length of the claw 150 mm from center line of jack body.

- Construction height : 1100 mm ± 100 mm
- Total stroke : 800 to 850 mm
- Compressive force : 35 to 40 tonne 3 nos.

Note: Jacks with detachable claw are also acceptable.



2.9.3. Complete set of accessories to be used in conjunction with step jack and lifting belt - 3 set

2.10. Hydraulic Jacks

Telescopic Hydraulic jacks as per configurations given below shall be offered.

2.10.1. The jacks shall be produced from a high strength light metal alloy. The cylinder shall be forged to shape from a high-strength aluminum alloy. Special heat treatment shall be employed to ensure complete homogeneous structure & rigidity. The piston shall preferably be made of same alloy or steel and an

extremely hard surface treatment shall be employed to achieve long service life & superior wear resistance.

Material used for pistons and the treatment given to pistons for protection against wear shall be explained in the offer.

- 2.10.2. Overload protection provided shall be indicated in the offer.
- 2.10.3. Hydraulic jacks shall incorporate all safety measures like relief valves, flame proof protection, hydraulic locking against bursting of pipes, protection against slipping of jacks and load from top of jacks etc.
- 2.10.4. Inlet and outlet of jacks should preferably have suitable filters at coupling points to prevent ingress of dust from dirty hose connections.
- 2.10.5. The extended pistons of the lifting jacks should be repressed very quickly back to their initial position with full operating pressure, either by a motor driven suction unit fitted on the pump or by re-pressure system, thus making the jacks immediately ready for a new operation.
- 2.10.6. Each jack should be provided with hydraulically releasable return valve for securing the piston of the lifting jacks against accidental lowering in case of a possible failure/bursting of a hose pipe.
- 2.10.7. Telescopic Jacks

| Approx. Cap. Range | Closed height | Lift | Weight | Qty. |
|--|-------------------|-------------------|--------------|-------|
| Piston 1-550 to 600 KN Piston 2-250 to 300 KN | 400 mm + 50 mm | 450 mm ± 50 mm | Within 40 Kg | 4 nos |
| Piston 1-550 to 600 KN Piston 2-250 to 300 KN | 225 mm + 25 mm | 200 mm + 25 mm | Within 30 Kg | 2 nos |
| Piston 1-1000 to 1200 KN Piston 2-550 to 600 KN | 400 mm + 50 mm | 450 mm ± 50 mm | Within 80 Kg | 4 nos |
| Piston 1-550 to 600 KN Piston 2-500 to 600 KN | 225 mm + 25 mm | 200 mm ± 25 mm | Within 40 Kg | 2 nos |

- 2.10.8. The jack should be with adequate base to provide stability. Both integral and separate base plate design are acceptable. Where the jacks are to be used with a separate base plate the weight and thickness of the base plate should be indicated in the offer. In case of separate base plate indigenous base plate are also acceptable, Manufacturer/Authorised agency will have to stand warranty for indigenous base plate.



- 2.10.9. Multi Stage Jack

| Approx. Cap. Range | Closed height | Lift | Weight | Qty. |
|----------------------|-------------------|-------------------|--------------|------|
| Piston 750 to 800 KN | 225 mm + 25 mm | 200 mm ± 25 mm | Within 50 Kg | 2nos |

The multi-stage jacks are required for lifting loads over a height of 500 mm in steps in conjunction with cylinder supporting rings/frame supports and piston, pressure pieces/piston supports.

- 2.10.10. Also, to recommend quantities of accessories required for their equipment.

2.11. Pulling Equipment

Pulling equipment shall consist of pulling jack of 200 to 250 KN capacity, holding rope, pulling rope, and rail attachment suitable for the track gauge (BG) 1676 MM and should offer rail attachment suitable for 1000 MM (MG) as optional. 1 no.

2.12. Tilting Jack

Tilting jack having capacity 200 to 250 KN, construction height 550 to 600mm, stroke of 400 to 450 mm with hooked wheel stop. Tilting jack with accessories should be suitable for quick re-railing of a single set of wheels of railway goods wagon. 1 no.

2.13. Distributor Valve

The distributor valve is required for connecting one more cylinder to the control desk. The distributor valve should preferably have throttle function to provide simultaneous lifting speed of two cylinders even at unequal load distribution. 1 no.

2.14. Wheel Set Trolley

The wheel set trolley is required for haulage of locomotive/coaches/wagons important parts of travelling gear has failed i.e. to the nearest workshop for repair when one of its wheel gets locked, preventing the movement of vehicle. The trolley shall be suitable for load up to 30 T and capable to run at a speed of minimum 15 Kmph. It shall be possible to assemble and disassemble the wheel set trolley at site and for ease of quick assembly, the parts of trolley shall be colour coded.



Annexure - 2

HYDRAULIC RESCUE DEVICE

1. BASIC DESIGN FEATURES & PURPOSE FOR WHICH REQUIRED AND CAPABILITY

- 1.1. The equipment shall be capable to perform various operations such as spreading and peeling of coach body, opening of closed doors & windows (560 mm height), cutting of window bars, window frame channels, body panel sheet (corten steel sheet/sun mica/plywood), roof sections as well as berth supports etc. and pillars between windows and various body sections efficiently and quickly with ease in all types of coaches used in Indian Railways.
- 1.2. The equipment shall be capable of performing various operations detailed at 1.2 above on various body sections and other assemblies. There are fabricated out of mild steel/corten steel sheets up to 5mm thickness and round bars up to 28mm dia having a tensile strength of up to 55 kg/mm square. The coach body and for other dimensional details of the BG/MG coaches, the following drawings No. COFMOW/IR/HRD/2001 sheet 3 or 3 and 3 of 3 i. e. CSC- 1668 for layout of BG day coach, CSC- 1668 for layout of BG day coach, CSC-1650 for layout of MG day coach may be referred for guidance.
- 1.3. The equipment shall be of robust design and construction and shall be easily portable. It shall be able to withstand manual handling while moving it from one place to another on rough terrain. It should have a very high degree of reliability so that its satisfactory performance during the course of operation at accident site is ensure.
- 1.4. The equipment shall be of light weight construction and ergonomically designed for ease of handling & operation by single man. There shall be provision for firming up the equipment in position for temporary relief of the operator.
- 1.5. The working pressure at maximum capacity shall be approx. 700 bars + 3%. The weight of individual equipment, as specified in Schedule-I may exceed by a maximum of 10%/ There is, however, no limit on the lower side.
- 1.6. The equipment shall be hydraulically operated by portable power pack unit consisting of light weight petrol engine and hydraulic pump. The engine shall be totally protected from dust and designed to withstand frequent starts, stops as demanded. The equipment should not transmit any jerk/vibration to the operator.
- 1.7. The equipment must conform to European Specification EN 13204 (latest/ American specification NFPA 1936 (latest).



2. MAIN CHARACTERISTICS OF EQUIPMENT:

2.1 HYDRAULIC PUMP WITH POWER UNIT

2.1.1 Petrol engine hydraulic pump shall be proven to capable of developing adequate hydraulic pressure and pulsation free flow to operate two rescue devices at a time with provision for connection for two rescue devices for performing rescue operations as stipulated at clause.1.1 and 1.2 above. The working hydraulic pressure should be indicated in the offer.

2.1.2 The petrol engine shall be of light weight construction and preferably available in India. The installed output of the engine shall be compatible with the requirement of the hydraulic pump. Details of the petrol engine provided should be indicated in the offer.

2.1.3 The hydraulic pump should be of positive displacement type capable of developing and maintaining adequate operating pressure and shall provide a pulsation free flow of oil. Details of pump, its type, make, capacity etc. should be clearly explained in the offer. The pump shall, be two stage type for low and high-pressure outputs. The oil sump capacity should be indicated in the offer.

2.1.4 The pump should have a suitable oil filter at the suction end. Filter element should be reusable after periodic clearing. The type, make and other details of the filters as well as the recommended cleaning process and periodicity should be explained in the offer.

2.1.5 Simultaneous operation of two tools connected to the pump at one time should be possible from the same power pack (Hydraulic pump and power unit) without coupling and uncoupling pressure and return lines of equipment. Details of the arrangement provided should be explained in the offer.

2.1.6 The pump along with power pack should be mounted on light portable metal frame having rubber feet. The frame should be provided with suitable handles to enable two persons to carry it easily over undulating / rough terrain.

2.1.7 An independent hose reel with two sets of return and pressure hoses of 20 meters length each and quick coupling shall be provided for ease of handling. It shall be possible to coil and uncoil hoses independently even under working pressure. The hoses shall be of high quality suitable to withstand the high pressure involved in working of the equipment for pressure and return lines. The coupling points and hoses for the power/hand operated hydraulic pump and all the rescue devices shall be clearly marked and color coded for pressure and return lines. Non-interchangeable hydraulic coupling designed for quick connection/disconnecting shall be provided with dust caps. The coupling details should be explained in the offer. The ends of hoses shall be clearly marked and so designed to ensure that tools cannot be misconnected. The hoses shall be capable for coupling together to increase the length.

Coupling/ Tool shall have a safety valve, which will be actuated, to prevent the equipment from being damaged, if there is any sudden change in system pressure; say due to bursting of hoses. The hoses shall be tested for bursting pressure (four times maximum operating pressure) and impulse test. The tenderer shall provide the test certificate along with catalogue of the manufacturer with offer. The total weight of the hoses and reel drum shall be indicated.

2.1.8 The hydraulic oil shall be of non-corrosive type oil of equivalent grade suitable for the equipment should be freely available in India from leading oil companies. The



equipment shall be supplied with the first fill of hydraulic oil. it shall be required to indicate at least three Indian sources for supply of the equivalent suitable hydraulic oil.

2.1.9 Hydraulic circuit shall conform to ISO R1219. The following features, gauges/indicator and safety devices shall be provided in power pack unit.

(i) **Engine:**

- a) Single switch operation.
- b) Easy access for filling of fuel.
- c) Protection cap for spark plug.

(ii) **Hydraulic pump:**

- a) Easy access for filling of hydraulic oil.
- b) Pressure gauge and pressure relief valve.
- c) Hydraulic oil level indicator/gauge.

Drain plug shall be provided at the lowest position of the fuel/hydraulic oil tank. It shall be possible to drain the entire oil/fuel from the tank without disconnecting any pipe or other fittings.

2.2 MANUAL HYDRAULIC PUMP

2.2.1 A light weight hydraulic hand pump mounted on suitable base plate shall be offered as a standby unit for operating the rescue devices at the venue of accident. The pump shall have a 4.5-meter-long hydraulic hose set.

2.2.2 It shall be capable of developing adequate pressure for operating for opening rescue devices up to their full capacity. It shall be possible to operate the pump even when placed in an inclined/vertical position.

2.2.3 The pump shall have two stages operation for low & high pressure. The operating pressure and flow rate shall be indicated in the offer. It shall be possible to convert the hand pump to foot operated. The hand pump handle shall be adjustable in two positions (i) Pumping in horizontal position (sitting down) and (ii) pumping in vertical position (standing up)

2.3 SPREADER

2.3.1 The spreader should be double acting hydraulically operated device of light weight construction made of anti-corrosive high strength metal capable of being lifted, held and operated manually with ease. The details and design features of the hydraulic spreader and its controls, and material used for construction of its major components such as spreader arms. Cylinder and other components should be explained in the offer.

2.3.2 It should be capable of spreading, pulling, squeezing, and peeling and lifting various sections, parts of Indian Railway coaches of various steels as required in rescue operation.

2.3.3 The spreader assembly shall include 0.5-metre-long hydraulic hose complete with coupling, dust caps and protection spring over length of 125 mm minimum from coupling end.

2.3.4 Spreader arms should be light weight robust construction and properly ribbed for strength. Quick locking system for spreading/peeling tips and chain attachment shall be available.

2.3.5 The operating controls, should be conveniently positioned. All the control positions for (a) spreading (opening), (b) stopping and (c) closing, should be clearly marked to



avoid and ambiguity. It should be possible for right handed as well as left handed operator to operate equipment conveniently.

- 2.3.6 The spreader tips shall be made of alloy steel suitably heat treated to spread/open the steel doors, window, side panel, roofs of passenger coaches without the tips getting bent or broken. The material specification of the tips and their hardness should be indicated in the offer and should be well proven for at least five years preferable in India. It should be possible to quickly interchange tips/accessories without the use of hand tools and without loosening connecting parts.
- 2.3.7 The tips of spreader should be suitable serrated to prevent any slip during operation. These should be of easily replaceable type and should have provision for mounting chains for pulling operation.
- 2.3.8 Spreader should have safety features like dead man safety valve and easily operable by Left & Right Handed operator. There should be a gap between two arms of spreader when the tips are fully closed so that operator fingers are not squeezed any time.

2.4 CUTTER

- 2.4.1 The cutter shall be double acting hydraulically operated along with 0.5m long hose complete with coupling, dust caps and protection spring over length of 125 mm Minimum from coupling end. It should be strong, reliable and of light weight construction capable of being lifted, held and operated manually with ease. Details of the cutter and material used for construction of its major components such as cylinder, piston and other components should be explained.
- 2.4.2 The cutter blade should be parrot type and shall be capable of meeting the requirements mentioned in clause 1.1 and 1.2. The cutting blades should be of shock resistant non-corroding alloy steel, hardened and ground and shall be exchangeable and regrind able. The material specification of the cutting blades and hardness shall be indicated in the offer.
- 2.4.3 Cutters should be tested for 50% of operating pressure. The cutter should have dead man control valve and should be operable by Left and Right Handed Operator.

2.5 COMBINATION TOOL

- 2.5.1 The combination tool should be double acting hydraulically operated device of light weight construction made of anti-corrosive high strength material capable of being lifted and operated manually with ease. The details and design features of the combination tool and its controls and material used for construction of its major components such as arms, cylinders and other components should be explained in the offer.
- 2.5.2 The multipurpose combination tool should be capable of spreading, cutting and pulling and shall be capable to meet the requirements mentioned in clauses 1.1 and 1.2.
- 2.5.3 The tool should be supplied with connection hoses of 0.5-meter-long complete with quick connect coupling, dust caps and protection springs over length of 125mm minimum from coupling end.
- 2.5.4 The operating control should be conveniently positioned and it should be possible for right-handed as well as for left handed operator to operate equipment conveniently.
- 2.5.5 The blades should be a shock resistant non-corroding alloy steel hardened and



ground and shall be exchangeable and regrindable. The material specification of blades and hardness should be indicated in the offer.

2.6 LAMINATED GLASS CUTTER WITH HAMMER

The equipment shall be very handy and light weight and shall be able to cut ordinary coach glass and laminated toughened glass of AC coaches. The time required to cut one ordinary coach window glass (size: 540mm x 560mm) and AC coach window glass (size: 122mm x 540mm) shall be indicated. The hammer should be of material so that it is easy to tap and break the glass.

2.7 LIGHT WEIGHT FOLDING TYPE LADDER

Lightweight ladder of all aluminum construction and robust in design suitable for carrying out rescue work at elevated position 5 meter high. The offered ladder shall be of collapsible type and sturdy enough to withstand the load of minimum 150 kg. It will be possible to place the ladder firmly even on rough and uneven surface or on a slippery surface. If required, ladder shoes shall be provided to avoid slippage. The weight of the ladder shall be indicated in the offer and should be as light as possible. In addition to above, a suitable plastic leather/rope leather and safety belt etc., should be provide to work on the bridges etc. The details on this may be furnished in the offer.

2.8 HIGH PRESSURE AIR BAG FOR LIFTING

2.8.1 The air bags shall be used in re-railing/rescue operation where application of conventional hydraulic jacks is not possible due to insufficient gap between the vehicle and ground. The air bags can also be used for extricating passengers trapped inside the coaches. The equipment should be of proven reliability in railway accidents.

2.8.2 Lifting bags shall be lightweight with maximum versatility, safety and reliability. The bags will have a minimum safety factor of four. Cross-sectional view and construction details of air bags will be provided.

2.8.3 It shall be possible to inflate air bag with air bottles and also with a portable compressor. The tenderer shall indicate the volume of air at working pressure and time required to inflate bag to its maximum height. Air filling arrangement shall have safety valve to prevent over filling.

2.8.4 Material of air bag shall be of armide type such that it does not get punctured in spite of rough and rugged use as the accident site is likely to have sharp edges of debris.

2.8.5 Chemical and physical properties of material shall be provided. It shall also be possible to repair the air bags easily and the tenderer shall provide details for the same and also supply the repair kit and material for two years. The tenderer shall also specify the type of repairs, which can be done.

2.8.6 Life expectancy of air bags to be indicated along with support of proof for such claim.

2.8.7 A portable dedicated self-driven air compressor (preferably made in India of sufficient capacity with accessories is required for inflating the air bags should be supplied. The cut-in, cut-out and safety valve operating pressure shall be indicated.

2.8.8 The hoses shall be of minimum 10 meters length and capable of withstanding high pressure. The hose should be fitted with good quality and fittings preferably extra safe quick release connector. Shut off hoses with safety valves & quick release to be provided.



2.8.9 A flexible dual hand controller to be provided for simultaneous lifting of bags. Controller should be inbuilt with flow regulator and pressure gauge for indicating instantaneous pressure in the air bottle/tank.

2.8.10 The maximum insertion height and minimum inflated height will be 25 mm and 460 mm respectively.

2.9 Air Bottle

There should be adequate compressed air available for five times filling of air bags.

2.9.1 Air bottles shall be of light weight and have sufficient capacity of inflate the air bag at working pressure.

2.9.2 The capacity of air bottle with approximate weight and working pressure should be mentioned. The maximum time for which a filled air bottle will last without being used shall also be indicated. Periodicity of its inspection shall also be indicated.

2.9.3 It shall indicate the number of air bottles required for inflating the air bag. The method and accessories required for re-felling the air bottle with quotation shall also be indicated.

2.10 HYDRAULIC LIGHT WEIGHT PUMP WITH POWER UNIT

2.10.1 Petrol engine driven hydraulic pump shall be capable of developing adequate hydraulic pressure and pulsation free flow to operate one rescue device at a time with provision for connection for two rescue devices for performing rescue operations. The working hydraulic pressure should be indicated.

2.10.2 The petrol engine shall be of light weight construction. The installed output of the engine shall be compatible with the requirement of hydraulic pump. Details of the petrol engine provided shall be indicated.

2.10.3 Details of pump, its type, make, capacity etc. should be clearly explained in the offer. The pump shall be two stage type for low and high-pressure outputs. The pump should have a suitable oil filter at the suction end. Connection of two tools connected to the pump at one time should be possible and without coupling and uncoupling pressure and return lines of equipment so that one of the tools can be activated by means of a selector valve. Details of the arrangements provided should be explained.

2.10.4 The firm should be provided with a suitable handle to enable one person to carry it easily over undulating rough terrain.

2.10.5 A hose assemble with return and pressure hose of meter length and self-locking quick coupling shall be provided for ease of handling. The hose shall be of high quality suitable to withstand the high pressure involved in the working of the equipment for the pressure and return lines.

2.10.6 Hydraulic circuit shall be equipped with the following safety and inspection equipment:
-
(a) Checking of hydraulic oil level and fuel level.
(b) Drain plug at the lowest position of the tank. It shall be possible to drain the oil from the tank without disconnecting any pipes or other fittings.



2.10.7 Protection cap for spark plug.

2.10.8 Pump shall also have following features: -

- (a) Single switch operation.
- (b) Easy access for filling of fuel and oil.
- (c) Auto shut off on low oil level.



Annexure - 3

FIRE FIGHTING

1. CAPABILITY

- 1.1 Firefighting equipment required to meet the exigencies of fire occurring at the accident site.
- 1.2 The firefighting Equipment offered should be capable of extinguishing all classes of fire including electrical fires.
- 1.3 The firefighting system offered should be back-pack type. The firefighting shall be portable water mist type firefighting system.
- 1.4 The portable Water Mist Fire Fighting System should work satisfactorily under ambient temperature ranging from 0 deg. To 55 deg. Centigrade with 100% relative humidity and dusty and corrosive atmosphere and Altitude 1200M above mean sea level.

2. DESCRIPTION AND SCOPE OF SUPPLY:

- 2.1 The specification covers the requirement of design, manufacture, testing supply and commissioning of a Portable Water Mist Fire Fighting System along with accessories for firefighting during rescue operation at the time of accident. It shall be light weight portable and occupying less space.

3. CONCOMITANT ACCESSORIES

The following accessories shall form a part of the firefighting equipment.

- a) Portable System Water Mist Compressed Air Back Pack 9 liters capacity (suitable for all fires) with one 4.5 – 5.0 ltr. X 300 bar cylinder – 1 (one) number
- b) High pressure Air compressor portable Petrol Engine driven complete with all Standard accessories for filling 300 bar cylinders. – 1 (one) number
- c) 4.5– 5.0 ltr. X 300 bar spare cylinder (Carbon fibre type) – 4 (four) numbers
- d) Personnel protection gear as per EN 469 (latest) or equivalent for each operating personnel - 2 (two) Sets

The protection gear consists of

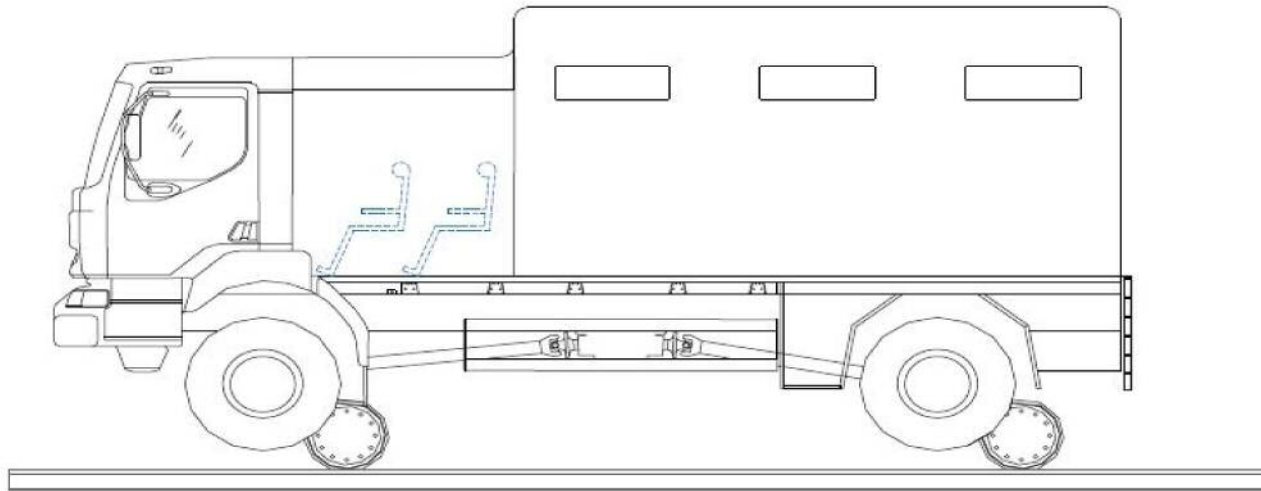
- i. Fire Trousers
ii. Fire Jackets
iii. Firefighting helmets
iv. Fire fighter boots
v. Fire fighter gloves.





- e) Spare water can of 100 litres capacity for refilling - 2 nos.
- f) One can of Aqueous film forming foam (AFFF) 3 litres with 6% concentration (for use against 'B' class fires)

SKETCH -7

RAIL CUM ROAD, MULTI UTILITY VEHICLE WITH MMU EQUIPMENT



| | | | | |
|---|---|--|--|--|
| <p>Project Title: Dedicated Freight Corridor Project (Western Corridor Phase-2: Dadri - Rewari & Vadodara - JNPT Section)</p> | <p>Client:  5th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA.</p> | <p>Drawing Title: <u>RAIL CUM ROAD, MULTI UTILITY VEHICLE WITH MMU EQUIPMENT</u></p> | <p>Drawing Number : SKETCH-7 Scale : NTS Reference : BID DOCUMENTS P-6 Drawn by : _____ Checked by : _____ Approved by : _____</p> | <p>Consultant:  NK Consortium 4th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA.</p> |
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Section 9.5.2 Rail cum road Vehicle with Crane for Civil works

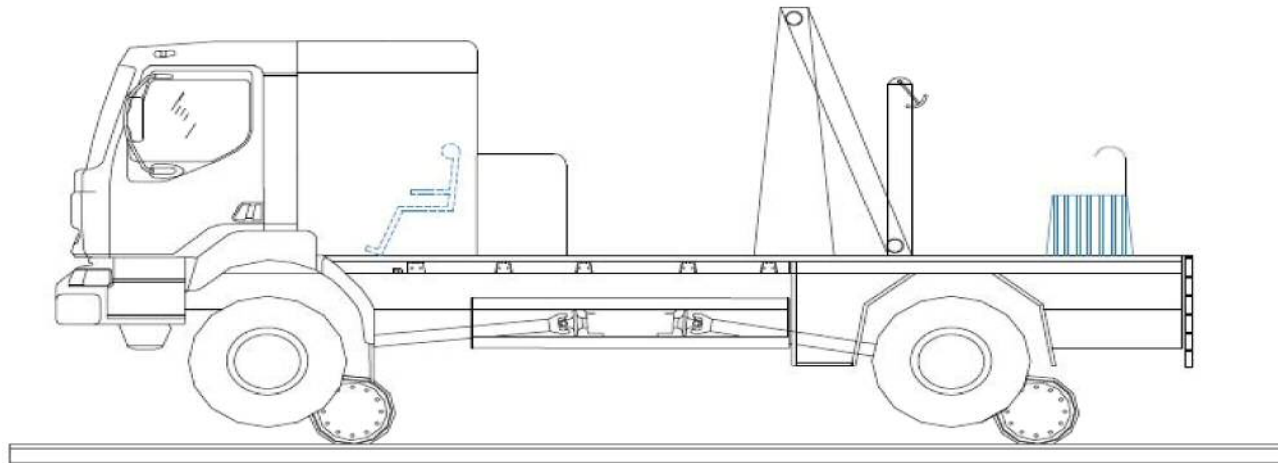
This specification shall be read in continuation of the specification given in Section 9.5



- 1 The vehicle is meant to undertake miscellaneous material handling work in the section for stacking of the released track material, stacking of new material near the track, removing infringements, loading and unloading of material, etc.
- 2 It should work on the rail at 50 Km/h with hydrostatic traction and on the road as per vehicle manufacturer specification.
- 3 It should have a cushioned seating capacity for about 5 persons.
- 4 A knuckle boom (articulated boom) type crane shall be mounted having a capacity such that it can lift 1T material from a distance of 10 meters with capacity of 11 t-m. Full technical details of the crane with mounting arrangement on the vehicle, safety details with diagram of its reach with stability shall be submitted. However, the same shall be finalized during design stage ensuring all safety and operating features.
- 5 The crane shall have provision of necessary tackles for handling the following situations
 - a. Standard hooks for lifting rail, sleepers, CMS crossings etc.
 - b. Cradle for lifting two persons with carrying capacity of 200 Kg for trimming of trees and removing infringements.
- 6 The road vehicle shall conform to the following requirements
 - a. Make and model of the vehicle : To submit
 - b. Average Mileage on Highway : To submit
 - c. Fuel : Diesel
 - d. Lifting Capacity: : 15 t-m
 - e. Fuel Tank Capacity : To submit
 - f. Gross Weight : 16 t
 - g. Tare Weight : As per road manufacturer specification
 - h. Speed in the reverse Gear on rail : To submit
 - i. All necessary accessories as per the Road vehicle manufacturer
 - j. All parameters of BHP, Torque, Average Km/l, overall length of the vehicle, etc. shall be submitted as per the vehicle manufacturer data book.
- 7 Sketch No. 8 showing the layout is attached for the purpose of guidance.



SKETCH -8

RAIL CUM ROAD VEHICLE WITH CRANE FOR CIVIL WORKS



| | | | | |
|---|---|---|---|--|
| <p>Project Title: Dedicated Freight Corridor Project (Western Corridor Phase-2: Dadri - Rewari & Vadodara - JNPT Section)</p> | <p>Client:  5th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> | <p>Drawing Title: <u>RAIL CUM ROAD VEHICLE WITH CRANE FOR CIVIL WORKS</u></p> | <p>Drawing Number: SKETCH-8 Scale: NTS Reference: BID DOCUMENTS P-6 Drawn By: _____ Checked By: _____ Approved By: _____</p> | <p>Consultant:  NK Consortium 4th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> |
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Section 9.5.3 Rail cum road Vehicle with Crane for OHE Works

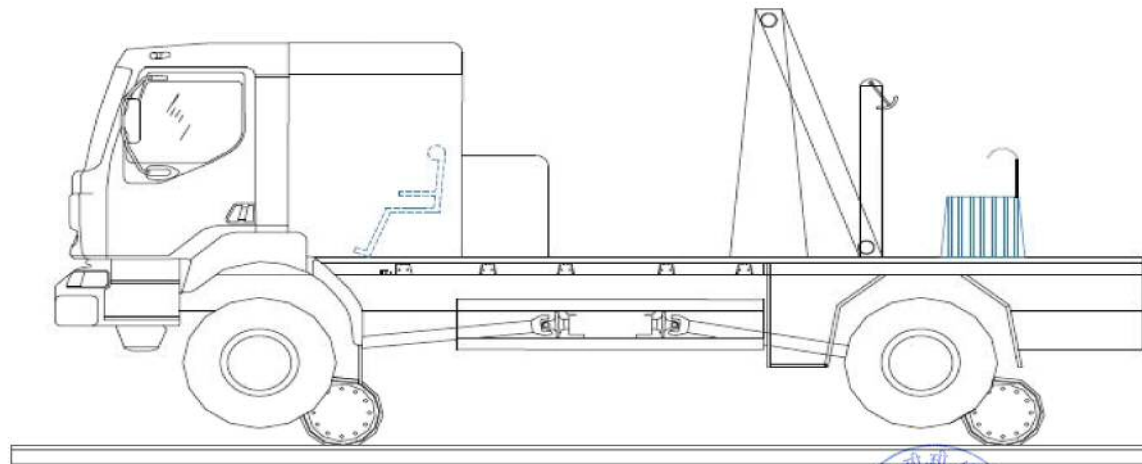
This specification shall be read in continuation of the specification given in Section 9.5



- 1 The vehicle is meant to undertake miscellaneous material handling work in the section and stores for stacking of the released or new OHE material, loading and unloading of material, maintenance work of erection of portal etc.
- 2 It should work on the rail at 50 Kmph with hydrostatic traction and on the road as per vehicle manufacturer specification
- 3 It should have a cushioned seating capacity for about 5 persons.
- 4 A knuckle boom (articulated boom) type crane shall be mounted having a capacity such that it can lift 1T material from a distance of 10 meters with capacity of 11 t-m. Full technical details of the crane with mounting arrangement on the vehicle, safety details with diagram of its reach with stability shall be submitted. However, the same shall be finalized during design stage ensuring all safety and operating features
- 5 The crane shall have provision of necessary tackles for handling the following situations
 - a. Standard hooks for lifting mast, portals, mast erecting etc.
 - b. Cradle for lifting two persons with carrying capacity of 200 Kg. with possible height of reach of 12 meters.
- 6 The road vehicle shall confirm to the following requirement
 - a. Make and model of the vehicle : To submit
 - b. Average Mileage on Highway : To submit
 - c. Fuel : Diesel
 - d. Lifting Capacity: : 15 t-m
 - e. Fuel Tank Capacity : To submit
 - f. Gross Weight : 16 t
 - g. Tare Weight : As per road manufacturer specification
 - h. Speed in the reverse Gear on rail : To submit
 - i. All necessary accessories as per the Road vehicle manufacturer
 - j. All parameters of BHP, Torque, Average Km/l, overall length of the vehicle, etc. shall be submitted as per the vehicle manufacturer data book.
- 7 Sketch No. 9 showing the layout is attached for the purpose of guidance



SKETCH -9

RAIL CUM ROAD VEHICLE WITH CRANE FOR OHE WORKS



| | | | | |
|---|--|--|---|---|
| <p>Project Title: Dedicated Freight Corridor Project (Western Corridor Phase-2: Dadri - Rewari & Vadodara - JNPT Section)</p> | <p>Client:  5th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA.</p> | <p>Drawing Title: RAIL CUM ROAD VEHICLE WITH CRANE FOR OHE WORKS</p> | <p>Drawing Number: SKETCH-9 Scale: NTS Reference: BID DOCUMENTS P-6 Drawn By: _____ Checked By: _____ Approved By: _____</p> | <p>Consultant:  NK Consortium 4th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA.</p> |
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Section 9.5.4 PSI Equipment Testing Van (Road only)

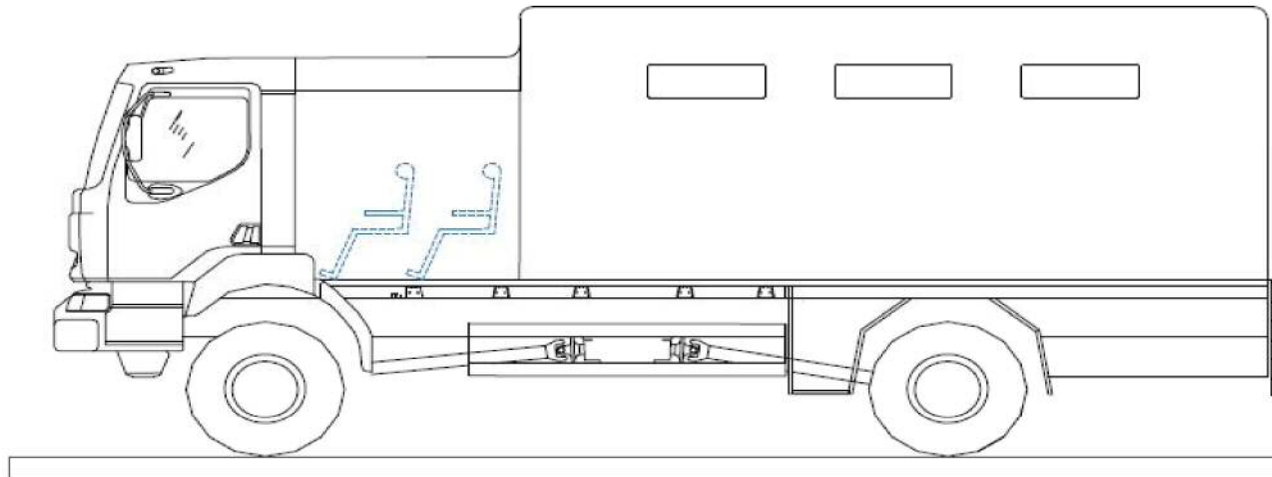
- 1 The specification covers the procurement of standard road vehicle chassis from the established manufacturer in India, design and fabrication of cabins and facility for provision of testing facility of Power Supply Installation (PSI) at Traction Sub-station/SP/SSP etc. of DFC/IR network. A layout is given at sketch no. 11 for the purpose of guidance.
- 2 One set of each of the equipment will be installed on this testing van. This van will move along with staff to the fixed traction installations such as TSS, SP, and SSP etc. and attend for condition monitoring, schedule and unscheduled maintenance.
- 3 The cabins and cubicle for mounting and fixing the equipment shall be sturdy, robust, durable of reputed brand from India with design features to hold it without any possibility of damage during movement.
- 4 The minimum size of the van including driving console shall be around 10 meters.
- 5 It will be the responsibility of the Contractor to arrange and include registration, insurance of the van.
- 6 One separate row of seating arrangement for minimum of 4 staff shall be provided.
- 7 List of tools and equipment to be installed in each of the van are given below. Each of the measuring and testing equipment shall be of reputed brand and rating suitable for the testing of the equipment installed at PSI installation of WDFC.
 - a. Cable Fault Locator (proven brand)-one number
 - b. AC power analyzer (proven brand)-one number
 - c. Earth Leakage Detector (proven brand)-two numbers
 - d. Earth Megger (proven brand)-two numbers
 - e. Manual Megger 1000 V (proven brand)-two numbers
 - f. Motorized Megger, mains/battery pack operated for selectable voltage range up to 5kV, IR measurement range of 100 K-ohms to 500 M-ohms and weight not exceeding 10 Kg with maximum limit of error for measurement of $\pm 5\%$.
 - g. Primary injection test kit (proven brand)-one number
 - h. Secondary injection test kit (proven brand)-one number
 - i. Relay testing kit (proven brand)-one number
 - j. Industrial Multimeter with clamp and Infra-red remote Thermometer (similar to FLIR CM 78 Industrial Clamp with IR thermometer)-one number
 - k. Dielectric test kit (proven brand)-one number
 - l. Thermal imaging camera (FLIR C2 pocket sized thermal camera or similar)-one number
 - m. Video Camera (Sony Handy-cam FDR-AX40 Digital 4K Video Camera Recorder or similar)-one number
 - n. Dissolved Gas Analyzer set (with proven record of supply to Indian Railways)
 - o. Multipurpose tool kit (proven brand)-one number



The Bidder shall be submitting the product as per prevailing International Standards and proven make and brand. The manufacturers certificate with warranty card for each of the item shall be furnished at the time of delivery of the equipment.



SKETCH -11

PSI EQUIPMENT TESTING VAN (ROAD ONLY)



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| <p>Project Title: Dedicated Freight Corridor Project (Western Corridor Phase-2: Dadri - Rewari & Vadodara - JNPT Section)</p> | <p>Client:  5th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> | <p>Drawing Title: PSI EQUIPMENT TESTING VAN (ROAD ONLY)</p> | <p>Drawing Number: SKETCH -11 Scale: NTS Reference: BID DOCUMENTS P-6 Drawn By: _____ Checked By: _____ Approved By: _____</p> | <p>Consultant:  NK Consortium 4th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> |
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Section 9.6

Rail cum Road based vehicle with motorized elevated working platform (MEWP)

The total quantity under procurement is 26 (twenty-six). There are two different designs identified for specific application of handling situations at IMD and SIMD. The two designs are given below at A and B called MEWP Scheme 1 and 2. The Contractor shall supply 13 nos. of MEWP Scheme 1 and 13 Nos. of Scheme 2. The supply schedule is accordingly in even numbers so that one of each design is supplied in every schedule of supply.

A. MEWP

Scheme 1(Sketch no. 12A-1 and 12A-2)

- 1 This is a rail-cum-road vehicle, self-driven, mounted with hydraulic platform and crane to carry out OHE inspection and repair of defects. The vehicle shall comply with standards of Road vehicle in India as well as SOD and MMD of IR/ DFCCIL as detailed in Vol III.
- 2 The vehicle shall be provided with a driving cab, hydraulic platform, crane with cradle, small workshop with few staff to sit and an instrumented pantograph.
- 3 The vehicle shall be all wheel drive systems, manual control of the gear box for forward and reverse motion. It should be fitted with a suitable gear arrangement to drive on bad and bumpy road conditions.
- 4 The make of the road vehicle shall preferably be any one of MAN, Renault, or Volvo and all-wheel drive.
- 5 The frame shall be made of two parallel girders with reinforced steel transverse beams. It should be designed to bear all static and dynamic loads for working in the most arduous duty cycle. The Contractor shall submit the Finite Element Analysis of the frame at design stage.
- 6 The engine shall be diesel driven using HSD oil IS specification and readily available in India and complying with the latest norms of pollution set by Government of India. The capacity of the diesel engine shall be calculated to meet the requirement as specified in this specification. The Bidder shall submit the calculation of the maximum power at different rpm, cooling arrangement etc.
- 7 The rail device for travel on rail shall be designed with a wheel diameter to provide full stability during travel on rail. It should be possible to put the vehicle on road to rail and vice versa within 5 minutes.
- 8 The axle counter provided on the network shall be able to detect the movement for track occupation.
- 9 Electrically or other controlled hydrostatic transmission system shall allow for continuous speed variation in forward and reverse directions. The hydrostatic system while working on rail shall provide for two ranges of speed, i.e. 30 Kmph (minimum and the bidder may offer higher speed) in forward/reverse and low creep speed from 0-5 Kmph. It should be possible to control the creep speed either from the cab or control transfer to the elevated platform or cradle of the crane ensuring relevant safety norms.

- 10 The vehicle shall be provided with the proven braking system acting on all wheels and an emergency push button for activation from the cab while travelling on the rail.
- 11 The driving cab shall be suitable for sitting of 3-4 persons including the driver and provided with wide angle look out glass for a clear view of the track and OHE from three sides. The cab shall be provided with air conditioning, but the staff travelling shall be able to hear any unusual sound from the track.
- 12 The vehicle shall be fitted with elevating, rotary, hydraulically operated platform of maximum height to attend high rise OHE contact wire, suitable for 4 persons to work together, access ladder, foldable sideboards of 1.1 meters high, swiveling up to 2700 with safety device to select rotation either right or left with locking arrangement on the selected direction. It should also be provided with an emergency hydraulic hand pump to allow retracing the platform to the base in case of hydraulic breakdown.
- 13 The vehicle shall be provided with a crane and cradle which can be used for lifting man for attending high rise OHE items particularly feeder wire.
Lifting with Cradle: Horizontal reach: 9 meters, capacity 200 Kg, vertical reach 12 meters.
- 14 The crane shall be fitted with a moment limiting device and hydraulic stabilizer. A safety device shall be provided to select the rotation in right or left so as not to infringe the adjacent occupied track. A control box shall be fitted on the crane to allow controlling the crane from cradle, in case of necessity. An emergency hydraulic hand pump shall be provided to retrace the crane to the base during hydraulic breakdown.
- 15 The vehicle shall be fitted with high rise, equipotential pantograph allowing working on non-live OHE. The pantograph shall lift to the OHE contact wire height and touching with a pressure of 7 kg/cm² and follow the stagger. The panto pan shall be fitted with a scale to view the stagger. Similarly, measuring device shall be provided for measurement of contact wire height manually. One number HD camera shall be provided to focus the point of contact and arrangement for viewing in the cab with recording for 10 hours.
- 16 The vehicle shall be fitted with a small workshop of useful area of about 5 sq. meter for material, tools and staff, to carry out light repairs and view the panto and contact wire interaction. The workshop shall have following facilities:

4 cushioned seats, welded steel structure with approved painting scheme, good interiors, non-slip flooring, sliding door for access, one window suitably designed to view the OHE and pantograph interaction, sun-visors, small workbench, suitably designed space for material and tools etc.
- 17 The vehicle shall have the capability to work at a
 - a. Maximum speed on Road: 80 Km/h
 - b. Maximum speed on Rail: 30 Km/h (with possibility of design options to have higher speed on rail to be explored during design review)
 - c. Maximum gradient on Road to maneuver bumpy terrain, pits with capability to climb the track formation when required
 - d. Creep Speed: 0-5 Km/h

- e. Speed in reverse direction: 30 Kmph with reverse view camera

- 18** It should be fitted with facility of keeping tools. The list of tools to be decided at the design approval stage depending upon the availability of space and requirement for handling maintenance works of 2x25 kV OHE system. The following safety tools
- a. Two numbers Fire Extinguisher
 - b. 4 sets of safety jacket, shoes and helmets
 - c. 4 nos. portable flood light with a mounting arrangement on the hydraulic platform and cradle.
 - d. All accessories as part of road vehicle supply such as extra road wheel, tools etc.
 - e. Hydraulic jack for lifting road vehicle in case of emergency
 - f. Mobile charging facility and power supply point for operation of laptop
 - g. Essential tools for hydraulic platform and crane

B. Rail cum Road based vehicle with motorized elevated working platform (MEWP) Scheme 2 (Sketch 12B-1 and 12B-2)

- 1** It is a rail road vehicle self-contained, self-propelled and having capability to maneuver bumpy terrain. Smooth ride over ballasted track without disturbing ballast profile and align on the track at the desired location in minimum possible time. The special features of the MEWP are detailed as follows:

- 1.1 This is a rail-cum-road vehicle self-driven to attend OHE defect.
- 1.2 The MEWP shall maneuver the bumpy field, ballast slope of 1:2 with fixtures to prevent damage to ballast profile and climb onto rail and off from rail within 5 minutes.
- 1.3 It should have a lifting platform to attend OHE and a lifting cradle to attend equipment of feeder wire up to 12-meter height. It should be possible to operate both the items i.e. crane-cradle and platform simultaneously. There shall be a provision to operate both the items through a remote control with the staff from the ground, platform or cradle and suitable in-built interlock for the purpose of safety.
- 1.4 The vehicle shall have a cabin for transportation of four staff on the MEWP and operation of the vehicle on rail and road and also possible for operation by remote control from ground. The working cabin, crane and cradle shall be self-balancing, while working on curvature to compensate against the cant.
- 1.5 The vehicle shall be a rail-cum-road vehicle with minimum speed of 20 Kmph on rail (with provision to explore the possibility of raising the speed up to 30 Kmph during design stage) and creep speed for working between 1-5 Kmph. Higher speed on rail will permit the movement of the MEWP to attend nearby location quickly. The Bidder shall submit the proposed speed on tires.
- 1.6 It should have suitable fixture for movement of the vehicle over ballasted embankment at a slope of 1:2 without any damage to ballast profile and also the track without undue stress on rail or its fittings.



- 1.7 It should have one hydraulically operated working platform and another crane/cradle. The operating reach of the hydraulic platform shall be as per the OHE parameters given in VOL III and that of a crane with cradle to attend the OHE equipment at the maximum height of the super mast/feeder wire.

Platform LxBxH 2000x1000x500 (appx.)Lifting height of contact wire with two persons working.

Cradle LxBxH1500x1000x1000(appx) Lifting Height to attend feeder wire with one person working and carrying material (Total Weight 150 Kg)

Remote operation of the MEWP, its platform and crane with cradle shall be possible with individual control and separate unit.

- 1.8 The Bidder shall submit the relevant International Standards concerning the safety features for the staff working on MEWP to which it has been manufactured giving the details of its functioning on the integration of radio remote control, manual control, limitation of movement if any etc.
- 1.9 Sketch 12B-1 and 12B-2 provides understanding of the Employer's requirement and is only indicative. The Bidder may submit design to meet the overall requirement.
- 2 One number of earthing pantograph ensuring safety in operation to check the stagger and height manually after the repair works are completed
- 3 The Bidder shall submit the complete layout, dimensions, operating procedure, capability, power of engine, calculation to support the capability and stability while movement and work during design approval stage, etc. with video clip for user friendly understanding.
- 4 The Contractor shall ensure provisions of all safety measures relating to electrical, movements, personal during travelling and working on the MEWP and shall furnish all details during design approval stage.
- 5 It should be fitted with necessary tools and accessories to facilitate safe and easy working.

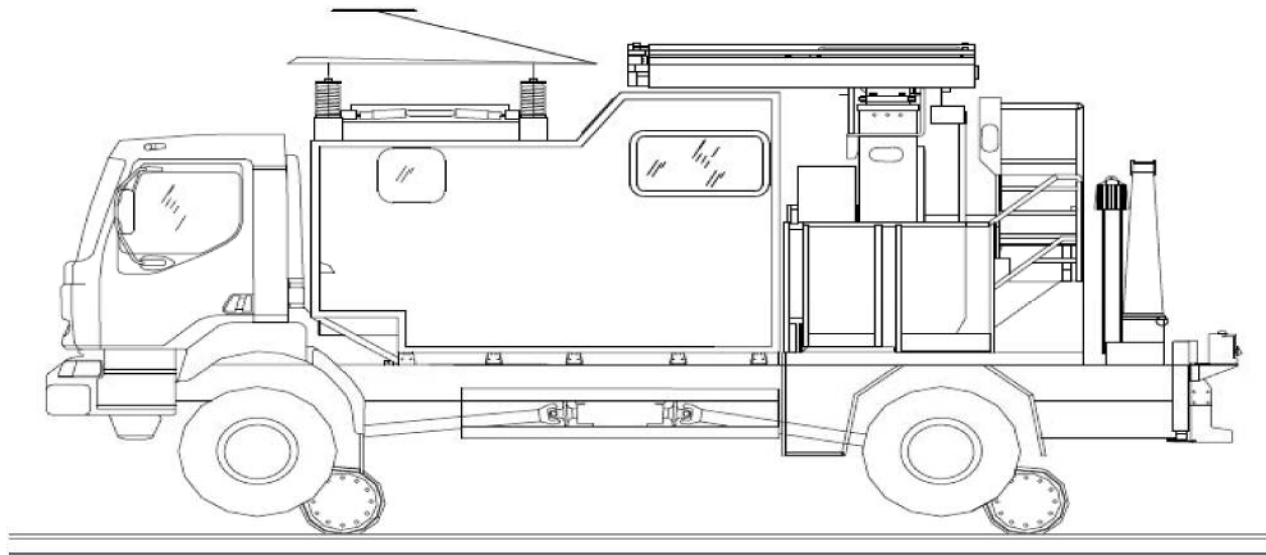
The following safety tools shall be provided

- (a) Two numbers Fire Extinguisher
- (b) 4 sets of safety jacket, shoes and helmets
- (c) 4 nos. portable flood light with a mounting arrangement to cover general lighting, on the hydraulic platform and cradle.
- (d) Mobile charging facility
- (e) Essential tools for hydraulic platform and crane
- (f) Any other tools necessary to be specified during bid.



SKETCH -12A-1

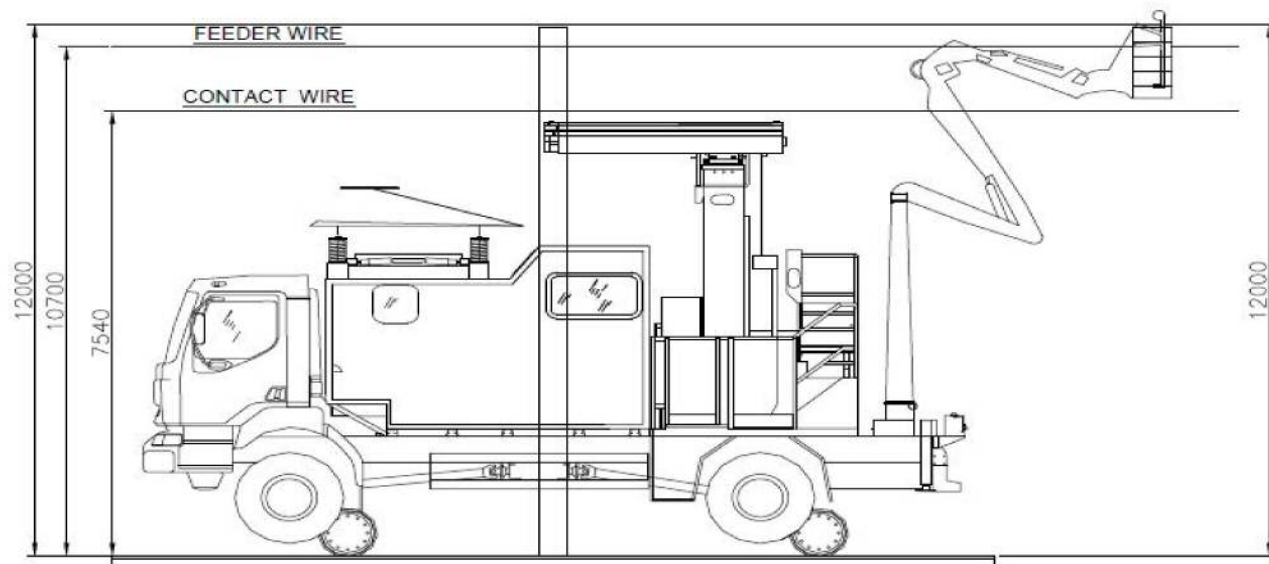
RAIL CUM ROAD BASED VEHICLE WITH MOTORIZED ELEVATED WORKING PLATFORM (MEWP)
SCHEME-1





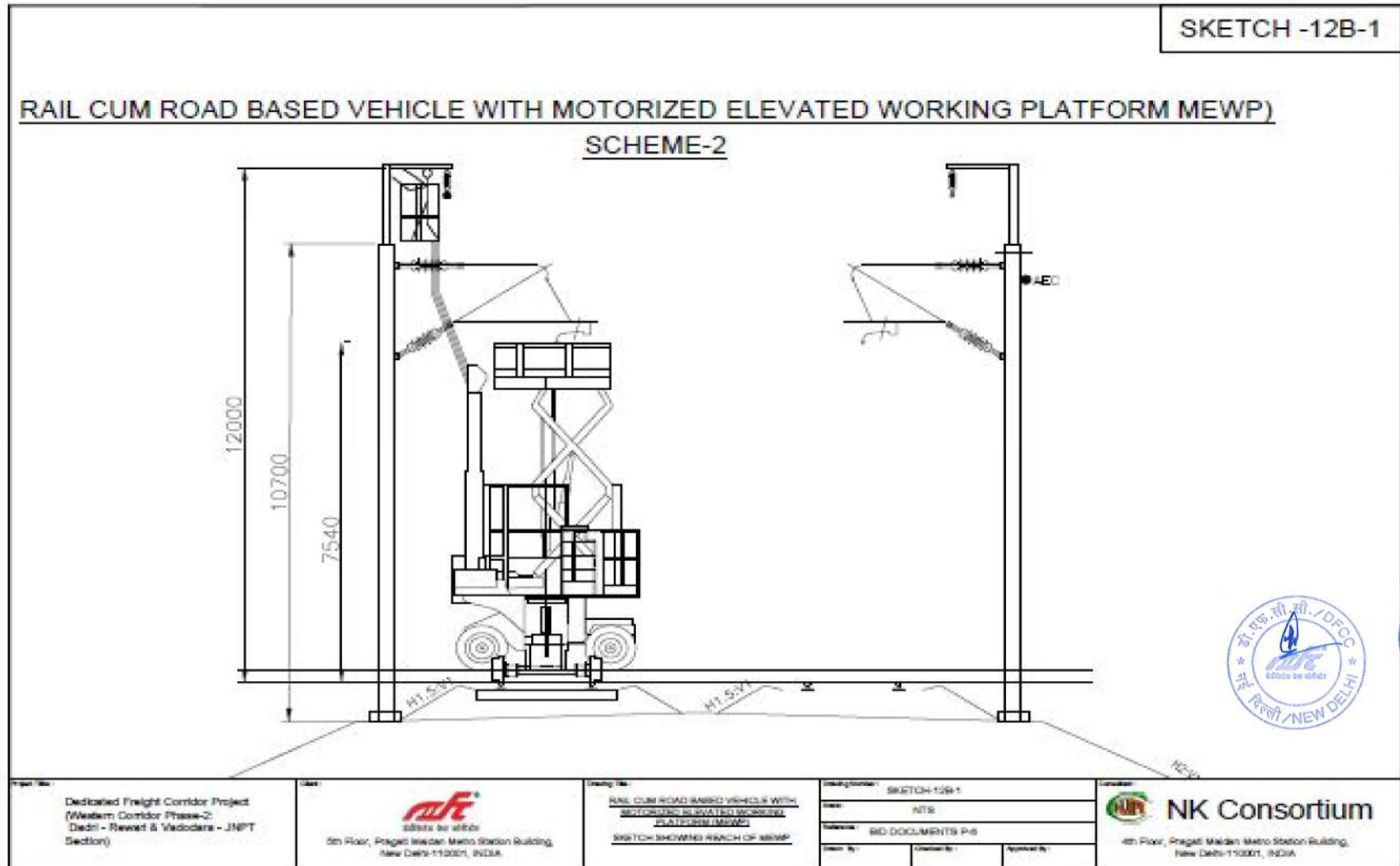
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| <p>Project Title: Dedicated Freight Corridor Project (Western Corridor Phase-2: Dadri - Rewari & Vadodara - JNPT Section)</p> | <p>Client:  5th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> | <p>Drawing Title: RAIL CUM ROAD BASED VEHICLE WITH MOTORIZED ELEVATED WORKING PLATFORM (MEWP)</p> | <p>Drawing Number: SKETCH-12A-1 Scale: NTS Reference: BID DOCUMENTS P-6 Drawn By: _____ Checked By: _____ Approved By: _____</p> | <p>Consultant:  NK Consortium 4th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> |
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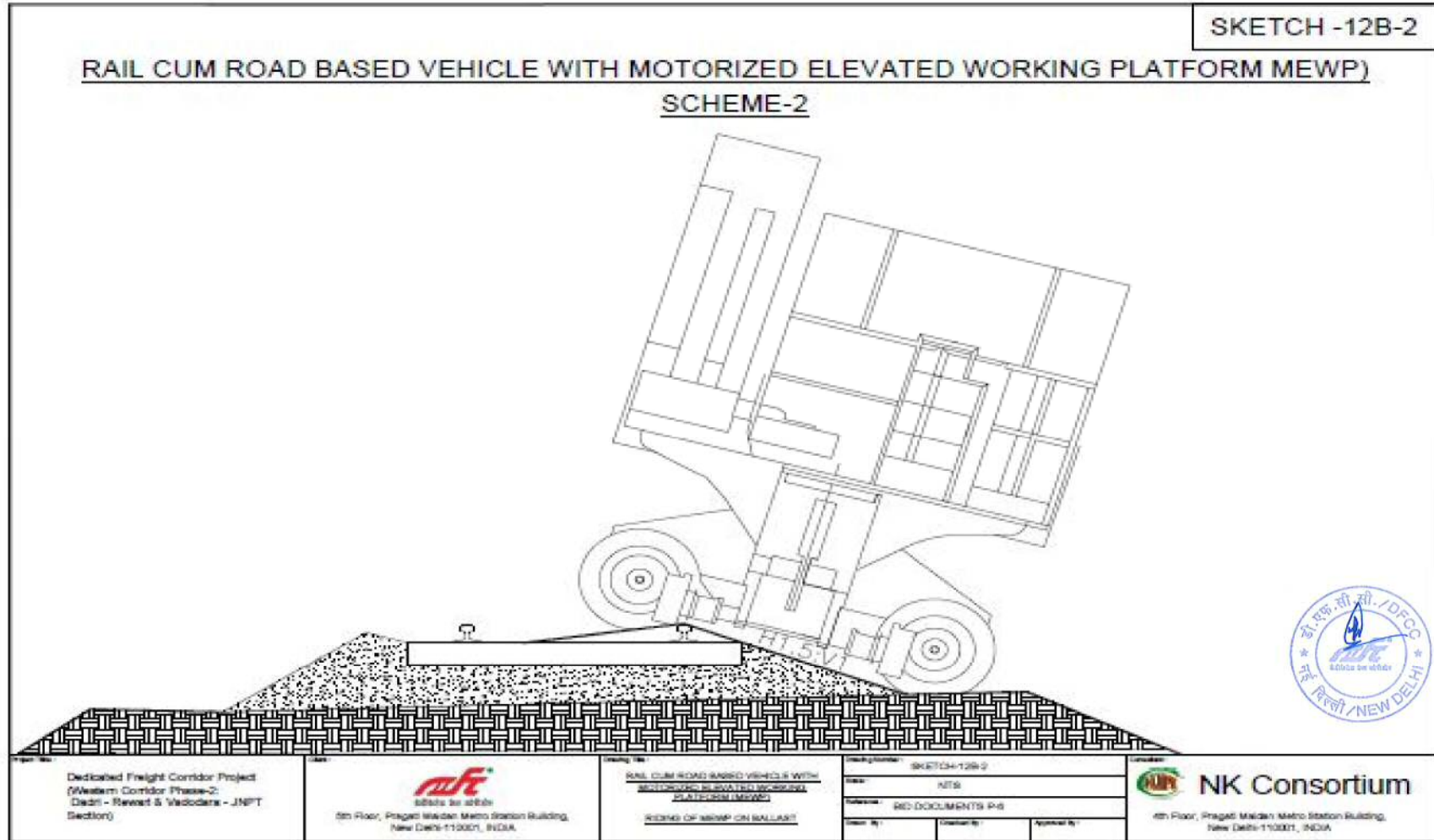
SKETCH -12A-2

RAIL CUM ROAD BASED VEHICLE WITH MOTORIZED ELEVATED WORKING PLATFORM (MEWP)
SCHEME-1



| | | | | |
|---|---|--|--|--|
| <p>Project Title: Dedicated Freight Corridor Project (Western Corridor Phase-2: Dadri - Rewari & Vadodara - JNPT Section)</p> | <p>Client:  5th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> | <p>Drawing Title: RAIL CUM ROAD BASED VEHICLE WITH MOTORIZED ELEVATED WORKING PLATFORM (MEWP) SKETCH SHOWING REACH OF MEWP</p> | <p>Drawing Number: SKETCH-12A-2 Scale: NTS Reference: BID DOCUMENTS P-6 Client By: _____ Checked By: _____ Approved By: _____</p> | <p>Consultant:  NK Consortium 4th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> |
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Section 9.7 Vehicle Condition Monitoring Equipment Base Station

Vehicle Condition Monitoring Base Station to be called (VCMBS) in this document shall be provided at three locations on the WDFC network. The locations for the VCMBS shall be identified during the design approval stage. The VCMBS shall be equipped with

- Wheel Impact Load Detector (WILD) Particular Specification Section 9.7.1
 - Hot Axle and Hot Wheel Detection (HAHW Particular Specification Section 9.7.2
- 1 The criteria for identify the location of VCMBS is on approach to a wagon maintenance depot or station having lines to detach the defective wagon and siding for placement or feeder route connecting Indian Railway network. The run time of the train to the maintenance depot or station shall be more than the total time taken for the assessment of the defect and sounding alarms.
 - 2 The train shall generally be in free rolling without any traction or braking effort for smooth detection of defects while passing over the detection zone. Such locations are naturally available at neutral sections/feeding post. The single phase 230V (+10% and -25%) traction supply through Auxiliary Transformer is expected to be available. The Contractor can also avail power supply from the nearest railway station with variation of about $\pm 10\%$ by laying its own cabling system for the purpose.
 - 3 Generally, there shall not be any power supply interruption through AT but the Contractor shall arrange reliability in the power supply system through UPS.
 - 4 VCMBS shall be located close to the DFCCIL data node.
 - 5 The design of VCMBS and installation of WILD and HAHW shall take into consideration the environmental and climatic conditions as specified in Attachment 14 Vol III and SSOD of DFCCIL etc. Since part of the equipment will be assembled, minimum ingress protection IP 66 be complied with.
 - 6 In case the Contractor proposes to use 230V Auxiliary Traction or from Railway Station supply, the responsibility to ensure protective system towards wide variation of voltage, harmonics, surges and lightening lies with the Contractor. The other alternative with the Contractor is to provide solar panels of suitable capacity for sourcing the power for the purpose. The Contractor shall specify the sourcing of power supply. In case, the Contractor suggests any other alternative, the same shall be specified and design features for sourcing the power supply shall be given. However, the same shall be finalized at the time of design approval stage.
 - 7 It is planned to install two equipment namely Wheel Impact Load Detector (WILD) and Hot axle and Hot Wheel (HAHW) detector. The Bidder shall keep provision for installation of additional equipment at a later stage if decided by the Employer and enlarge the area by 50% over the minimum required for the two numbers of equipment.



- 8 The system shall include and not limited to all track side equipment, cables-electric and communication, server computer, client computer at OCC, SMS delivery system, software for site and central server etc. The layout of the WILD and HAHW in the base station shall be designed ensuring friendly access for maintenance and inspection. All assemblies/parts of the system shall be easily accessible for maintenance.
- 9 The system design shall be such that it shall not modify the rail requiring drilling, grinding, welding, cutting or replacing the existing rails with external instrumental rail. It should be possible to remove the system with ease during the working of track maintenance and rail grinding machines.
- 10 Two tiers shielding or grounding arrangement against external factors shall be provided for the protection of equipment.
- 11 The data cable laid for transfer of data shall be common for both the equipment with 100% redundancy. The Contractor shall make arrangement for transfer of data to OCC/Station and also SMS to five DFCCIL officials using GSMR network.
- 12 The cabling from an instrumented portion of rail should be through armored protected PVC sheathed electron beam irradiated copper cable with adequate protection in harsh environment.
- 13 The Data acquisition system, electronics, etc. shall be enclosed in a suitable steel enclosure with IP67 protection to avoid ingress of water and dust. In case fan is used for the purpose of cooling, the desired Ingress protection shall be with fan in working condition. The details of the IP shall be submitted.
- 14 Modules liable to develop faults shall be plug-in types to enable replacement of the defective ones quickly. The unit shall be fabricated using industrial grade electronic components.
- 15 The Contractor shall design the IP required of the VCMBS room from rain, thunderstorm, lightning, electro-magnetic interference etc. and shall submit the details.
- 16 One set of WILD and HAHW is mounted at each VCMBS. The format for data collection and display shall be standardized in a format so that operator at OCC shall visualize the measured parameters of each axle in one display, i.e. wheel impact load and temperature of each axle and wheel tread together.
- 17 The Contractor shall submit the range, resolution, error tolerance and repeatability of each of the parameters measured by the WILD and HAHW and shall confirm to International Standards as applicable for such measurements.
- 18 It should be possible to monitor both tracks on a double track line from each of the VCMBS and in both direction.



- 19** The data acquisition system shall be of suitable type using an appropriate number of channels to support the dynamic acquisition of all train data. The track side equipment shall have the capability to record and locally store raw captured data for up to 1000 trains and the processed reports for up to 20000 trains.
- 20** The system should be able to generate hard copy of reports covering various parameters, e.g. site identification, wheel identification, axle identification, impact load, speed, direction, date, time etc. at the central control office whenever required.
- 21** Automatic Identification of Train and Automatic Measurements (applicable for HAHW Section 9.7.2 as well)
- 21.1 The WILD equipment at VCMBS shall have the capability to determine the vehicle identity through the data of each of the trains available with the OCC and associate the impacts of each wheel with the corresponding vehicle identity and communicate the same to the WILD server. A RFID based vehicle identification system shall also be provided covering both WILD and HAHW as Indian Railways is providing RFID tag on its wagons and shall be available for use when ready.
- 21.2 Based on above identification of each vehicle with corresponding impact and temperature values of each wheel, the WILD/HAHW server must store the history of impacts of each vehicle for at least the last six months.
- 22** Automated Alarm Notification based on Load levels, ILF and HAHW
- 22.1 It is generally expected by the user that when the WILD raises an alert/alarm, the flagged/suspect wheel should have a defect in the wheel tread when the vehicle is subjected to a visual inspection at a station operationally convenient to DFCCIL. There shall not be more than one case of automatic alarm notification per month where the defect is not detected during visual inspection. The Contractor shall arrange for detailed investigation if more than one false automated alarm notification in a month is reported to the satisfaction of the Engineer.
- 22.2 The system shall be able to calculate the impact load factor for all wheels and generate an alarm.
- 22.3 The system shall also have provision for multiple alarms, which shall be user configurable. Provisions shall be made for critical level alarm reports. However out of above mentioned alarm level, the only high alarm level shall be transmitted at centralized control of DFCCIL. There shall also be sufficient provision in software of increasing impact load alarm up to 60t and it should also be possible for the user to change alarm levels. The initial alarm levels to be set shall be as decided during the design stage.
- 22.4 System shall be capable of generating alarms for Hot Axle and Hot Wheel as per Section 9.7.2
- 23** The system shall be capable of detecting the approaching railway vehicle for 'switching on' of the detection system of HAHW and WILD. Upon completion of the measurement and transmission data for alarms and reports, the system shall automatically 'Switch off' or switch to standby mode to conserve electrical energy.

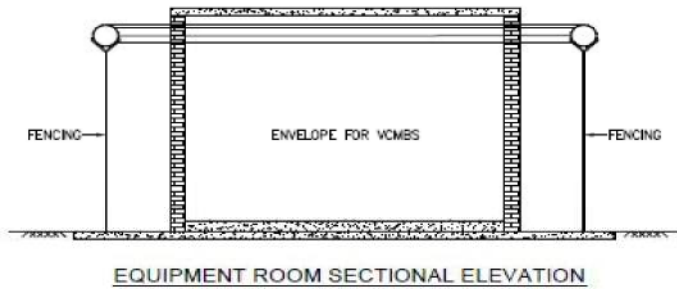


- 24** HAHW and WILD system shall be able to operate continuously round the clock daily without any human intervention and record data of movement of vehicle in either direction.
- 25** The Contractor shall integrate the sensors, power supply, or any other hardware of WILD and HAHW instead using different sensors and hardware for achieving the same purpose.
- 26** The Contractor shall be responsible for providing the server system and required software for collecting data, storage and presentation of reports sent by the track side equipment such as WILD and HAHW. The Contractor shall also integrate system for transfer of reports of the train to the adjacent Railway and details will be finalized during design approval stage when location of installation is finalized.
- 27** The installation will be at remote location and vulnerable to pilferage. A sketch No. 13 is given to make a room along with barbed wire fencing.
- 28** Maintenance
The equipment designed and manufactured to this and respective particular specification is expected to have the requirement of very minimal schedule maintenance. In view of this, it is expected that there shall not be any schedule maintenance requirement during the Defect Notification Period. In case, there is any schedule maintenance requirement other than what is required of visual checks that shall be Identified and advised with the Bid.

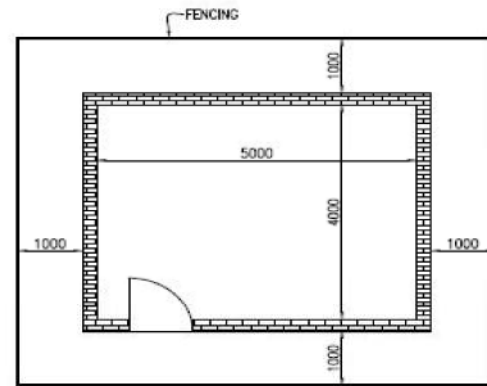


SKETCH -13



LAYOUT SKETCH FOR INSTALLING EQUIPMENT OF VCMEBS



EQUIPMENT ROOM SECTIONAL ELEVATION



EQUIPMENT ROOM PLAN

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| <p>Project Title: Dedicated Freight Corridor Project (Western Corridor Phase-2: Dadri - Rewari & Vadodara - JNPT Section)</p> | <p>Client:  MSE 5th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> | <p>Drawing Title: LAYOUT SKETCH FOR INSTALLING EQUIPMENT OF VCMEBS</p> | <p>Drawing Number: SKETCH-13 Scale: NTS Reference: BID DOCUMENTS P-6 Drawn By: _____ Checked By: _____ Approved By: _____</p> | <p>Consultant:  NK Consortium 4th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> |
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Section 9.7.1 Wheel Impact Load Detector (WILD)

It should be read in continuation of the specification given in section 9.7

Wheel Impact Load Detection system shall be able to perform data acquisition of wheel impact on a rail more than the set standard for the wheels of trains under moving conditions at all speeds and shall further proceed for report generation. The Bidder shall propose Specialist Manufacturer who qualifies as per supply and commissioning performance of 10 systems in last three years (refer sub-factor 3.2(e)(iii) 12) Vol I). A client certificate being attached shall also include the time period of service performance from the client.

- 1 The scope of work includes design, testing, inspection, supply, installation of WILD at each VCMBS, commissioning, field test, training and attention to defects during the Defect Notification Period.
- 2 The WILD server must have software for trending of the impact history of wheels of vehicles. The Contractor must confirm what minimum functional features of trending software are being offered. Some minimum desirable examples are – the software should be capable of generating an alert if a vehicle has any parameter (as measured by the one or more detectors) repeatedly over user-settable threshold limits. It should be capable of predicting the approximate time to reach a certain user-settable threshold limit based on past trends of parameters as measured by one or more detectors. Further improvements as per the direction of the Employer shall be incorporated by the Contractor at no extra cost.
- 3 The system shall comprise adequate number of channels, with two numbers as spares for each pair of rail, which shall be sufficient and capable to demonstrate coverage of 100% of wheel tread/circumference of all types of rolling stock over the full speed range of 30 kmph to 100 kmph.

The system shall be able to count the number of axles from various measurement channels.

Graphical and animated videos or any other method shall be submitted with the Bid to prove the compliance of 100% coverage of the wheel circumference for any defect resulting in high impact loading. The method of testing during inspection and site acceptance shall be submitted.

- 4 Impact Load Measurement & Impact Load Factor (ILF) Measurement of all Wheels
 - 4.1 The system should be able to record values of the dynamic impact load for each passing wheel picking up the maximum dynamic load. The average of the lower values should be worked out for each wheel and stored as normal dynamic wheel load, accordingly the system should be able to calculate the impact load factor i.e. ratio between maximum impact load and average wheel load.
 - 4.2 For detection of impact load each channel shall comprise of measurement sensors configured to give the desired results. The details of the measurement sensors as per the latest technology shall be submitted with the Bid.



- 4.3 The system shall be able to detect high impact load causing wheels of 770 mm to 1100 mm diameter by measuring the impact load on rails. With 600 mm being the inter-sleeper distance on DFCCIL which cannot be changed, the Bidders should present a graph depicting percentage coverage of the wheel circumference by the instrumentation proposed by them from 770 mm to 1100 diameter with 100% coverage of wheel circumference.
- 4.4 The system should be able to measure impact load up to 60 tonne or more for the complete speed range of measurement.
- 4.5 The system shall be able to measure average dynamic wheel load for all wheels from various measurement channels and should be able to find out the maximum dynamic wheel load.
- 5 The system should be able to work effectively in the speed range of 30 Kmph to 100 Kmph.
- 6 Software generated Automatic Report & Analyzed Data transfer to DFCC Control Office.
The software shall be able to generate the report having following items for each train.
- Date of run.
 - Time of train passing.
 - Train no.
 - Axle no. from front
 - Average normal dynamic wheel load.
 - Maximum dynamic wheel load.
 - Impact load factor.
 - Speed of each Axle.
 - Overloaded wheels details
 - Speed of train.
 - Alarm generation
- A format shall be finalized during the design stage for daily and monthly report. The Bidder may submit the standard proforma followed as per his design. DFCCIL may agree with the Bidder proforma of defect reporting or otherwise if any change is required the same will be decided at the design approval stage.
- 7 Self-Calibration of Channels to maintain accuracy
The system shall be able to automatically check all measurement channels periodically to maintain reliability. The train data should be published only if it passes the Data Validation criteria to be decided at the design approval stage.
- 8 Self-Diagnostics
The system should have the self-diagnostic facility for faulty measurement Channels and discard data from them during measurement.
- 9 Instrumentation optimized for capturing full Wheel Circumference data.
- 10 More Number of Measurement zones as per the technology adopted shall provide greater accuracy.
- 11 Programmed software for easy analysis of defective wheels

- 12** The system shall be designed with the ability to detect and identify all types Defects that can cause High Impact Load
- a) Unevenness in Side Bearer
 - b) Wheel Flat
 - c) Broken Spring
 - d) Dashpot Oil Leak
 - e) Cone Defect
 - f) Bolster Spring
 - g) Axle Box Cant
 - h) Friction liner
 - i) PU Pad
- 13** Wheel Impact Load Detection (WILD) system shall be designed with the major components as follows:
- a) Signal conditioning unit
 - b) Train Trigger Sensor
 - c) Real time Embedded controller
 - d) Impact Load Analyzer Software
 - e) Wireless data transfer
 - f) Power back up
 - g) Calibration Setup



Section 9.7.2 Hot Axle and Hot Wheel Detection (HAHW)

It should be read in continuation of the specification given in section 9.7.

- 1 The specification and design parameters HAHW system are based on RDSO Specification No. 12 (Vol III) but not mandatory for the Bidder. In case an alternate design qualifies with proven performance of supply and commissioning of minimum 10 systems in last three years (refer sub-factor 3.2(e)(iii) 13) Vol I) the same shall be submitted with complete technical details along with Technical Bid.
- 2 A HAHW detection system shall be able to and identify for approaching rolling stock for measurement of temperatures of axle box and wheel tread while the train is in motion up to a speed of 100 Kmph and to automatically transmit data, alarms and reports to the end users.
- 3 The system shall be designed with the ability to detect and identify all types of axle boxes of different rolling stock operating on the IR freight train and service vehicles of DFCCIL. It should have the flexibility for adding any new design in the future.
- 4 The HAHW system shall also be possible to be integrated with the automatic vehicle identification capability for differentiation of individual wagon and axle passing through the sensing location at a particular date and time. This will allow vehicle or individual axle box to be predicted by trend analysis of historical data.
- 5 The mechanical components and sensor housing shall be made of heavy duty stainless steel or best suited for this purpose, suitable ingress protection, anti-pilferage mounting and protection from the environmental condition Attachment14 (Vol III) and SSOD (clause 2.4(b) Section 8).
- 6 The wheel diameter of the stock working in this section shall vary from 700 mm to 1100 mm and the number of vehicle with 4 axles may go up to 150 vehicles (600 axles) of all categories, i.e. locomotives, freight wagons, service vehicle etc.
- 7 The system should be capable of acquiring the temperate of axle boxes and wheel tread of trains moving up to a maximum speed of 100kmph. The measurement range for axle box shall be 0-150-degree, resolution +1K and repetition accuracy of $\pm 2K$ ($\pm 1K$ at 70 degrees and $\pm 2 K$ at 30 degree). The measurement range for wheel shall be 140 -650 degrees with accuracy of better than $\pm 10K$ for temperature range of 140-400 degree and $\pm 20 K$ for temperature range of 401-650 degree. However, the final range, accuracy, repeatability etc. shall be decided during design approval stage.
- 8 Train parameters to be acquired: - The system shall be capable of measuring the temperature of both the axle boxes and wheel tread of each axle of passing train and integrate with the recorded parameters of WILD as per Section 9.7.1.
- 9 The HAHW detection system shall be designed with the major components as follows:



- 9.1 Electronic rail contacts to activate the turning on of the measuring process while the railway vehicle passing the sensing location. The system shall be automatically turned into standby mode after the collection of measurement data.
- 9.2 Detectors or sensors to acquire temperature of axle boxes and wheels of both sides of a train with fast response time to achieve accurate measurement of high speed rolling stock running at 100 Kmph.
- 9.3 Adequate numbers (so as to acquire temperature of axle boxes and wheel treads/rims of both the sides of a railway vehicle in a train) of Pyrometers/sensors with response time to meet the speed criteria with focus able optics for spot of measurement of the order of 0.3mm or less (to achieve better accuracy) for non-contact temperature measurements on metals, ceramics, graphite with LASER pointing system for target identification (targeting LASER light should have capability to switch on and off on requirement) for acquisition of axle box temperature and wheel tread/rim temperatures. The pyrometer/sensor should provide a current output proportional to the temperature sensed. The pyrometer/sensor should have a repeatability of 0.1% or reading of 1-degree C or better.
- 9.4 The Bidder shall submit the complete details of the system offered.
- 10** The Data acquisition system shall be such that it acquires, processes and transmits the data in real time preferably within 5 minutes.
- 11** A communication network to transmit data from the data acquisition equipment to the nearest data node for onward transmission to OCC. The format for printing report shall be integrated with that of WILD.
- 12** There shall also be provision in software of the trackside equipment for increasing the number and type of limits and it should be possible for user to change alarm levels and types of alarms. If these require modification to the system / backend software at the server these will done by the manufacturer whenever required without any additional cost and shall be deemed as a part of the supply / maintenance agreement.
 - 12.1 The software of the track side equipment shall constantly keep a watch on time taken for analysis. In case time is exceeding 10 minutes for analysis, the system should automatically take required corrective action.
 - 12.2 The software of the track side equipment shall have in-built diagnostic features for ease in maintenance. The software shall be so designed that a system test is performed after every boot up and a diagnostic report with suitable warning and error message as found necessary with date & time are transmitted to the server systems.
- 13** Local Trackside Equipment Requirement:
 - 13.1 SCT (service and Control Terminal) Requirement:

The main part is an IPC (Inter Process Communication) that is able to cope with extreme environmental conditions. All Service and test functions regarding the infrared sensor can be carried out using the IPC. The measured data is automatically stored. Automatically, the SCT is the interface to next level network structure. It shall determine the operating temperature of each bearing and/or wheel and transmit this in digital form using an efficient data protocol to the central server.

- 13.2 It shall determine the operating temperature of each bearing and wheel and transmit this in digital form to the central server.
- 13.3 It shall be capable of carrying out the following analysis on the received data from the Track side sensors to be used for determination of alarm states based on the:
- Absolute temperature threshold.
 - Ambient temperature.
 - Temperature difference on bearings and wheel tread on same axle.
 - Temperature of Axle Box and wheel tread w.r.t. average temperatures of all Axle Boxes/wheel tread of train on that side of axle box.
 - Difference of Maximum and Minimum temperatures of Axle Boxes and wheel tread on that side of the train.
 - The alarm thresholds shall be configurable.
- 13.4 The system shall be configured to have the capability to detect false alarms and error messages:
- Influenced by sun, sparks from brakes, reflections, external heat sources or even internal effects shall be detected and such false alarms shall be consequently discarded.
 - It shall be possible to set or change the alarm levels individually for each type alarm for all vehicles, stored in the vehicle register.
- 13.5 There shall be only low voltage equipment in the track area (<50 V).
- 13.6 Backup protection of minimum 1 hour shall be provided by UPS.
- 13.7 In case of Power failure, the shutter shall close automatically and the system shall report main failure and battery low status to the central.
- 13.8 The train's speed on each scanning occasion (axle passage) with accuracy better than $\pm 2\%$ resolution of 1 kmph).
- 13.9 The length of the train (distance in meters between the first and the last axle) with accuracy better than $\pm 3\%$ (resolution of 1 m)
- 13.10 The outdoor temperature at the detector site (air temperature in shade) with the accuracy better than $\pm 2^{\circ}\text{C}$ (resolution of 1°C)
- 13.11 The system shall count the total number of axle of the train
- 13.12 The Scanning and measuring results shall be independent of:
- The train's direction of travel and train's speed (within the speed interval of 3 kmph to 100 kmph)
 - Train length.
- 13.13 Following items shall be supplied for storage at each of the VCMBS
- Black body source for calibration of temperature sensors or any other suitable equipment for calibration depending on the model being offered by the Bidder. Complete technical details shall be provided in the offer
 - Hand held non-contact pyrometer similar to Fluke 62
 - Any other fixture considered necessary for checking the alignment of installation of sensors.

Section 9.8 **Ballast Hopper Wagon with Remote Control Discharge**

The technical description of the Ballast Hopper Wagon is Bogie Open Rapid Discharge Hopper Wagon and will be named as Ballast Hopper Wagon in this document. Abbreviation used for this wagon in IR context is BOBYN wagon.

1 General

- 1.1 Ballast Hopper wagon is meant to be used for the purpose of supply and distribute the ballast on DFCCIL track.
- 1.2 The ballast hopper wagon shall confirm to the SOD and SSOD Clause 2.4 Section 8.
- 1.3 RDSO drawing for Hopper wagon is given at sketch No. 14 and may be designed and developed on the same basis but complying the performance parameters as given in clause 2 below.

2 The technical Parameters of the Hopper wagon for guidance and developing a design are as follows:

- a) Axle Load: less than -25t
 - b) Tare Weight: Less than 27.5 t
 - c) Carrying Capacity: more than 66.4 t
 - d) Density of stone ballast: 1.442 t/m³
 - e) Volumetric Capacity Up to Top: more than 46.1 m³
 - f) Length of Head Stock: 10.718 m – 12 m
 - g) Maximum speed 100 Kmph in loaded and empty condition
- 2.1 Twin pipe Air brake wagon
 - 2.2 CBC transition coupler and complete compatibility with attachment to Indian Railway rolling stock
 - 2.3 The Bidder shall submit a proposed design which shall meet the technical parameters using bogie/suspension arrangement of existing design running over IR network at speed and axle load stated above or new design. The design shall include compliance of para 3 below.

3 System of Ballast discharge

Ballast discharge system shall consist of Automatic and manual discharge.

- 3.1 Manual Discharge
Four numbers of wheel on both sides with linked mechanism to open and close the gate shall be provided. This system shall only be operated when automatic discharge system is disabled.
- 3.2 Automatic Discharge
 - a) Automatic discharge system shall consist of mechanized operation of gate and actuation system for mechanical operation. The mechanized opening shall have minimum three slots to regulate the opening as per the requirement of ballast deficiency assessed at a particular place. Continuous operation of gate is also acceptable.



- b) Automatic discharge system should have provisions of remote operation as well as joystick type simple operation which can be operated by the staff walking along the track. For the purpose of remote operation, the minimum distance and provision of selection of hopper shall be finalized during design stage but details shall be submitted along with the Bid.
- c) The operator shall have a system to select either of the three slots and any position if continuous operation is proposed. It shall also be able to change the same in between the operation of discharge.
- d) It should be possible to close the gate when working in any position during emergency.
- e) The mechanized operation shall preferably be hydraulic or any other system having proven records. The source of power supply may be solar chargeable battery or DG powered. The proposed system shall be advised but will be finalized during design approval stage.

4 **Supplier Experience**

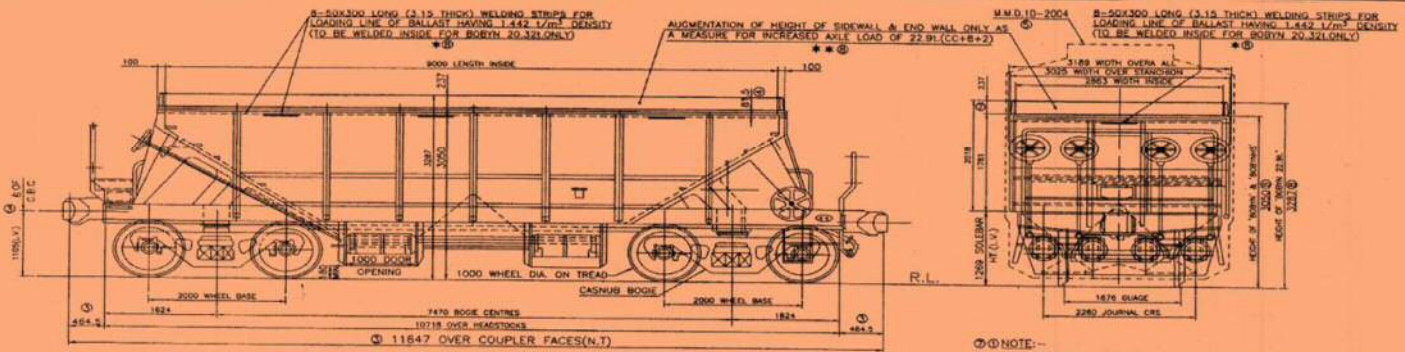
There are two important parts of the P&E namely the Hopper Wagon and another the Automatic Discharge System. The Other Manufacturer chosen by the Bidder shall meet the following experience collectively:

- a. Hopper Wagon: Existing RDSO approved source for supply of wagon stock to Indian Railways or any other manufacturer having minimum supply of 100 hopper wagons to world Railways during the last three years.
- b. Automatic Discharge System:
 - i. Experience of supply of minimum 100 automatic discharge systems installed, commissioned and working on hopper wagons for the last three years on any world Railways.
 - ii. In case, the Bidder proposes another source having experience in manufacture and supply of minimum 100 sets of hydraulic or electric power operating gate along with independent power supply of similar capacity for different application during last three years, then the Other Manufacture shall provide additional warranty of minimum 2 years over and above the Defect Notification Period. The period of additional warranty shall not result in any additional contractual obligation on part of the Contractor.



BALLAST HOPPER WAGON WITH REMOTE CONTROL DECHARGE

SKETCH -14



SUMMARY OF WEIGHTS (ESTIMATED) Ⓢ

| S. No. | DESCRIPTION | MEASURES FOR BOBYN WAGONS | | |
|--------|---|---------------------------|----------------------|---------------------|
| | | # (22.32t) AXLE LOAD | # (22.32t) AXLE LOAD | # (22.9t) AXLE LOAD |
| 1 | UNDERFRAME | 3.0 t | 3.0 t | 3.0 t |
| 2 | FLOOR PLATE | 0.10 t | 0.10 t | 0.10 t |
| 3 | BODY STRUCTURE COMPLETE WITH DOOR OPERATING GEARS, HOPPERS, DIAPHRAGM PLATE RAILINGS ETC. | 8.21 t | 8.21 t | 8.51 t |
| 4 | BREAK GEAR ON UNDERFRAME AND AIR BRAKE PIPING ETC. | 0.65 t | 0.65 t | 0.65 t |
| 5 | CBC COMPLETE INCLUDING UNCOUPLING GEAR(N/TRANSITION) | 1.32 t | 1.32 t | 1.32 t |
| 6 | BOGIES COMPLETE EXCEPT SPRINGS WHEELS & AXLES & AXLE BOXES(CASNUB) | 4.13 t | 4.13 t | 4.13 t |
| 7 | FOUR PAIRS OF WHEELS AND AXLES | 5.75 t | 5.75 t | 5.75 t |
| 8 | EIGHT AXLE BOXES | 0.82 t | 0.82 t | 0.82 t |
| 9 | BOLSTER AND SNUBBER SPRINGS | 0.35 t | 0.35 t | 0.35 t |
| 10 | TWO TOP CENTRE PIVOTS | 0.10 t | 0.10 t | 0.10 t |
| 11 | BOGIE BRAKE GEAR COMPLETE | 0.50 t | 0.50 t | 0.50 t |
| 12 | ESTIMATED TARE | 24.9 t | 24.9 t | 25.2 t |
| 13 | CARRYING CAPACITY | 56.38t | 64.38t | 66.4 t |
| 14 | GROSS | 81.28t | 89.28 t | 91.6 t |
| 15 | AXLE LOAD | 20.32t | 22.32t | 22.9 t |
| 16 | RATIO PAY LOAD TO TARE | 2.26 | 2.59 | 2.6 |
| 17 | TRACK DENSITY | 6.88t/m | 7.87/m | 7.88t/m |
| 18 | NO. OF WAGONS IN 585 METERS | 50 | 50 | 50 |
| 19 | PAY LOAD PER TRAIN | 2819 t | 3219 t | 3320 t |
| 20 | GROSS PER TRAIN | 4054 t | 4454 t | 4580 t |
| 21 | C.G. FROM R.L (EMPTY) | 1.24 m | 1.24 m | 1.3 m |
| 22 | C.G. FROM R.L (LOADED) | 1.79 m | 1.85 m | 2.4 m |
| 23 | VOLUMETRIC CAPACITY (UP TO TOP) | 39.9 m ³ | 39.9 m ³ | 46.1 m ³ |
| 24 | VOLUMETRIC CAPACITY (UP TO LOADING LINE) | 37.8 m ³ | 37.8 m ³ | 46.1 m ³ |
| 25 | SUMMARY OF DESIGN MEASURES FOR ENHANCED LOADING | | | |

| S.NO. | WAGON DATA | LIGHT WAGON |
|-------|---|-------------|
| 1. | HEIGHT OF CENTRE BUFFER COUPLER FROM R.L. | 1105mm |
| 2. | DISTANCE BETWEEN WHEEL FLANGE AND FLOOR | 240.5mm |
| 3. | SIDE BEARER CLEARANCE | NIL |

| S.NO. | BOGIE DATA | |
|-------|--|---------|
| 1. | HIT OF BOTTOM OF BOGIE FRAME FROM R.L. AT CENTRE | 66 mm |
| 2. | DISTANCE FROM R.L. TO TOP OF TOP-PIVOT | 830 mm |
| 3. | DISTANCE FROM R.L. TO TOP OF THE SIDE BEARER | 819 mm |
| 4. | HEIGHT OF THE SPRINGS | 252 mm |
| 5. | JOURNAL CENTRES | 2260mm |
| 6. | JOURNAL DIA. | 144.5mm |
| 7. | WHEEL DIA. ON TREAD | 1000mm |
| 8. | DIA. OF WHEEL SEAT | 210mm |

| NO. | DESCRIPTION | DATE |
|-----|-------------|-------|
| 1 | NO. 1002 | 03/13 |
| 2 | NO. 1002 | 03/13 |
| 3 | NO. 09071 | 08/09 |
| 4 | NO. 09039 | 08/09 |
| 5 | NO. 09078 | 10/06 |
| 6 | NO. 06015 | 3/06 |
| 7 | NO. 05013 | 2/05 |
| 8 | NO. 04037 | 3/04 |

PRELIMINARY SKETCH

ONLY FOR PROTOTYPE APPLICATION UNDER GUIDANCE OF R.D.S.O.(WAGON)

BOGIE OPEN RAPID DISCHARGE HOPPER WAGON TYPE 'BOBYN', 'BOBYNHS' Ⓢ

DIAGRAM

B.G. R.D.S.O. GROUP WD-96021-S-02



Section 9.9 OHE Rehabilitation and Renewal Equipment

1 General

- 1.1 The equipment is meant for undertaking the work of rehabilitation, renewal and laying of new OHE over DFCCIL network and Indian Railways.
- a) Rehabilitation: To undertaken restoration of OHE during accidents, panto-entanglement etc. within minimum possible time. The work requires simultaneous re-rolling of defective/broken contact and catenary wire and simultaneous un-rolling in of the new contact and catenary wire.
 - b) Renewal: To undertake renewal of contact wire when worn out. The work may require removal of old contact wire (may or may not including the catenary wire) and unrolling of new contact wire under tension.
 - c) New Wiring: To undertake electrification of existing or newly laid rail network. The work includes simultaneous laying of contact and catenary wire under tension, fixing on the cantilever assembly (preinstalled) and dropping. For the purpose of fixing cantilever and dropping, the TW under procurement in this package will be used.
 - d) During un-rolling/re-rolling, the contact/catenary wires shall remain in constant tension and no twisting shall take place in contact wire in any condition.
 - e) The 8-wheeler tower wagon covered in the Section 9.4.2 and MEWP covered in Section 9.6 are proposed to be used to assist in other related work of dropping, work at cantilever etc. The Bidder shall ensure compatibility of these maintenance vehicle for this purpose.
- 1.2 The Bidder shall confirm and submit the description and working system, along with the Bid, utilizing these P&E for achieving the objective of work given in clause 1.1 above.

2 The equipment shall be installed on the vehicle for which a sketch 15 is attached. The vehicle platform shall be similar to Section 9.4 except that in the present case it is self-propelled with one DG set and two numbers of Traction Motor and no facility for staff, store, workshop, tools etc. shall be required. It should be possible to work the vehicle at a creep speed of 0-5 kmph. The maximum permissible speed when hauled on its own power shall be submitted. The maximum permissible speed when attached to a train shall be 100 Kmph.

3 While laying out new contact and catenary wires, it shall be capable for erection of tensioning equipment and droppers. It shall also be capable for providing proper tension in contact and catenary wires, adjustment of droppers and OHE profile for proper height of contact wire and stagger etc. The tension length over IR is of 1550 m and on DFCCIL may be around 2000 m.

- 3.1 While replacing old contact and catenary wires, it shall be capable for removal of droppers/jumpers and then re-rolling of contact and catenary wires simultaneously. It shall be capable for laying contact and catenary wires with tensioning equipment and droppers and shall provide proper tension in contact and catenary wires, adjustment of droppers and proper OHE profile of height of contact wire and stagger. It should be possible to complete this process in a traffic block of 2 and 3 hours for 1550 m and 2000 m contact length respectively.



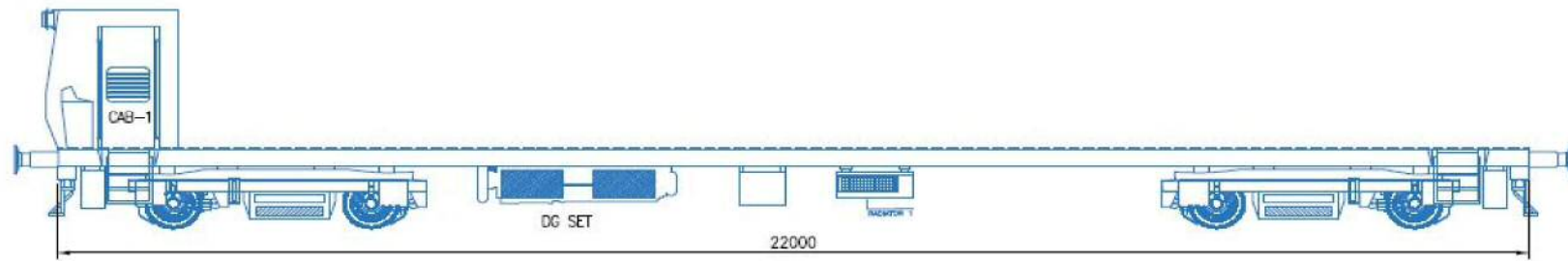
- 3.2 In view of this, the Bidder shall submit the entire scheme with composition of assisting P&E detailing the process, manpower required at different locations, efficiency multiplier tools (if other than already provided in Section 9.4.2) etc. for the employer to have complete understanding of the capability of the offered equipment.
- 3.3 An animation of the process shall be submitted detailing the work procedure for clause 1.1 above showing different stages of the work.
- 3.4 Unrolling and re-rolling shall be possible in both the directions.
- 4 Provisions on the platform of the P&E**
The Employer is looking for following provisions in the P&E. The Bidder shall study the requirement and may suggest the scheme differently but achieving the objective and purpose substantially.
- a. Vehicle for OHE Rehabilitation and Renewal Equipment mounting as given in sketch 15 attached with this section.
 - b. Four numbers of unrolling/rerolling stand for contact and catenary wire.
 - i. Each one shall be capable of unrolling and re rolling one wire and shall have independent control.
 - ii. The size of the drum shall be calculated based on the traction length of 2 Km for the contact and catenary wire as specified in this document.
 - iii. Each stand shall consist of one main frame, one rotational hydraulic drive consisting of hydraulic motor, brake for providing suitable tension while rolling/unrolling along with Hand brake as a safety measure.
 - iv. The reel stand shall have automatic lateral movement capability (auto align device) in order to guarantee 0° angle of the wires.
 - c. Re-rolling Masts
 - i. Two rerolling masts shall be fitted in front of reel stands.
 - ii. These masts shall be fitted with horizontal and vertical rollers to ensure the movement of the wires from the main guiding masts to the reel stands.
 - d. Auxiliary Guiding masts
 - i. Two auxiliary masts for guiding the wires shall be provided on each side of the tensioner.
 - ii. Each mast shall be provided with two fully enclosed, four rollers, and smooth heads to ensure the movements of the wires. Heads shall be of nylon type material to prevent the damage of the wire.
 - e. Guiding rollers
 - i. Guiding devices fitted with horizontal and vertical rollers ensure the guiding of the wires from the reels to the tensioner shall be provided.
 - ii. The rollers shall be of nylon type material to avoid damage of the wires.
 - f. Reversible Tensioner
 - i. A reversible tensioner shall be capable to unroll/reroll one contact and one catenary wire simultaneously with independent control. It shall be capable of to adjust tension without stopping the train.
 - ii. It should have tension measuring device and devices for other working parameters such as pre-set and real-time tension, unrolling speed etc. The accuracy of these parameters is of prime importance.
 - g. Main Guiding Masts
 - i. Two hydraulic telescopic guiding masts shall be provided, one on each end of the car, to ensure the guiding of the wires from the unrolling system of the equipment to the next telescopic elevating platform or to their destination.
 - ii. Each one shall be equipped with guiding rollers.



- iii. All the movements of these masts shall be actuated by means of hydraulic rams.
 - iv. The height of the guiding device for contact and catenary wire shall be decided to carry out the works as given in clause 1.1 over IR having normal height OHE and DFCCIL having high rise OHE.
 - v. The control of the columns shall be at the base as well through a remote control.
- h. Hydraulic Crane
- i. Hydraulic Crane shall not be required as already provided on each of the P&E covered in Employer's Requirement.
- i. Hydraulic Power Unit
- i. Hydraulic power unit of suitable capacity and reputed make and brand shall be provided installed on board/underslung in noiseless enclosure with all necessary equipment to cater hydraulic power required for tensioner, reel stands, masts and winch etc.
- j. Telescopic and tilting mast
- i. A telescopic and tilting mast of suitable design may be required in front of the platform to guide wires to the mast when anchoring is required.
- k. Safety
- i. All safety provisions for the equipment, working, staff, infringement shall be provided to avoid any untoward incident.
- 5 Site Acceptance Test**
- a. The OHE network of DFCCIL on Western and Eastern Corridor is new and the work requirement as specified in clause 1.1 shall not be available for conducting the Site Acceptance Test.
 - b. In view of this, the Contractor may be asked to complete the Site Acceptance Test on any of the nearby electrified network of IR where actual test can be performed to any of the function under clause 1.1.
 - c. Site Acceptance Test shall be conducted based on the ITP as approved during design stage and shall include minimum the following: -
 - i. The wiring of one tension length of 2 Km or 1.6 Km in 3 or 2 hours respectively.
 - ii. Quality of wire laying work by measuring the height, stagger, gradient, physical examination for any twist in contact wire etc.
 - iii. To conform the requirement of manpower as proposed in the Bid submittal.



SKETCH -15

VEHICLE FOR OHE REHABILITATION & RENEWAL EQUIPMENT



| | | | | |
|---|---|---|--|--|
| <p>Project Title: Dedicated Freight Corridor Project (Western Corridor Phase-2: Dadri - Rewari & Vadodara - JNPT Section)</p> | <p>Client:  5th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> | <p>Drawing Title: <u>VEHICLE FOR OHE REHABILITATION & RENEWAL EQUIPMENT</u></p> | <p>Drawing Number: SKETCH-15 Scale: NTS Reference: BID DOCUMENTS P-6 Drawn By: _____ Checked By: _____ Approved By: _____</p> | <p>Consultant:  NK Consortium 4th Floor, Pragati Maidan Metro Station Building, New Delhi-110001, INDIA</p> |
|---|---|---|--|--|

Section 9.10 Flat Wagon for carrying Rails

1 General

- 1.1 Flat wagons are meant for carrying rails, concrete sleepers, points and turnouts for carrying out different maintenance activities over WDFC network of DFCCIL.
- 1.2 The flat wagon shall be of BRNAHS classification of Indian Railway standards and as given in sketch no. 16.
- 1.3 The flat wagon shall be air braked stock with provision of twin pipe i.e. brake pipe (BP) and feed pipe (FP).
- 1.4 The wagon shall be fit to work at a speed of 100 Kmph for which the speed certificate is issued by RDSO for working over Indian Railways vide letter No. MW/BRNA dated 22.4.2004.
- 1.5 CBC coupler with buffers and transition screw coupler and fit to attach any stock of Indian Railway.
- 1.6 The Bidder shall ensure that the manufacture of the wagon shall be an existing RDSO approved manufacturer having its design approved with speed certificate issued for the maximum permissible designed speed.
- 1.7 CASNUB 22 HS bogies shall be used for the purpose.
- 1.8 Bidder shall submit the drawing based on which the manufacturing is proposed.

2 The flat wagon shall generally be attached to RBMV covered under section 9.4.1. The crane provided shall be utilized for the purpose of loading and unloading of the heavy material. The Bidder shall ensure that both the items are compatible to perform the function.

3 Side posts shall be provided to prevent falling of material of the vehicle along with slings to secure the loaded material with the posts for full safety.

4 The technical parameters of the vehicle are as follows

- a. Axle Load: 20.32 t
- b. Tare Weight: optimized as per SSOD and to be submitted
- c. Carrying Capacity: optimized as per SSOD and to be submitted
- d. Length of Head Stock: optimized as per SSOD and to be submitted



