

रेलिड&बाकारखाना,कपूरथला  
RAILCOACHFACTORY,KAPURTHALA

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Please find enclosed a copy of under mentioned specification MDTS44415 Rev. 00, for information and necessary action at your end.

Description: TECHNICAL SPECIFICATION FOR OBCMS

  
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CQM-I,II	CPLE	CWE/Fur	CMM/ HSQ	CMM/TKJ	CWE/Shell
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<b>SPECIFICATION</b>	<b>SCHEDULE OF TECHNICAL REQUIREMENTS FOR ON-BOARD CONDITION MONITORING SYSTEM (OBCMS) FOR IR COACHES</b>	<b>MDTS:44415</b> <b>Rev.: 00</b> <b>Page: 1 of 15</b> <b>Date: 19.05.2025</b>
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## Forward

The condition monitoring and predictive maintenance hold the key to increase reliability and availability of rolling stock on the Indian Railways network. The vibration based Onboard Condition Monitoring System (OBCMS) on IR coaches has been conceived as the earliest method for detection of failures, together real time data from various sub systems and generate actionable alerts post analysis.

Such a system would finally result in improved safety, improved reliability, higher utilization, increased up-time and reduced operation cost of the railway assets by enabling predictive maintenance and reduction in sudden catastrophic failures of these assets.

## Scope:

The specification covers the requirements for design, development, supply, commissioning, and after sales service of OBCMS on IR coaches. Through OBCMS, Indian Railways shall be able to monitor subsystem and create actionable alerts for the concerned authorities in case of any deviation from the norm. Each coach shall be provided with a data computing unit to integrate the digital systems onboard. The IR coaches shall be able to deliver the expected performance independently and in rake formation. The specification defines the various subsystems for their construction, fitment and integration process.

The bidder shall provide the cost breakup for the offer. The item-wise cost quoted shall be considered to account for any variation in quantity of supply.

## Key Objectives:

Indian Railways / RCF wishes to install train mounted, ‘Onboard Condition Monitoring System’ enabling predictive maintenance that will monitor the health of subsystem as defined at Employer’s Requirement at 1(b) of this specification by meeting the following functionalities:

- a) Improving reliability and safety by early warning of distress in or impending failures in subsystems as referred in this document using the vibration signature of the wireless sensors that are strategically placed on the wheel axle box.
- b) Improvement in reliability of these assets by detecting early signs of deterioration and providing ample time for planning preventive and predictive maintenance and avoiding sudden breakdowns in service.
- c) Enabling scientific decision-making for maintenance of assets based on accurate deterioration trending and quantified indices of state of health of these subsystems as referred in this document to plan condition-based maintenance rather than time-based maintenance.
- d) It should be possible to Install On-Board Condition Monitoring System on rolling stock on “in service” within normal scheduled maintenance time when the rolling stock comes for routine inspection and maintenance usually at the end of the trip. This is needed to reduce cost of

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installation, increased asset availability and prevention of train service disruption while reaping benefits of such predictive maintenance systems.

- e) The proposed system should be capable of being used with existing bearings without having to make any structural modifications in the bearings or any major intrusive modification in the bearing/bogie frame or electrical schematics in case of train sets.
- f) Easy operation of the On-Board Condition Monitoring System by simple, automatically generated, and actionable alerts.
- g) Smart coach web portal hosting, access and management
  - i. The supplier shall host the web portal and database of the OBCMS for the IR coaches at its own or on CRIS server or on standard secured cloud services used by Indian Railways, with physical datacenters located in India.
  - ii. Firm shall provide recorded data to Indian Railways.
  - iii. Firm shall comply with all presently applicable extent data protection rules issued by Government of India and any rule issued thereafter.
  - iv. The application should display the essential parameters on a dashboard. Also, Smartphone applications with authentication shall permit railway users to monitor the dashboard. The layout of the dashboard shall be designed with concerned Railway consultation.
  - v. Automatic generation analytical reports for predictive and corrective maintenance by IR.
  - vi. System's each & every component must be meet applicable international/national standards of standardization & integration. It must be able to integrate with other Smart system of coaches. It must be able to send to Railway servers.
  - vii. System should be "future proof" to the extent that any change in communication technology and sensor electronics should not degrade its performance nor should necessitate that Indian Railways is compelled to change the purchased system to reap its intended benefits.

## Technical Requirements:

### 1. General:

- a) This document describes the requirements of Supply, Installation, Testing, and Commissioning with 4 years of CAMC (Comprehensive Annual Maintenance Contract) for Onboard Condition Monitoring System (OBCMS) on Rolling Stock after the completion of warranty period manufactured by Indian Railways/RCF.
- b) The OBCMS contractor shall monitor the vibration of the system to determine the health of the rolling stock subsystems follows:
  - 1. Health of axle bearings
  - 2. Health of Suspensions(both Primary & Secondary)
  - 3. Health of wheels
  - 4. Health of track
  - 5. A system that will give alert signal corresponding to acoustic signals for different parts of bearing to detect bearing health.

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- c) The Software-as-a Service (SaaS) on secured cloud data center physically located in India for 6 years (This includes applications, data storage, Runtime, Middleware, Operating System, virtualization, servers, storage and networking) from the date of completion of warranty for each coach.
- d) The contractor shall provide GSM network subscription to facilitate required data transmission between OBCMS and Cloud at 2G/3G/4G/5G/LTE for 6 years. The web server applications to process and analyze the data uploaded by OBCMS and generate actionable alerts automatically through e-mails and SMSs.
- e) A single web portal to access all the data monitored by OBCMS with standard filtering and sorting (should include Coach Wise, Rake Wise and Depot wise views). Web portals have OBCMS data analysis, alert and escalation functions for IR Coach Systems. The web portal shall internalize the acknowledgement and escalation structure. Any name, word, phrase, logo, symbol, design, image, or a combination of these elements developed in the process shall be approved by concerned Railway and shall be the intellectual property of IR.
- f) Labour, material, tools, wire, cables, connectors, fasteners, brackets and any other concomitant accessory or item that might not be mentioned but essential for satisfactory functioning of the system shall be under the scope of supply of the contractor.

**Note:** Use of any licensed or proprietary software/application should be avoided as far as possible. If unavoidable, the requisite number of licenses shall be obtained and renewed to cover the warranty period.

## 2. Deliverables expected from the OBCMS System:

- (i) The system should be capable of operating effectively with 2G/3G/4G/5G cellular data network coverage. The system must be scalable to further upgradations as and when needed in future without having to replace the complete data concentrator.
- (ii) The data concentrator must have a wireless module to use onboard concentrator cellular network for the transfer of data. The supplier shall be responsible for the required 2G/3G/4G/5G data service and shall be accommodate the same in the package.
- (iii) All data shall be captured and transmitted from data concentrator to a central server for inspection and analysis. The analysis software should be smart enough to do self-diagnosis. The recheck shall be done for the sensors detected by software to avoid false positive.
- (iv) The Wireless sensor Node (WSNs) should be designed & tested to withstand vibration levels exceeding 200g & up-to maximum of 500g in compliance with Indian Railway environment & be capable of self-diagnosing its health to ensure continuous operational efficiency. Further, all sensor data shall be time, date & location stamped. Indian Railways shall appreciate availability of proven design of Wireless sensor Node (WSNs) withstanding vibration levels more than 200g up to 500g & to comply as per EN 61373: 2010 standard.
- (v) Vibration data shall be captured at time intervals based on speed. If required, it should be held in buffer on board the data concentrator and then transmitted to a central database for processing, analysis and alert. In the event of cellular network not being available, the data shall be held for the entire required time until cellular network coverage becomes available and then data must be transmitted at the earliest. The data holding buffer must be designed accordingly.

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- (vi) The System shall be capable of measuring vibration data with suitable speed gating, and temperature data shall be monitored and measured continuously. The temperature data shall be sent to Onboard Concentrator continuously.
- (vii) The design of sensors and data concentrator shall be robust and fit in all the respects for the environmental condition of India. If any part gets defective within warranty period from the date of completion of installation work, the contractor shall replace the same with serviceable part to ensure un-interrupted condition monitoring of the subsystem.
- (viii) The design of sensors and data concentrator shall be universal (Hardware and Software) to all types of axle bearing sand other subsystems of any make and shall not be specific to any type or to any specific bearing supplier.
- (ix) Vibration shall be measured and transmitted under suitable speed gating and load condition to get good frequency response.
- (x) Different types of concentrators should not be used to collect data.
- (xi) System must be able to measure health of axle bearings, health of Suspensions (both Primary & Secondary) & Health of wheels.
- (xii) The system shall have proven capability of detecting bearing damage at least 3-4 months (At least expected running 50,000 Kms) before a bearing replacement is required, allowing ample time for the bearing replacement activity to be planned in with other maintenance activities. In many cases due to maintenance defect, there is sudden failure of bearing, so it should have provision of telling early tell-tale signs as well.
- (xiii) The subsystem condition scale shall, after appropriate configuration and calibration, enable the RCF to distinguish between subsystem with none or low level of damage and those that required increased attention and finally those requiring replacement to allow continued reliable operation of the train without a line-failure of the bearing.
- (xiv) In the event of wireless sensor damage a warning shall be generated to enable safe replacement at the next inspection interval.
- (xv) Data analysis and event generation will be the responsibility of the contractor. Access to the dashboard by at least ten users from RCF should be free of cost. The screen of the dashboard should be compatible with Laptop/Desktop/Mobile/Tablet.
- (xvi) The system must be able to provide reports in different formats (CSV, PDF or similar format files which can be opened and viewed in standard PCs).
- (xvii) Alert levels should be configurable and set by the operator to enable simple, actionable responses. However, the contractor shall take the responsibility of identifying the values and setting the limits and alarm thresholds after studying the RCF IR coaches running condition on Main Line/Depot.
- (xviii) User must have the provision to define the alarm thresholds and to visualize all the parameters numerically and graphically on the screen which has exceeded the alarm thresholds (defined as event).
- (xix) The condition monitoring software algorithm should also report the state of the health of the subsystem on discreet band zone – “Green Zone” for unconditionally safe to run, “Yellow Zone” - for beginning of noticeable deterioration and “Red Zone” - for indication to pull out the asset as soon as possible since it is reaching an impending failure stage.
- (xx) The “condition band” (Green band, Yellow band and red band) as mentioned above shall, after appropriate configuration and calibration, enable the operator to distinguish between bearings/wheels and track with none or low level of rate of degradation, those that require to be kept sight of for further deterioration and finally those requiring prompt attention to allow continued reliable operation of the train without a line-failure of the asset.



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- (xxi) The wheel condition monitoring system must be able to detect defects arising of Rolling contact fatigue like wheel shelling/wheel flats/ subsurface defects/thermal crack in wheel. It should give actionable alerts in advance before reaching the limit of wheel shelling (40 mm & 1.5 length & depth) & wheel flat (50mm) .
- (xxii) The supplier shall be obliged to assist Indian Railways / RCF personnel in understanding the logic of the thresholds set by them to the full satisfaction of the Indian Railways / RCF personnel. The contractor shall supply a proven and reliable system which requires the least time for any fine tuning of its algorithms.
- (xxiii) All sensor data shall be time, date and location stamped. Data location shall be typically accurate to  $\pm 10\text{m}$  or better. Date and Time stamp shall be taken from the Dual band GPS/GLONASS system only.
- (xxiv) The allocation of wireless sensor nodes to a data concentrator and train shall be easily configured through the radio waves with dedicated frequency range using an internal antenna-
- (xxv) All the sensors should have configuration facilities so that any sensor could be installed/replaced with any other sensor by programming its location ID, there should not be any need of re-programming of data concentrator.
- (xxvi) Only standard Industry Communication protocols and encryption algorithms shall be used in the system from data concentrator to the cloud. The Onboard data concentrator shall have open communication platform like Modbus TCP/IP or RS485 for transfer of data to onboard systems. Concentrator integration with the other controller should not be restricted.
- (xxvii) A system schematic is shown in Figure below. The sensors transmit the data wirelessly to the data concentrator, which in turn, transmits the data for storage and processing in the cloud. Additional details on the system components are presented in the following sections.

### 3. Scope of Supply:

The requirement of hardware for Onboard Condition Monitoring System on Train set is as below:

S.No	Description of Requirement	Quantity Per Coach				
		FAC	2T	3T	BAC	PC
(A)	Vibration cum temperature based Wireless Sensing Node (WSN) on each wheel axle box.	8	8	8	8	8
(B)	Data concentrator (DC) unit.	1	1	1	1	1
(C)	RF Antenna for communication between DC and WSNs.	1	1	1	1	1
(D)	Secured mounting arrangement for WSN.	8	8	8	8	8
(E)	Appropriate mounting bracket and fasteners for DC.	1	1	1	1	1
(F)	MCBs (compatible with installed system ratings)	1	1	1	1	1

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#### 4. Technical Specification:

##### a) Wireless Sensor:

- i. A single wireless sensor shall be capable of monitoring both vibration and temperature condition data when fitted to the wheel axles box.
- ii. The Wireless sensor shall be battery-free & capable of generating its own energy through a specially designed energy harvester.
- iii. The sensor shall communicate to data concentrator reliably through wireless means of communication.
- iv. The sensor shall send the live temperature and vibration data to onboard data concentrator and shall not experience lag more than 60 seconds.
- v. The wireless sensor node should be deployed on the wheel axle box with suitable arrangement without disturbing the existing assembly or electrical schematics. There shall be no wired electrical output from the WSN
- vi. Wireless sensor node shall be common to all bogie/axles types. Customization may only be required for the fixing bracket arrangement.
- vii. Sensor housing and all other installation accessories shall be surface treated to protect it against corrosion.

The vibration based wireless sensor shall meet the following specifications:

S. No	Parameter	Specification
A	Vibration	In excess of 200g up to maximum of 500g
B	Temperature	-40°C to +105°C
C	Frequency Range	1-5000Hz
D	Housing Material Type	304 Stainless Steel or better.
E	Sampling Data Rate	At Least 2000Hz
F	Sensitivity/Accuracy	± 0.05g
G	Train Speed Before Measurements Commence	Above 15 Kmph(may be 5 Kmph, keeping in view of speed in yard section) based on Speed Signal
H	Protection Class	At least IP68 & IP69k
I	Certification	EN 50121-3-2 EN 50155:2007 EN 45545-2/HL3
J	Shock and vibration	EN 61373 : 2010

##### b) Data Concentrator or Communication Hub:



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- i. The Data Concentrator shall have at least 16 channels to incorporate all wheel axle box output for vibration and temperature analysis (Extra channels have been asked considering the future requirements).
- ii. The data concentrator shall be mounted on Train Body (Either inside or under the Car frame); therefore once the bogie is dismounted from car, it shall not require any configuration.
- iii. The data concentrator shall be powered by standard 24/110 V DC power supply. 110 V DC will be available from train side, protective MCBs and installation arrangement should be done by Contractor.
- i. iv. The data concentrator shall have, GSM, Modbus TCP/IP & RS485 for the following functions:
  - a) Configuration of Concentrator by the cloud using GSM network. The configuration shall be done by Mobile device both IOS and Android. For any trouble shooting the same application shall be used.
  - b) GSM shall be used for continuous data streaming to cloud. GSM Network shall support 2G/3G/4G/5G with auto switching mode.
  - c) Communication between coach & cloud/server shall be through GSM/LTE-module. The system should be able to switch between the two, whenever required.
  - d) The entire remote configuration shall be handled by GSM/LTE
  - e) Data Concentrator should accept industry standard protocols like Modbus, RS485. This will be used for reading the sensor data from “third party” devices whenever they are fitted on the existing system. Data concentrator should be able to configure and transmit the field data from such devices.
  - f) Shock & vibration testing shall comply as per IEC-61373-2010 standard.
  - g) The entire components like GSM/LTE router, GSM/LTE antenna should be in one unit and well secured for rigorous train environment.
  - h) The Data Concentrator shall have the ability to collect sensor data, tag it with date, time and location of the transmission and forward it to cloud for processing.

The data concentrator shall meet the following specifications:

<b>S. No</b>	<b>Parameter</b>	<b>Specification</b>
A	Voltage Supply	110 V DC will be available from train side, protective MCBs and installation arrangement should be done by Contractor. Additional battery backup option should be available if required.
B	Communication with Wireless Sensor	Using licensed frequency band 866.1MHz
C	Remote data transmission	2G/3G/4G/5G (dependent on region) data modem- requires a data compatible SIM card with SMS enabled. Data transmission is directed to the cloud. Processed data may be forwarded to customer facilities or accessed online via a web browser.
D	Local data transmission	Local streaming serial data output, 9-way D type connector, RS485
E	Data Storage (for periods of low/no data connection)	≥30days of data at selected rate

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F	Incident report function	Continuous calculation and reporting of Ride Comfort Index including alerts ( <i>As defined in BS EN 12299:2009 "Railway applications - Ride comfort for passengers - Measurement and evaluation"</i> )
G	Mobile Data Network Support	2G/3G/4G/5G (micro-SIM or e-SIM)
H	Communication Protocol	Modbus RS485
I	Protection Class	IP67
J	Certification	EMC EN/IEC 61000-6-4EN 50121-3-2 Railway Standards Compliant with EN 50155:2017 and EN 50121-3
K	Indication/Status	One indication for power. One indication for communication.

**c) Cable and Connectors:**

The power cables and connectors shall meet the following specifications:

<b>S. No</b>	<b>Parameter</b>	<b>Specification</b>
a)	Rated Voltage and Current	As per requirement of the contractor.
b)	Connection Method	Push-in connection
c)	Connector Performance Standards	Shock and Vibration Compliance with EN50155:2001 Fire and Smoke EN45545-2 Temperature Range- 20°/+85°C Degree of Protection IP67
d)	Cable Performance Standards	Fire retardant - EN60332-3-25 Flame retardant - BS6853 EN50305 Hazard level HL1-HL3 : EN45545-2
e)	Conformity	Connector: Shock and Vibration EN 50155:2001 Connector/Cable : Fire Protection EN45545-2 Cable: Fire retardant EN60332-3-25 Cable: Hazard level HL1-HL3:EN45545-2

- i. All cables (Power and communication cable) must be protected by fire retardant shrinkable sleeve throughout its routing.
- ii. All cables are to be routed through suitable and railway grade conduits/ grommet / glands & to be properly clamped.
- iii. Long lasting and as per railway standards proper wire numbering to be done for all power and communication cables.
- iv. E-beam cable as per RDSO specification shall be used for supply cables. Sufficient circuit protection shall be provided.

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- v. Any stray voltage/ leakage currents shall not affect the working of the system i.e. suitable protection shall be provided for the same.
- vi. Positive and Negative cables shall be segregated. Any cables passing through under frame shall be provided with cable sealing/ cable jacketing system.

**d) Software and Algorithm:**

- i. The software shall receive filtered data to analyze the received raw sensor data and produce simple actionable alerts for maintenance staff. The actionable alert should include the recommendation for the maintenance staff.
- ii. The output from the software algorithms shall be a simple numerical value, graphical representation as well as color coded to quantify the seriousness of any emerging problem depicting:
  - a. Normal Health of the asset (Wheel, Axle bearing, track, Suspensions, etc) being monitored.
  - b. Beginning of deterioration but does not warrant intervention.
  - c. Deterioration in the health of assets requires intervention within 3-4 months.
  - d. Deterioration in the health of asset that requires immediate replacement from service at the next available service check.
- iii. The output from the software algorithms shall display the current value with respect to the values mentioned above in suitable color codes for all the four conditions.

**e) Environmental Conditions:**

<b>Description</b>	<b>Limiting values</b>
Maximum Ambient Operating Temperature	55-60°C The temperature of the outside train body when exposed directly to the sun for long period of time during peak summer, may be assumed to rise up to 70°C approx.
Minimum temperature	-10°C
Humidity	100% saturation during the rainy season.
Rainfall	Rain during Summer season generally occurs from June to September. However, occasionally rain also takes place during the winter season. Average annual rainfall of Chennai is approximately 850mm and maximum rainfall in any 24hr period is up to 250mm.
The atmosphere during the hot season	Extremely dusty including bird feathers.

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Maximum wind speed	150Kmph
SO2 level in atmosphere	80-120 mg/m <sup>3</sup> Thus contractor shall provide conformal coating on PCB boards to mitigate high SO <sub>2</sub> content in atmosphere as specified in contract.
Suspended particulate matter in the atmosphere	360-540mg/m <sup>3</sup>
Shock & Vibrations	The sub-systems and their mounting arrangements shall be designed to withstand satisfactorily the vibration & shocks encountered in service.

**f) Communications:**

- i. Communications to and from the vibration-based sensor nodes shall be wireless only.
- ii. 2G/3G/4G/5G Cellular or satellite communications shall be used to send data to and from the train.
- iii. Data compression and filtering will be part of the “on train” systems so that communications can be achieved effectively with 2G/3G/4G/5G cellular data communications.
- iv. The communication from the wireless sensors shall be free from interference by passenger communication systems such as Wi-Fi, Bluetooth and cellular radio.
- v. The communication from onboard concentrator to server shall be encrypted and protected from any interception by outside agency.

**g) Front-end Presentation / Dashboard:**

- i. A user website shall be provided to display the current status of all monitored items defined in 1(b).
- ii. The user website shall be used to configure wireless sensor nodes to monitor all assets defined in this specification.
- iii. Proper color coding should be used to indicate healthy, required maintenance within 3-4 months and immediate replacement of the monitored assets.
- iv. The output from the software algorithms shall display the current value (Index/Numeric) with respect to the values mentioned above in suitable color codes for all the four conditions.

**h) Server:**

- i. Information about the monitored assets on the user website shall be compatible of accessibility with common mobile devices (i-Phone, Android, Windows phone, tablets) as well as standard desktop computers running a web browser.
- ii. Sensor information shall be available as simple colored status diagrams, tables of numerical values indicating alert, equipment health and diagnostic information, and graphical display of historical condition information allowing comparison on all common Internet browsers, including mobile platforms.

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- iii. The information for monitored rail assets with sensors shall include but not be limited to:
  - a. Speed.
  - b. Direction.
  - c. Health state (including state of the sensors and data concentrator).
  - d. Condition as indicated by vibration.
  - e. Necessary APIs (Application Program Interface) along with the mapping software should be developed by the supplier of the system and shall be free of cost for all future uses - including obtaining any authorization for use of Geo-mapping data and software.
- iv. The website shall be hosted on a non-proprietary cloud computing system with scalability and geographical resilience with adequate redundancy and with mirrored redundant servers at each geographical location.
- v. The website shall display the train sets with the correct vehicles order displayed on a single or layered webpage. Numbering of axle boxes shall be as per standard nomenclature of CAMTECH/IR.
- vi. The website shall have a top-level summary page displaying summary status of the fleet.
- vii. The website shall have multi-level query menu as per the demands of Organizational hierarchy - relevant to that administrative level of person logging in.

**i) Documentation:-**

Documentation to supplement the understanding, planning, execution, maintenance and troubleshooting of IR coach systems. The following shall be provided by the bidder at the time of submission of the tender.

- a) Detailed Gantt Chart to integrate with concerned Railway production stages with clear timelines
- b) Detailed wiring diagrams, connection diagrams and sensor/equipment fitting on the coach drawings. This shall include a booklet containing the principle of working/algorithm for each of the sensors.
- c) Bill of material with detailed leaflet, documentation in soft and hard for each coach.

At least 4 hard copies and soft copies for each Operating, Maintenance and Troubleshooting manuals coach shall be provided by the bidder.

**Miscellaneous Requirements:**

- a) For LHB, other axle end equipments such as pulse generator, WSP sensors, ERCU etc. are provided on axle box front covers. Hence fitment of 'OBCMS' sensors shall be such that it should be suitable for fitment along with above equipments.
- b) The OBCMS equipment shall be fitted in such a way that there will be no vibration of the equipment, so as to get the accurate vibration data for bearing and axle box.
- c) OBCMS equipment shall be immune to Electromagnetic interference.
- d) Change of train composition and orientation of coaches might be required for train operation. The OBCMS on the IR coaches shall be designed so that the network configuration should be reconfigured automatically.
- e) The system should have sufficient space to store the acquired data for the period of non availability of GSM signal for data transfer. No data shall be lost during period of Non availability of GSM signal for a distance of atleast 100 Kilometers.

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- f) OBCMS or any other connected subsystem shall not allow any stray or unauthorized device to communicate with the IR coach system. The whole system should be designed to deny access to all unidentified or malicious or spoofing devices.
- g) The supplier must apply the policies and practices of the standard IEC 62443 relating to the cyber security of the industrial installations for all the systems of its supply. The application of this standard shall have to be evaluated by an independent accredited body and the certificate shall be submitted to IR as a prerequisite for the commissioning. Moreover, the bidder shall comply with following requirements:-
  - 1.1 Declare the country of origin of components and products used in the system.
  - 1.2 The Smart Coach system shall be designed to appropriately limit the rights for system access and configuration through identification and authentication control. Multifactor authentication methods like combinations of password, OTP, security questions, and Digital Signature Certificate (DSC) shall be used to protect critical access and control.
  - 1.3 The Smart Coach system shall have the intrusion detection and prevention system to avert any cyber-attack. A monthly report on cyber-integrity of the system shall be provided by the bidder during the warranty period. All essential data shall be archived regularly on offline storage media.
- h) All connectors shall be IP65 rated or higher and shall comply with the RDSO specification no. RDSO/CG-18001(Rev.2).
- i) All the required software/program/application and their installation/updation/support during warranty period and subsequent AMC shall be in the scope of supply of the firm.
- j) All fitment material, labour and design changes required shall be in the scope of contractor.
- k) The supplier shall bear the responsibility to integrate the data from existing Smart Coaches already fitted with OBCMS, on the web Portal.
- l) Any additional fixtures & labour required for the fitment of the OBCMS on the coach shall be in the scope of supply of the contractor. The contractor shall take approval of concerned Indian Railway / RCF before fitment on the coach.
- m) The supplier shall ensure that the products supplied under the system shall be within the SOD requirement (Maximum Height & Minimum clearance)
- n) All the sensors and equipment of the coach shall be firmly mounted on the coach with anti-pilferage measures (if required) to sustain the loads under normal operating conditions.
- o) The details of Subscriber Identification Module (SIM) used in the system shall be shared with the concerned Indian Railways representative.
- p) The login credentials to the web portal (User ID & Password) should be provided to concerned IR representative & base depots after successful completion of the training of using the portal. The portal shall have different user access levels to control and define the rights and privileges on the portal.
- q) Demonstration of the working of OBCMS on the web-based portal post installation and commissioning shall be done by the supplier.
- r) The Software User interface shall allow visualizing different measurement systems data on the same Software instance with the purpose of correlate data and improving maintenance activities.
- s) The OBCMS solution provided, wholly and individually, should be compliant with IR and UIC standards(whenever not adequately covered by IR standard)

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- t) Required testing (as per the latest versions of specified standards) and quality declarations by the firm and OEM should be provided.

#### **Method of Prototype Approval:**

- a) Prototype approval from concerned IR representative shall be obtained before bulk supply by the supplier based on the fitment and commissioning in each type of rolling stock at concerned Railway. Any change or deviation in drawing, material supplied or any other approved delivery shall need re-approval from concerned IR representative. All applicable test certificates, data sheets or any pertaining document shall be provided by the firm.
- b) Firm shall show architecture of system till component level & provide proven performance credential.
- c) Validation of product to be carried out with simulated faults on wheel & bearing with vibration signature & alerts.
- d) Successful bidder shall conduct a data logger trial during the prototype approval phase & submit the detailed report of the trial to concerned railway authorities for review & approval.

#### **Spares:**

The minimum design life of complete OBCMS system is 15 years. The supplier/OEM shall ensure the availability of all spares of the system for a period of at least 15 years . This shall be irrespective of the fact whether the supplier/OEM or his sub supplier/OEM have stopped manufacturing of the system/equipments to the design supplied to IR

The offer shall include a recommended list of spare parts required for day-to-day maintenance of the coach equipment. At least 10% of the spares of all critical hardware shall be maintained at the Railway concerned by the supplier. Any replacement request under the warranty shall be covered through this account and shall be later recouped by the supplier.

#### **Penalty Clause:**

The complete coach system shall be functional all the time. In case of any abnormal behavior or abnormal functioning of the installed system, the same shall be informed to the supplier by the respective coaching depot. The concern defect/malfunctioning shall be attended within 72 hours, beyond which penalties shall be levied as per contract conditions.

#### **Warranty & CAMC:**

- a) Installation, commissioning and proper functioning under warranty period is the responsibility of the bidder.
- b) Any software or application updation or up-gradation essential for designed performance, security and integrity of system shall be the responsibility of the bidder during the warranty period.



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- c) The contractor shall be responsible for any On-site replacement /repair / breakdown / debugging of any equipment /program supplied under the scope for a period CAMC & warranty period from the date of commissioning of OBCMS.
- d) The time period of warranty including the compulsory CAMC (Comprehensive Annual Maintenance Contract) should be minimum 6 years. Payment for CAMC service of each system shall be fixed percentage of per unit supply rate and shall be as per below tabulated rates. The payment may be done on quarterly basis.

<b>S No</b>	<b>Year of Warranty &amp; CAMC</b>	<b>Percentage of the per unit supply rate</b>
1.	1st year (Warranty period)	Warranty period. No payment shall be given. Firm to do preventive maintenance with necessary spares.
2.	2 nd year (Warranty period)	Warranty period. No payment shall be given. Firm to do preventive maintenance with necessary spares.
3.	3rd year ( Start of CAMC as per contract agreement)	5%
4.	4th year	5%
5.	5th year	5%
6.	6th year	5%

- e) Bidder shall provide complete maintenance schedule for the item.