

Specification no.	RDSO-SPN-RE-SMART YARD-2018 (Draft)	Date: 28/11/2018
Specification Title:	Specification for Supply, Installation and Commissioning of Automated Wayside Inspection and Detection System for Smart Yard	



भारत सरकार – रेल मंत्रालय
Government of India-Ministry of Railways

**SPECIFICATION FOR SUPPLY, INSTALLATION AND
COMMISSIONING OF AUTOMATED WAYSIDE INSPECTION AND DETECTION
SYSTEM FOR SMART YARD**

TECHNICAL SPECIFICATION NO. RDSO-SPN-RE-SMART YARD-2018(Draft)

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4.0 Preamble:

The Smart Yard is a step forward of Indian Railways (IR) to make existing yards fully equipped for on-line fault detection, monitoring of critical components of freight & passenger rolling stock operating over Indian Railways and eventually be equipped to become a part of connected railways. This specification intends to equip freight /coaching railway yard with automatic sensor based fault/ abnormality detection/health & condition monitoring and reporting system for better asset management of railway rolling stock fleet with a minimum of human interference. The system intended to be supplied against this specification would include fault detection systems like:

- 1) Online monitoring of rolling stock
- 2) Machine vision based inspection system for rolling stock
- 3) Hot Axle Hot Wheel detector (HAHW)
- 4) Track side bogie monitoring system cum hunting detector

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5.0 Scope of supply and work:

Scope of supply shall invariably include design, supply, installation, commissioning, testing, validation, maintenance and operation of all the equipments supplied by the Tenderer as a part of the complete SMART YARD system whether mentioned so at different places or not. The system should be designed to integrate all the sub-systems, intelligent nodes, optical devices and sensor modules communicating with each other on a common platform with capability to add-on more such intelligent modules and functionalities, as and when decided by Indian Railways. System architecture should be so designed to include and integrate the data acquisition analytics and post/pre-processed data/report transmission to the control room through a single and common platform. The system should be capable of importing and processing data imported from the third party system(s) already installed on Indian Railways. The system shall be in the form of modularized set of instrumented detectors. These equipments shall pick up data of moving trains using standard comparators to identify defect locations. Data collected from this system shall be analyzed at a central location in the yard using Software. Tenderer will make itself aware of the existing third party systems already installed and working on Indian Railways. The information and report generated by the smart-yard system shall be displayed in a user-friendly format for maintenance personnel and management. Also in future, all the data centers of Indian Railways will need to be integrated with each other to monitor wagons performance, get intelligent outputs, and monitor trends for maintenance. Algorithms for detecting different types of rolling stock: The software shall be programmed to identify each and every different type of rolling stock and their defects. System should be compact, energy efficient and compliant to the relevant international standards with regard to design, functionality and accuracy levels. The tenderer will have to share the source code(s) and communication protocol(s) including the application software with Indian Railway/RDSO. System should be capable of self-learning.

Different individual equipments covered in the scope of supply are given in the paragraphs below. Successful proving out of all the systems at the site of commissioning of SMART Yard installation, as decided by Indian Railways, shall be tenderer's responsibility. Decommissioning of the present system including removal and dismantling of civil work, if any, installation and commissioning of the new system along with all associated civil work and electrical work will fall under scope of work and will be the tenderer's responsibility.

Smart yard systems are proposed to be installed at the entry of the railway yards, sufficiently away to get warning signals in advance for maintenance. The data captured by the intelligent nodes (sub-systems) will be processed and transmitted to a remote data server for analysis and report generation. The Smart Yard System shall be designed on modular concept for easy maintainability and access. Defect free rails of required lengths, if required for the trouble free working of the system, shall be arranged by IR.

Software provided with equipment will be compatible for hosting on IR central server installed at Kishanganj, New Delhi or any suitable server decided by railway.

Smart Yard shall include following sub- systems for defect detection:

- 5.1 Online Monitoring of Rolling Stock (OMRS):** This system comprises of Acoustic Bearing Detection (ABD) and Wheel Impact Load Detection (WILD) with a provision for addition of other sensors/equipments in future. The System shall monitor the health of each rolling stock of the train in order to identify defective bearing or wheel. Defect report generation and alert communications shall occur in "real-time". The functional and technical requirements for this system as given below.

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- a. Acoustic Bearing Detection (ABD):** For functional and technical requirement of this module, RDSO specification No. RDSO/2008/TG/F/OMRS/003/Rev.0 dated 10.07.08 or latest may be referred. The relevant portion of this specification pertaining to ABD only needs to be referred.
- b. Wheel Impact Load Detection (WILD):** For functional and technical requirement of this module, the details given in COFMOW specification No. COFMOW/IR/WILD/2013 or latest needs to be referred.
- 5.2 Machine Vision Based Inspection System for Rolling Stock:** To monitor underframe, side view & top view defects of a wagon/coach. For Example- Wheel mounted brake equipment and shoes - brake shoe wear/brake disc position, EM pads, spring breakage, side bearer, CBC Coupler, etc. For functional and technical requirement of this module, RDSO specification No. RDSO-SPN-RE-MVIS-2018 or latest may be referred.
- 5.3 Hot Axle Box Hot Wheel Detector (HAHW):** HAHW is an automated wayside detection system for detecting hot axle boxes & locked wheels by monitoring temperature of the bearings, wheel rim/disks and brake disks. For functional and technical requirement of this module, RDSO specification No. RDSO-SPN-RE-HAHW-2017(Rev.1) or latest may be referred.
- 5.4 Track Side Bogie Monitoring System cum Hunting Detector (TBMS-HD):**
This system is a wayside detector that measures the geometry and stability of each wheel set of a bogie. It should be able to automatically measure the performance parameters of each passing bogie used in Indian Railways as it moves down the specially selected curved track as described below at operating speed ranging from 01 Kmph to 250Kmph:
The system should be laser based and able to measure following parameters:
- (i) Angle of Attack (AOA) of each wheel set
 - (ii) Tracking position (TP)
 - (iii) Inter-Axle Misalignment (IAM)
 - (iv) Tracking Error (TE)
 - (v) Rotation (ROT)
 - (vi) Lateral Shift (SHIFT)
 - (vii) Hunting (Lateral Instability)
- The system should be capable of detecting bogies having above parameters beyond user settable limits.
- a. Technical Requirements:**
- i. System should be able to works with all wheelset diameters used in IR.
 - ii. Auto calibration functionality should be inbuilt into the system, details of which shall be submitted along-with the offer.
 - iii. It should function in either direction of movement of train.
 - iv. The system should be able to work in ambient temperature range of 0° to 70°C and relative humidity up to 100%.
 - v. The maximum load on the power supply system should not exceed 2 KVA.
 - vi. It should confirm to following national/international standards:
 - a. Degree of protection for electronics- IP66
 - b. Degree of protection for optics- IP 54
 - c. Wheel contacts- IP67
- b. Operational capability requirements:**
- i. Operating speed – 1 to 250 Kmph.
 - ii. Train length- upto 1000 axles
 - iii. Train headway (1500axles): 3 minutes
- c. Tolerances applicable for various parameters/ defects:**

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- i. Tracking Position accuracy: < +/- 0.2mm
- ii. Angle of Attack accuracy: < +/- 0.5 mrad
- iii. Hunting accuracy: <1 mm

d. Regulation and norms applicable:

- i. EN 61010-1: Lab and Test Equipment
- ii. IEC 60825-1: Laser Safety
- iii. EN 60950-1: IT Equipment
- iv. EN 50121-4: Railway Applications - Electromagnetic Compatibility

The system design shall relate and comply with the above mentioned standards. (In case of any contradiction, the strictest standard shall apply). In addition to above, any other national/international standard which is relevant to the technology for similar application in the railway domain will also have to be complied with.

The system should be able to detect defects in the bogies like bogie wheel sets having high angle of attack and bogie with restricted ability to rotate under the wagon.

The above data shall be utilised for trending purpose. Necessary user friendly arrangement in GUI of software shall be made.

The alert limits of measuring parameters shall be user settable.

5.4.1 Proving-out test requirement for trackside bogie monitoring system cum hunting detector: -

The supplier and the IR/RDSO/DRM-Mechanical shall conduct the following proving out tests after commissioning: -

i. Consistency test:

- a. All the trains should be correctly recorded with regard to direction of motion, date and time of passing, speed, no. of axles, no of locomotives, no of vehicles other than locomotives. Acceptance shall be at 95%.
- b. The complete data report of the trains passed shall be generated.

ii. Calibration test: In addition to calibration test during the commissioning of system, the auto-calibration functionality shall also be demonstrated at the site during the commissioning of the system. The error should not exceed 2%.

6.0 Technical Requirements:

6.1 Installation requirements:

- 6.1.1 The sub systems of the Smart Yard shall be installed such that they do not infringe the IRSOD and shall be installed in consultation with authorised Railway Engineer. The tenderer must submit the installation drawings of equipments for scrutiny and approval by the purchaser. Installation clearance for specific sites shall be provided for individual sites by the respective DRM-Mechanical based on the equipment drawings and other documents submitted by the tenderer, as required by DRM-Mechanical.
- 6.1.2 The Smart Yard sub systems shall be installed such that they do not either require or cause stoppage of train traffic when they are functioning/not functioning/under breakdown/under maintenance.
- 6.1.3 The sensors or equipments installed on the rails/track should be so positioned and should be rugged enough to prevent them from getting damaged by any component of passing train/ vehicles. The components of the Smart Yard system should normally not require modification/alteration/removal of any other track or signal or electrical traction related structure at the installation site or at any remote location. In case of non-conformance in this regard, the tenderer should

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explain the required modification/alteration/removal of any track or signal or electrical traction structure in detail in its offer itself bringing out the reasons for non-compliance to this condition.

- 6.1.4 The Smart Yard system shall be so configured that it can be installed on single/multiple line sections and should function in either direction of movement of train.
- 6.1.5 The Smart Yard system shall be installed in such a way that it is not prone to theft and damages. The equipment shall be so constructed as to prevent unauthorized access to the system. Adequate locking (both mechanical and password based) shall be provided for this purpose
- 6.1.6 The Smart Yard system shall be capable of being powered by single phase power supply of voltage range varying from 110V to 230V, 50 +/-3Hz or through suitable solar power system. The maximum load on the power supply system and the details of the power supply module which would be as per individual specification of each sub system.
- 6.1.7 The functioning of the equipments shall not get affected by the environmental and site conditions like:
- (i) Vibrations from passing trains, track maintenance vehicles/equipment
 - (ii) Direct sunlight on the sensitive and delicate parts of Smart Yard System components
 - (iii) Heat from the sunlight
 - (iv) Lightning
 - (v) Heavy rain and water logging
 - (vi) Animal trespassing
- 6.1.8 The tenderer/supplier of Smart Yard Systems shall, in consultation with DRM-Mechanical of the concerned division of Indian Railways, finalize the actual location at the site of installation. For this, the tenderer and DRM-Mechanical shall organize a joint survey of the site after placement of order but before delivery of equipment at site. The tenderer/supplier should provide a checklist for this purpose including the general arrangement layout diagram, system requirements for proper / accurate functioning, mechanical / electrical and electronic interfaces with the other line side facilities already existing in the vicinity at the site of installation, precautionary measures to prevent malfunctioning and breakdown etc. However, the decision of DRM-Mechanical regarding site and actual mileage (location) shall be final and binding on the supplier. The site of installation should preferably comply with the following requirements:
- (a) Should be on a straight and level track (on either side of the equipment)
 - (b) Should be sufficiently near to a station/yard where the train speed is less than 100 KMPH
 - (c) Should be at least one train length (longest train in the section) away from the outermost approaching stopping signal of the station/yard
 - (d) Should be within 3 km of main power distribution facility
 - (e) Proper bedding of sleepers / ballast shall be ensured to minimize vertical / lateral displacement of the rail on passage of the wheel (This is required to correctly maintain the location of target sensing zones of the axle boxes and wheels with respect to the detector sensors). It is reiterated that the tenderer shall mention the track condition requirement to be fulfilled by Railways along with the offer.

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6.2 Functional requirements:

- (a) The system should be capable of automatic detection of approaching train, automatic switching-on of all the sensors, automatic acquisition of sensing data while the train is in motion, automatic transmission of data / alarms / reports and automatic switching off of relevant sensors to conserve electrical power and conserve life of equipments when the system is idling due to no train movement across the system.
- (b) System should be capable of automatically detecting the type of rolling stock passing through the system and should be able to compare the relevant captured parameters of identified rolling stocks with the historical data for the same parameter recorded during the earlier runs on the same rolling stock and raise an alert & generate trending report where deterioration in these parameters has reached a predetermined alert level calculated by system through machine learning process based on feedback input given to the system by railway engineers from time to time. The trending analysis for individual rolling stock shall be made available by the system on the management dashboard to support decision making
- (c) System availability: The Smart Yard systems are expected to run in 24x7 mission critical mode (available round the clock perennially) without any human intervention. Field equipment shall be designed to facilitate quick and easy replacement of major components, alignment and calibration in all weather conditions and minimize the life cycle ownership costs by minimizing the need for field servicing and calibration. The system shall be so designed as to simplify fault detection/assessment/isolation/ diagnosis, and to assist in minimizing mean-time-to-repair. Provision of triggering a self-test subroutine from a remote location through a MMI should be available for remote diagnostics to identify probable faults in the Smart Yard systems installed at various locations in the field. An uptime of better than 95% should be built in the design of the equipment.
- (d) The system should be capable of exactly identifying the location of defect in the formation of rake, i.e., type of rolling stock, axle no., left side/right side, bogie count from engine as the case may be.
- (e) Environmental conditions –
 - (i) The system should be able to work in ambient climate and weather conditions prevailing on geographical territory of India. (Temperature range: - 0° to 55°C including).
 - (ii) Relative humidity up to 100%.
 - (iii) All sensors and associated wiring are to be properly protected /cased to avoid damage by tamping/packing tools etc. used for track maintenance works. In case the above are required to be removed, it should be possible to remove and re-fit them easily.
 - (iv) The system should be rugged and tamper-proof to work round the clock in harsh and dusty outdoor environment exposed to sun, cold, rain, wind etc. without any need of any special chamber for the purpose.
 - (v) On IR at present, the toilet discharge from the passenger coaches is allowed to fall directly on the tracks. As such, the system should be adequately protected.
 - (vi) The equipment shall be suitable for installation on AC/ DC electrified and non-electrified sections.
 - (vii) It shall be suitable in all areas including where locomotives having thyristor-controlled single phase or 3-phase induction motors haul passenger or freight trains and where chopper controlled EMU stocks are operated. The equipment should be suitably protected from such EMI/RFI.

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- (viii) The system should be capable of functioning with train length- upto 520 axles of all categories, i.e. locomotives and freight wagons operating on Indian Railways.
- (ix) It may be noted that inter-sleeper/tie distance on majority of the track on Indian Railways is 600 mm.
- (x) The system should be capable of acquiring the data of trains moving up to 100 kmph.
- (xi) Train parameters to be acquired:
 - (a) Date of train passing
 - (b) Time of train passing
 - (c) Speed of train
 - (d) Total number of vehicles in the rake.
 - (e) Type of train and type of vehicles in the rake
 - (e) Ambient temperature
- (xii) All the sub systems/ sub-assemblies related to measurement /detection will comply with relevant international specifications and standards applicable for similar Railway applications prevailing at the time of supply. The tenderer will submit detailed technical specification and details of national and international standards to which each of the sub assembly offered by the tenderer as a part of the Smart Yard system complies.

6.3 Hardware requirements:

- (i) The Smart Yard system shall be housed in a rugged enclosure.
- (ii) The mounting arrangement of the Smart Yard system and its components shall be decided by the tenderer in consultation with authorized railway engineer and complete details elaborating the features which prevent shock, vibration and ensure electrical isolation shall be provided to the Railways.
- (iii) UPS (Uninterrupted Power Supply) and Battery back-up: UPS system of sufficient capacity shall be provided to automatically switch to back-up battery power in case of power supply failure, to allow the Smart Yard system at site to function for at least 8 hours on back-up power and to charge the back-up batteries from main power as well as solar power (where opted by the DRM-Mechanical). The UPS shall be capable of working from main power voltage as low as 110V to 270 V and produce a stable supply for operation of all equipment at site. The battery shall be of maintenance free type.
- (iv) The mounting of components shall be such that:
 - (a) They do not infringe with wheels, rolling stock body/bogie/coupler/brake rigging etc. during motion of the train
 - (b) do not get damaged by the wheels , rolling stock body/bogie/coupler/brake rigging etc. during motion of the train
 - (c) do not interfere with any other signaling and traction related equipment presently installed on Indian Railways.
- (v) The system shall have provision for integration with RFID reader likely to be installed by IR in future for automatic identification of vehicles.

6.4 Software requirements:

There shall be provision in software for increasing the number and type of limits and it should be possible for user to change alarm levels and also the types of alarms. Password protection shall be provided for changing the alarm level and type. 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, within the warranty / AMC period. Alarm level, types of alarms & limits should be user settable.

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- 6.4.1 The software of the trackside equipment shall constantly keep a watch on time taken for analysis. In case the analysis time is observed as exceeding 10 minutes, the system should automatically take required corrective action.
- 6.4.2 The software of the trackside equipment shall have in-built self-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.
- 6.4.3 The trackside equipment shall have the capability to record and locally store raw captured data for last upto 500 trains and the processed reports for upto 10000 trains.
- 6.4.4 Presently the format of data transfer from the trackside detector to server is not controlled on the Indian Railways. Manufacturers of the systems are free to use their own formats. A logical XML based standard format permitting integration on a common server system shall be issued and all equipment suppliers shall have to ensure compliance to the same. The equipment provider shall also upgrade software for already supplied equipment without further cost under warranty / AMC.
- 6.4.5 All data of each yard is likely to be sent and stored in server at kishanganj. The supplier shall be responsible for providing the required software for collecting data, storage and presentation of reports sent by the trackside equipment.
- 6.4.6 Maintainability requirements:
- 6.4.6.1 Modules shall be plug-in types to enable the replacement of the defective ones quickly.
- 6.4.6.2 The units shall be fabricated from industrial grade components.
- 6.4.6.3 The layout of the components and wiring shall be such that all parts are easily accessible for inspection, repairs and replacement.
- 6.4.6.4 The system shall be designed in such a way that for maintenance, only replacement of card is required at site.
- 6.4.6.5 All the components of the equipment at site shall be suitably protected against voltage surges. The offer shall provide details of the design used for such protection.
- 6.4.6.6 Wiring shall be colour coded or otherwise marked to differentiate between various connections.
- 6.4.6.7 Label (s) shall be provided in the units, which will show details for easy identification.
- 6.4.6.8 The supplier shall indicate special maintenance instruments and tools, which may be necessary for proper adjustments and maintenance of the equipment and supply them, if so, required by the purchaser of the equipment.

6.5 Safety Requirements:

- 6.5.1 The system shall be designed on fail-safe principles. Unsafe condition shall not develop due to faults and adequate safety margins must be incorporated in the design for systematic and random failures. If a portion of system or full system fails, it shall not relay any data. A fail-safe device is one that, in the event of failure, responds in a way that will cause no harm, or at least a minimum of harm, to other devices or danger to personnel.
- 6.5.2 Equipment shall be designed according to fail-safe principles. No single failure should result in an un-safe condition.
- 6.5.3 A fault must be detected and cleared quickly to kill the probability for another fault to occur simultaneously which can lead to unsafe condition.
- 6.5.4 Hardware faults, both open circuit and short circuit of one or more components, shall not lead to unsafe condition.

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- 6.5.5 The immunity to the interference current shall not be affected by component failure.
- 6.5.6 The equipment shall not fail on wrong side due to harmonic interference generated by 3 phase thyristor, single phase thyristor, chopper controlled, tap changer or other such technologies used on locomotives.
- 6.5.7 The equipment shall be insensitive to extraneous magnetic or electrical fields.
- 6.5.8 The equipment shall be suitably protected through at least two tier shielding or grounding arrangements against external EMI interference.
- 6.5.9 The equipment along with protective measure shall be so designed that it is not affected in case electrified OHE (Over Head Equipment) or lightning falls in its vicinity.

6.6 Output requirement:

6.6.1 The supplier shall launch, operate and maintain an internet-based website during warranty and during comprehensive maintenance period for making available the train reports to remote users authorized by DRM-Mechanical. The website shall have the following features:

- (a) Password based access so that only authorized personnel by DRM-Mechanical can enter/edit/view/download data and reports
- (b) Provision of mobile connection through two separate GPRS connections of two different service providers for data transfer from site to centralized location of the server so that in case of failure of any one of the connections, the data is still transferred by the other connection. The recurring expenditure on mobile connectivity for the warranty period will be borne by supplier. Subsequently, during AMC period, the recurring expenditure on mobile connectivity will be borne by supplier. DRM (Mechanical) shall make arrangement for providing internet connection at C&W control office and other terminals where monitoring computers/Laptops/tablets are installed/used to view the reports.
- (c) Differential privileges to different levels of users to access the resources of the website
- (d) The supplier shall supply at least 5 laptop computers at nominated places by DRM-Mechanical of the configuration as specified in the clause under concomitant accessories.
- (e) The system output shall consist of data based reports. Data acquired by the system shall be sent to a web server and the **following reports shall be available to the users on demand:**

Detailed report: This report shall be in detail showing all parameters as acquired by the remote wayside detector.

Exception report: This report shall be an abridged version of the detailed report showing only the list of vehicle component where the parameters have exceeded the prescribed limits.

Alarms report through SMS: Reports for alarms based on parameters exceeding the prescribed limits shall be sent to users through SMS. In case of delay in transmission of full reports, the system shall have the capability to send SMS directly to limited number of users. The delay shall be deemed to have occurred if the data is not dispatched within 10 minutes from the passage of last wheel of the train. These messages will convey the following minimum data:

- Date / time of train
- Direction of movement
- Vehicle position from start of train

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- Identification of component where the parameters were found out of range.
- Short description / error code (should be easily understandable without need of referring to a table)
- In case of error in recording or any system failure, alarms shall be generated and transmitted similarly.

Diagnostic reports: The system shall be capable of running self-diagnosis sub-routines and report the result through the website and by SMS.

Captured Data Reports:

The report of the data captured by the system shall be relayed by the wayside device via suitable communications media to a secure web server on the internet within 10 minutes after the passage of the last axle.

Where required by special site conditions, OFC / Copper cable / RF-Link connectivity shall be provided by the system provider for transfer of data.

The backend server systems shall be maintained and operated by the system provider. These servers shall be capable of storing and displaying (upon demand) parameter reports for up to last 3 years.

The access to these reports shall be provided by web based clients suitable for use from desktops / laptops / notebooks and smart phones. Users of the systems shall be provided logins / passwords for accessing the data.

7.0 Proving-out test requirement:

The tenderer and the IR/RDSO/DRM-Mechanical shall conduct the proving out tests after installation of the system at site as per sub system's specifications. Proving out test for Track side bogie monitoring system cum hunting detector will be as per para 5.4.1 of this specification.

8.0 Concomitant Accessories:

The scope of supply shall include following concomitant accessories the cost of which shall be included in the basic cost of machine. For information of the purchaser, the cost of these accessories shall also be quoted separately in the tender.

SN	Description	Qty	Remarks
1.	Data access terminal for divisional control office with latest configuration with all necessary peripherals and accessories, licensed softwares.	5	
2.	Uninterrupted online-stabilized power supply of 230±10Volts, 50±3 Hz / battery backup with at least 8-hour backup for the above work stations	1	
3.	Complete calibration set up	1	
4.	Suitable link including the required hardware to send/receive data to remote computer installed in DRM Office/Chief Yard Master's Office /TXR's Office/next station ASM's Office. The link from the sensing station to the reporting station should preferably be wireless with suitable range. The firm shall also quote rate of wireless connectivity with recurring charges on monthly basis.	1	

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5.	Suitable link including the required hardware to send/receive data to remote central computer installed in Central Server whose location will be decided later on. The link from the sensing station to the Central Server shall be wireless with suitable range. The firm shall also quote rate of wireless connectivity with recurring charges on monthly basis.	1	
6	Any other fixture/equipment for alignment of the sensors, if required. Complete technical details shall be provided in the offer.	1	

9.0 Interfacing, system integration:

- 9.1 System architecture should be designed to include and integrate the data acquisition, analytics and data/pre & post process report transmission capability to the control room through a single and common platform. Integration of all Smart Yard Sub-Systems on a common platform is mandatory. The system should have capability to port data from all the systems already installed in the field on IR and establish communication interfaces with any third party system.
- 9.2 System should be compact, energy efficient and compliant to relevant international standards with regard to design, functionality and accuracy levels.
- 9.3 Firm may not share the proprietary information but firm will definitely grant access to raw data captured for any train so that if IR desires to utilize the raw data and get a software developed by a third party, raw data could be sourced from supplier's server. The requirement of source code will be relaxed. Firm shall not use captured data for its commercial exploitation.
- 9.4 System should have capability to integrate with 3rd party system for which Interface control document (ICD) will be provided by Indian railways. Firm will supply the ICD for all sub systems of smart yard to the Indian railways.

10.0 Training:

- 10.1 Free training by the firm shall be imparted in operation and maintenance of the machine. The training to be imparted shall cover operation, troubleshooting and repair of all mechanical, hydraulic, electrical & electronics equipments, PLC etc as applicable. This training shall be provided to employees nominated by consignee, for a period of four days for every installation site free of cost at the consignee premises.
- 10.2 Two days training will also be provided to one person each free of cost from Consignee/COFMOW/RDSO on technical design aspects, system functionalities, internationally accepted norms for reporting, maintainability and reliability aspects of the system as a whole and also the sub-systems / modules integrated with the Smart Yard system. All charges pertaining to travel, boarding and lodging of railway personnel shall be borne by Indian Railways.
- 10.3 Technical experts from the manufacturer will fully and adequately provide training to operators and maintenance staff nominated by the consignee at the time of commissioning of the machine.

11.0 List of applicable international standards for components & systems :

- EN 50121 Railway applications – Electromagnetic compatibility
- EN 50122-1 Railway applications – Fixed installations – Electromagnetic safety, earthing and the return circuit, Protective provisions against electric shock
- EN 50124-2 Railway applications – Insulation coordination: Over-voltages and related protection.

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- EN 50125-1; Railway applications - Environmental condition for equipment
- EN 50153 Railway applications – Protective provisions relating to electrical hazards.
- EN 50388 Railway Applications - Power supply and rolling stock – Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability
- REFRESCO- Electromagnetic compatibility/conductivity (EMC)

The system design shall relate and comply with the above mentioned standards. (In case of any contradiction, the strictest standard shall apply). In addition to above, any other national/international standard which is relevant to the technology for similar application in the railway domain will also have to be complied with.

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