EXPRESSION OF INTEREST

EOI Notice no.: HQ/MECH/MVIS/EOI/2021

Sub: Invitation of "Expression of Interest" for the purpose of exploring likely sources of Machine Vision Based Inspection of Rolling Stock (MVIS) on Dedicated Freight Corridor routes on EDFC & WDFC

Ministry of Railways has launched its flagship project, the Dedicated Freight Corridors (DFCs) for construction of approximately 3300 kms of electrified, high axle load track, with liberal space envelope. The track is fit for running high capacity wagons and long haul freight trains at maximum speed of 100 km/hr. The corridor is between JNPT/ Mumbai and Dadri (Western Corridor) and Kolkata to Ludhiana (Eastern Corridor).

Purpose of EOI: The purpose of invitation of this EOI is to explore likely sources of Machine Vision Based Inspection of Rolling Stock (MVIS) on Dedicated Freight Corridor routes on Eastern & Western Corridor.

1. Introduction

- 1.1 Current practice for preventive maintenance of rolling stock is largely based on manual inspection which is either trackside or pit examination of stock in stationary or slow moving condition. Visual inspections are performed by trained manpower and is dependent on individual judgment. Automated inspection by machine vision based systems has the potential to overcome limitations of human inspection. The systems can be placed closer to the track or between the rails where it may be considered unsafe for a human to be positioned when a train passes.
- 1.2 Research Designs and Standards Organisation (RDSO) has developed a specification (no. *RDSO-SPN-RE-MVIS-2018 (Rev.1)*. This specification covers requirements for design, development and supply of all weather Machine Vision Based Inspection System, herein after referred as MVIS for automated inspection of rolling stock. The purpose of this specification is to spell out the functional and technical requirements of a MVIS system. Applicant shall acquaint himself/his design team about various types of rolling stocks operational on IR network and the types of defects required to be detected by proposed MVIS system under this specification. The specification is generic in nature with focus on functional requirements. On the basis of this specification, EOI for customized MVIS as per DFC requirements is being asked from the capable manufacturers. The respondent should have adequate technical capabilities to manufacture MVIS.

2. Technical requirements

- 2.1 The MVIS System for Inspection of running trains should be able to monitor the following parameters/defects for all types of Rolling Stocks, at train speed in the range of 5 to 100 Kmph.
- 2.2 Defects to be detected
 - 2.2.1 Side view defects
 - 2.2.1.1 Broken / Missing Axle Box covers
 - 2.2.1.2 Major damages in Wheel Disc
 - 2.2.1.3 Open/hanging Doors of Wagons
 - 2.2.1.4 Laterally displaced Springs/ Shock Absorbers, as applicable

- 2.2.1.5 Standard Wheel Profile and other wheel related defects (hollow tyre, deep flange, thin flange, difference in wheel diameter of the same axle etc.) as per latest IRCA conference rules part III & part IV.
- 2.2.1.6 Brake pads/ brake block Worn or missing
- 2.2.1.7 Broken or missing Brake beams and pull rods
- 2.2.1.8 Broken or missing suspension springs.
- 2.2.1.9 Missing/ Damaged Springs
- 2.2.1.10 Missing Brake Block or key
- 2.2.1.11 Missing/ damaged hand brake wheels
- 2.2.2 Underframe defects
 - 2.2.2.1 Visually detectable structural integrity defects like cracks etc. of underframe, as visible from ground below the underframe between the tracks.
 - 2.2.2.2 Yoke pin support plate bolts missing or broken for CBC stock
 - 2.2.2.3 Damaged Centre sill or other under frame members as visible to the human inspector's naked eye.
 - 2.2.2.4 Missing CBC knuckle pins
 - 2.2.2.5 Missing CBC operating handles
 - 2.2.2.6 Damaged/broken Empty Load devices
 - 2.2.2.7 Missing Brake gear items
 - 2.2.2.8 Broken or Bent Brake beams
 - 2.2.2.9 Missing/damaged brake pipe hose/feed pipe hose
 - 2.2.2.10 Hanging parts
- 2.2.3 Top view defects
 - 2.2.3.1 Deformed/Bulged side walls, uneven loading of consignment etc.
 - 2.2.3.2 Open/hanging doors of wagons
- 2.3 <u>Confirmation of Standards</u>: It should confirm to following national/international standards:
 - 2.3.1 Degree of protection for electronics- IP66
 - 2.3.2 Degree of protection for optics- IP 65
 - 2.3.3 Degree of protection for enclosures IP67
 - 2.3.4 OEM recommended Calibration methodology of the system/ Sub system/sub assembly shall be submitted along with the offer.
 - 2.3.5 It should function in either direction of movement of train.
 - 2.3.6 System should be able to flag safety critical alerts on real time basis within 5-10 seconds per wagon and 60 seconds for complete rake. The system should be able to generate complete/comprehensive report within 45 minutes after passing of train. Safety critical alerts will be decided by DFC.
 - 2.3.7 The system should be capable of automatic detection of approaching train, automatic switching-on of relevant sensors, automatic monitor the defects while the train is in motion, automatic transmission of data, alarms and reports and automatic switching off of relevant sensors to conserve electrical power.
 - 2.3.8 The system should be able to work in ambient temperature range of -10° to 60 °C and relative humidity up to 100%.

- 2.3.9 System should have character recognition feature to extract details painted on side walls of rolling stock for use in automatic report generation. Marking diagrams for BOXN wagon WD-80007-S-21, Loco (WDM2)-SKDL 3947 have been enclosed as annexure C & D for reference and guidance.
- 2.3.10 Operational capability requirements
 - 2.3.10.1 Operating speed: 5 to 100 Kmph.
 - 2.3.10.2 Train length: upto 600 axles
 - 2.3.10.3 Typical track profile: As per IRPWM 2019 or latest a mended from time to time: latest correction Slip (ACS –155)
- 2.3.11 Reliability Parameters for Proving out of the system

S.no.	Parameters/Defects	Tolerances	
1	Broken in two pieces or missing Axle box covers	- Ealco positivo	
2	Hanging parts	• Faise positive	
3	Major Damages in Wheel Discs	he more than 1%	
4	Open/hanging Doors of Wagons	per train per	
5	Laterally displaced Springs/ Shock Absorbers	defect	
6	Brake Pad missing	 False negative 	
7	Broken or missing Brake beams and pull rods	alarms should not	
8	Broken or missing suspension springs, in the		
	visible range	per train per	
9	Structural integrity of underframe, as seen from	defect.	
	bottomarea between the track	Reporting should	
10	Yoke pin support plate bolts missing or broken	match the seeded	
	for CBC stock	test condition	
11	Damage in Wagons		

2.3.12 Regulation and norms applicable

- 2.3.12.1 EMVA 1288
- 2.3.12.2 EN550121-4:00 (immunity test)
- 2.3.12.3 73/23/CE, 93/68/CE
- 2.3.12.4 EC DIRective 2006/860/CE
- 2.3.12.5 EN55024:98
- 2.3.12.6 EN61000-4-2:2009
- 2.3.12.7 EN61000-4-3:2006 +A1:2008+A2:2010
- 2.3.12.8 EN61000-4-4:2004 +A1:2010
- 2.3.12.9 EN 301489-1
- 2.3.12.10 EN 55011-2-3:2017
- 2.3.12.11 EN 55022:2010
- 2.3.12.12 EN 55024 :2010+A1:2015
- 2.3.12.13 EN 55032
- 2.3.12.14 IEC 61000-6-4:2018
- 2.3.12.15 IEC 61643-12,61312 & VDE 0100-534
- 2.3.12.16 EN 50125-1:2014
- 2.3.13 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 will also have to be complied with.

- 2.3.14 The system should be modular, with self-diagnostic features. The system should be designed for compatibility with all important Railway Standards, some of which have been mentioned in this document above.
- 2.3.15 The MVIS should run 24x7 without any human intervention. The system should be programmed for self-checks periodically. This self-test must test all vital elements. The result of self-tests shall be indicated on central server.
- 2.3.16 The system should be equipped with robust, networked, alertmanagement software with full suite of graphical analysis and diagnostic tools. Full TCP/IP support should be inbuilt into the system to facilitate smooth integration into all existing railway data networks.
- 2.4 Installation requirements
 - 2.4.1 The MVIS system shall not infringe the EDFC & WDFC SOD (Annexure D & E). The applicant must submit the installation drawings of equipments for scrutiny and approval by the purchaser.
 - 2.4.2 The MVIS 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.
 - 2.4.3 AC voltage 230V, 50 +/-3Hz. shall be made available at installation site by Railway. The maximum load on the power supply system shall be indicated in the offer.
- 2.5 <u>Functional requirements</u>
 - 2.5.1 The system should be able to detect and report all parameters/defects as mentioned in Para 2.1. System shall log the date of train passing, time of train passing, speed of train, number of axles passed, total number of vehicles in the rake.
 - 2.5.2 System shall be designed for a headway (time between two consecutive trains pass) of 5 minutes.
- 2.6 <u>Hardware requirements</u>
 - 2.6.1 In case the cameras are mounted on the rail or tie/sleeper or specially designed sleeper by applicant, the technical details and drawing(s) of such sleeper shall be submitted along-with the offer.
 - 2.6.2 System will be equipped with UPS for graceful shutdown of equipment in case of power failure. System should have feature of self-start/boot on resumption of power supply.
 - 2.6.3 The MVIS system shall have provision for integration with RFID reader likely to be installed by DFC in future for automatic identification of vehicles. The details of location of RFID tags on rolling stock shall be provided to applicant.
 - 2.6.4 System should have capability to integrate with 3rd party system for which Interface control document (ICD) will be provided by DFC. Applicant will supply the ICD for the MVIS to the DFC.
- 2.7 <u>Software requirements</u>
 - 2.7.1 The trackside equipment shall have the capability to record and locally store raw captured data/images for last 500 trains.

- 2.7.2 The supplier shall be responsible for providing required software for collecting data, storage and presentation of reports sent by the trackside equipment.
- 2.7.3 The system should have self-learning capability to improve its performance as it acquires different types of defects passing over it during warranty period of the system.
- 2.7.4 The system should have inbuilt standard library of rolling stock defects being used worldwide such as bogie defects, under-frame defects, wheel defect and brake gear defects. However, standard component templates applicable to DFC shall be provided to applicant. It is the responsibility of the applicant to acquaint himself with the components/assemblies of rolling stocks and various defects available in Railway yards/workshops/depots/sheds etc, before offering the system.
- 3. **Safety Requirements:** 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, locomotives and 25 KV Single Phase AC OHE Supply, return current in rails, track and signaling circuit, etc. It should not infringe with the working of signaling system, track circuits and other railway equipment installed in the yard or on the track side.

4. Output requirement

- 4.1 The supplier shall launch, operate and maintain an internet-based website during warranty and during comprehensive maintenance period for making available the train reports.
- 4.2 The website shall have the following features:
 - 4.2.1 Password based access so that only authorized personnel by concerned CGM of the field unit can enter/edit/view/download data and reports
 - 4.2.2 Differential privileges to different levels of users to access the resources of the website
- 4.3 The supplier shall provide necessary man manual interface (MMI)/ human manual interface (HMI) as per standard industry practices complying with national/International norms applicable for such systems.
- 4.4 The system output shall consist of data 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.
- 4.5 Detailed report: This report shall be in detail showing all parameters as acquired by the remote wayside detector.
- 4.6 The Software should produce a train consist list, comprising train arrival & departure times, speed, number of axles, vehicle type.
- 4.7 The system shall generate alarms based on the interpretation of the data. It should give exception report. It should be possible to individually set preset value for different type of alarms at each site from Central Control. It is the responsibility of the applicant to acquaint himself with various types of defects on Indian Railway's rolling stocks listed in this specification. The defect and limit specified in the IRCA conference rules part III & part IV should be referred for specifying limits and alerts.

- 4.8 Applicant will submit the sample templates of dashboard report for each type of defects mentioned in this specification, as generated by the proposed system elsewhere worldwide along with offer. Reports/ messages shall convey the following minimum data:
 - 4.8.1 Date / time of train
 - 4.8.2 Direction of movement
 - 4.8.3 Vehicle position from start of train
 - 4.8.4 Rolling Stock Number, (if legible/recognizable by the system), in which the parameters were found out of range.
 - 4.8.5 Short description / error code (should be easily understandable without need of referring to a table)
 - 4.8.6 The image of defective portion in the rolling stock shall be uploaded on web report.
- 4.9 The access to these reports shall be provided by web based clients suitable for use from desktops / laptops / net books and smart phones. Users of the systems shall be provided logins / passwords for accessing the data.
- 5. **Type of Tests:** Inspection and testing of the equipment shall include all inspections, tests, checks, procedures etc., whether mechanical, electrical or software related as required to ensure that the equipment supplied meets the requirements of the specification. Inspection and testing shall comprise, but not limited to:
- 5.1 Acceptance tests
 - 5.1.1 <u>Factory Acceptance Test (FAT)</u>: All sub-systems/assemblies shall be demonstrated for satisfactory working of sub systems & assemblies. Calibration of systems/sub-assemblies (wherever applicable) shall also be demonstrated by firm. Successful capture of data/analysis by software by input of a simulated data file (wherever possible) shall be demonstrated
 - 5.1.2 <u>Proving-out test requirement:</u>
 - 5.1.2.1 <u>Consistency test</u>: Detailed Test scheme for consistency test shall be prepared by DFC in consultation with applicant. This test is intended to establish the following performance parameters:
 - 5.1.2.1.1 To examine and ensure the capability of equipment for faithful captureof details like direction of motion, type of rolling stock(Wagon/Locomotive), date and time of passing, speed of train, no. of axles, no of locomotives, no of vehicles other than locomotives under repeated running of test train/commercial train without any miss (100%).
 - 5.1.2.1.2 Fault-seeded rolling stocks (faults as per list in para 2.1) shall be passed through the system. The system should be able to demonstrate the reliability and consistency of fault detection as indicated in this document.
 - 5.1.2.2 <u>Calibration test:</u> As per OEM recommended procedure shall be demonstrated at site after commissioning of equipment with all subsystem operational.

- 6. **Scope:** The MVIS system shall be supplied on turnkey basis. The MVIS system shall mean and include all equipment by the side of the track, cables electric, server computer, website, client computer, software of the track-side equipment and software of the central server and any other element necessary for optimal functioning of the system. The scope shall include
- 6.1 <u>Supply</u>: Supply of -
 - 6.1.1 MVIS site equipment
 - 6.1.2 Concomitant accessories including HMI/MMI interface.
 - 6.1.3 Spares
 - 6.1.4 Maintenance tool kit
 - 6.1.5 Material, as required for civil engineering work
 - 6.1.6 Power & communication cables as per requirement for successful commissioning shall be provided by applicant.
 - 6.1.7 Modem/communication equipment's, as suitable to the trackside equipment
- 6.2 <u>Installation at site</u>: Installation of the system would be done by and under the supervision/direction of firm's Engineers. It shall include the following:
 - 6.2.1 <u>Civil engineering</u> and other allied works (if required) such as construction of hut of suitable size to house UPS, batteries, electronic and electrical equipment, solar power system etc.; grouting supports for steel enclosures/equipments, control box, battery box etc., necessary work e.g. trench etc. for power cables.
 - 6.2.2 <u>Electrical engineering</u>: laying of power cables from the site to the main power distribution box where the CGM of the field unit has made the availability of electrical power of 230 V 50 Hz.
- 6.3 <u>Provision of mobile connection and internet connection</u> for transfer of data and display of reports and audio-visual alarms from site of installation to centralized location.
- 6.4 <u>Web-server</u>: The supplier shall launch and maintain an internet web server at any location with following features:
 - 6.4.1 A comprehensive web-based software to access all system data and images
 - 6.4.2 A web based virtual train inspection portal to review all system images and perform a virtual train inspection, when needed.
 - 6.4.3 Multiple User password protected log-in
 - 6.4.4 Differential access and usage rights to multiple level of users e.g. write- only, read-only, administrator rights
 - 6.4.5 Facility to export data in other data base formats e.g. MS-Excel and XML.
 - 6.4.6 The supplier shall offer at least two designs for web-user interface for selection.
 - 6.4.7 Sufficient capacity to handle data traffic with fast data transfer rate for all authorized users (to be controlled by providing username and password) who shall access though public internet access.
- 6.5 <u>Ownership and confidentiality of data and software</u>:
 - 6.5.1 All the data being generated by the MVIS equipment, website, servers etc. with respect to DFC operations shall be the property of DFC and shall not be shared with 3rd party without explicit written consent of DFC.

- 6.5.2 The data shall be compiled, stored in a medium, transferred and made available in a format as decided by DFC. However supplier may offer their customised format for sharing/ displaying data/ processed report for evaluation/acceptance by the consignee if found suitable.
- 6.5.3 The data shall not be divulged by the supplier to anyone other than DFC officials.
- 6.6 Apart from the details mentioned in this documents, any other accessory/component/system(s) essentially required for ensuring proper functioning of the MVIS system, will fall under the scope of supply of the applicant.
- 7. The current invitation of EOI is to explore the response from the prospective Respondents. Based on the responses, the final documents will be firmed up and will be called for by DFC at a later date. The requirements and conditions of the MVIS briefly mentioned in this document are for guidance of the respondents and subject to change based on the examination of responses received and in line with the DFC related standard norms, conditions, rules andpolicies. DFC may change any or all of the terms, conditions, parameters, specifications and measurement related to assignment variants, commercial/operational requirements in their final document from the ones, which are specified in the current invitation for Expression of Interest. The revised set of conditions and specifications that shall then be part of final Invitation for Bids document which will be published at the time of calling for bids.

8. Invitation for EOI

- 8.1 DFC reserves the right to call for submission of additional documents orany specific document, etc. required to be submitted in reference to the purpose of this EOI.
- 8.2 DFC reserves the right to use information received in the replies to EOI for further development of the project. Mere fact of responding to the EOI, however, shall not confer any right on the parties to preferential treatment at the subsequent bid/development stage.
- 8.3 All costs incurred by respondents in connection with the EOI shall be borne by respondents themselves.
- 8.4 DFC reserves the right to cross check and confirm the information/details furnished by the respondents in response to this EOI.
- 8.5 All the information submitted by the party through EOI will be kept as strictly confidential by DFC and will not be shared with any other party.

9. How to respond

9.1 Applicants are requested to submit their EOI within the stipulated time. Any late submission will not be entertained. The response to the EOI shall be submitted online through e mail (vgautam@dfcc.co.in) as well as in hard copy by courier/speed post before the last submission date and time (22.10.2021, 15.00 hr) to General Manager (Mechanical), Dedicated Freight Corridor Corporation of India Ltd. 5th Floor, Supreme Court Metro Station Building Complex, New Delhi – 110001.

- 9.3 The language for submission of document shall be English.
- 10 **Respondent's Responsibility**: It is expressed that before submitting the EOI, the respondent or applicant must havecarefully examined the contents of all the documents. Any failure to comply to do so will be at the respondent's risk.
- 11 **Amendment:** DFC may modify the EOI by issuing an addendum before last date of submission of the Application. Any addendum thus issued shall be part of EOI and shall beposted on the website. To give respondents reasonable time in which to take addenduminto account in preparing their Applications, DFC may extend the last date of submission of response.
- 12 **Governing law**: The governing law for the purpose of the process is the laws of India and courts of New Delhi shall have full jurisdiction considering any matter arising out of this EOI and the process.
- 13 **Compliance to relevant Govt. of India guidelines/policy on Make in India**: Guidelines issued from Govt. of India regarding Make in India would be followed during scrutiny of the responses.
- 14 **Business dealing with neighboring countries**: While scrutiny of the responses, various guidelines issued from Ministry of Finance under Subject: Restrictions under Rule 144 (xi) of the General Finance Rules (GFRs) 2017 on "Business dealing with neighbouring countries" would be adhered to.

FORMAT FOR LETTER OF RESPONSE

Respondents Ref No.:

Date:

Group General Manager (Mech) Dedicated Freight Corridor Corporation of India Ltd. 5th Floor, Supreme Court Metro Station Building Complex, New Delhi - 110001

Dear Sir,

Subject: RESPONSE TO EOI FOR PARTICIPATION

- 1. We, the undersigned, offer the following information in response to the Expression of Interestsought by you vide your Notification No., dated_____.
- 2. We are duly authorized to represent and act on behalf of _____(hereinafter the "respondent")
- 3. We have examined and have no reservations to the EOI Document including Addenda No(s)_____.
- 4. We are attaching with this letter, the copies of documents defining:
 - 4.1 The Respondent's legal status;
 - 4.2 Its principal place of business;
 - 4.3 Its place of incorporation (if respondents are corporations); or its place of registration (if Respondents are cooperative institutions, partnerships or individually owned firms);
 - 4.4 Self-certified financial statements of Last three years, clearly indicating the financial turn over and net worth.
- 5 We shall assist and/or its authorized representatives to obtain further clarification fromus, if needed.
 - 5.1 DFC and/or its authorized representatives may contact the following nodal persons forfurther information on any aspects of the Response:

S. No.	Contact Name	Address	Telephone	E Mail
1				
2				

- 5.2 Plant Location:
- 5.3 Manufacturing Capacity per Annum:
- 5.4 Resources : Man power deployed:
- 6 This application is made in the full understanding that:
 - 6.1 Information furnished in response to EOI shall be used confidentially by DFC or thepurpose of development of the project.

- 6.2 DFC reserves the right to reject or accept any or all applications, cancel the EOI and subsequent bidding process without any obligation to inform the respondent about the grounds of same
- 6.3 We confirm that we are interested in participating in development of the project.
- 7 We certify that our turnover and net worth in the last three years is as under:

FINANCIAL YEAR	TURN OVER	NET WORTH

- 8 In response to the EOI we hereby submit the following additional details annexed to this application.
 - 8.1 Details of various items being manufactured/consultancy undertaken.
 - 8.2 Details of customer(s) and supplies made in the field of item under EOI.
 - 8.3 Experience and expertise for the items proposed in EOI.
 - 8.4 Details of man-power with their qualification and experience.
 - 8.5 Detailed proposal for items proposed in EOI including alternative proposal, if any.
 - 8.6 Details of Intellectual Property Rights (IPR) held, patent filed/held and MoU/agreement signed.
 - 8.7 Details of ISO certification
 - 8.8 Undertaking as per Annexure-B:
- 9 The undersigned declare that the statements made and the information provided in the duly completed application are complete, true, and correct in every detail. We also understand thatin the event of any information furnished by us being found later on to be incorrect or any material information having been suppressed, IR may delete our name from the list of qualified Respondents. We further understand that DFC will give first preference to the applicants considered relevant for the purpose.
- 10 Our response is valid till (date in figures and words):_____

Yours sincerely,

(Sign) NAME In the Capacity of Duly authorized to sign the response for and on behalf ofDate (To be taken on non-judicial stamp paper of appropriate value as applicable in the respective state and dully notarised & witnessed)

UNDERTAKING

I, son of aged about Years resident of do hereby solemnly affirm as under:-

- 1. That the deponent is the Authorised signatory of (Name of the Sole Proprietorship Concern/Partnership Firm/ Registered Company/ Joint Venture).
- 2. That the deponent declares on behalf of (Name of the Sole Proprietorship Concern/ Partnership Firm/Registered Company/Joint Venture) that:
 - a) In regard to matters relating to the security and integrity of the country, no charge sheet has been filed by an agency of the Government / conviction by a Court of Law for an offence committed by the ------(name of the entity)or by any sister concern of the ------(name of the entity) would result in disqualification.

DEPONENT

VERIFICATION

I declare that the contents of para 1 to 2 above are true as per my knowledge and nothing has been hidden.

DEPONENT

PLATE 4

MARKING OF OPEN WAGON

See Rule 2.4





Annexure-D

Annexure-D

MMD OF DFC FOR EASTERN CORRIDOR



ALL DIMENSIONS ARE IN MILIMETERES EXCEPT WHERE OTHERWISE SHOWN.



MMD OF DFC FOR WESTERN CORRIDOR

