भारत सरकार - रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ - 226 011
EPBX (0522) 2451200
Fax (0522) 2458500

Government of India-Ministry of Railways
Research Designs & Standards Organisation
Lucknow - 226 011
DID (0522) 2450115
DID (0522) 2465310

No.R2/244/Innovation for IR/Vol.III

Dated : 24/09/2014

The Director,
Indian Institute of Technology Delhi,
Hauz Khas,
New Delhi-110016

विभाग : समन्वय विभाग
Dept.: COORD. SECTION
संदर्भ संख्या/Ref. No. 20...14...ICDN..1322
दिनांक/Date :.....14/10/14.....

Phone : 011-26591701 FAX : 011-26582659

Sir,

Sub : Collaborative R&D on issue of interest to IR.

Research Designs & Standards Organisation (RDSO) is the sole R&D Organisation and Technical Wing of Indian Railways. Innovation is the key growth drivers for any R&D activity. RDSO has also forged close linkages with Academia and Industry for joint development of new and appropriate technologies.

Hon'ble Prime Minister has declared 2010-2020 as decade of innovation. In order to further promote innovation, RDSO has formed a Special Working Group, consisting of Railway Officials, representatives of Ministry of Science and Technology, Industries and Academia. The group has identified many areas where collaborative R&D can improve the safe operation on Indian Railways which is the life line of the Nation.

To begin with, the Special Working Group has proposed to take up one of the major problem areas, where the collaborative approach can be utilized. Rail Fracture Detection System is one such area which requires innovative solution. Brief on Rail Fracture Detection System and various technologies available worldwide on the subject are enclosed as Annexure. 1(A)

It is proposed to hold a brain storming session on this issue to develop a cost effective indigenous solution sometime in December 2014 at RDSO. We seek your assistance and guidance for forming a multi-disciplinary team to suggest solution to this problem. You are also requested to kindly advise willingness to participate in this brain storming session.

After the session, IR will take up project (s) with cooperation from Ministry of Science and Technology and suitable Industry Partner to further develop a promising and innovative solution (s) presented in this session.

Further details on this issue can be obtained from the Executive Director Research / RDSO, on his Email ID: edresrdso@gmail.com.

Thanking you,

Yours sincerely,

15 OCT 2014

Enclosure : As above

(Pramod Kumar)
Additional Director General

Dean/R&D Please circulate to all faculty highlighting their interest pomby.
AK Sh. Bansal in (A) specifically: to be communicated back by Nov 1.
7/X/14 16/10

ANNEXURE

Brief About Development Of Rail Fracture Detection System

1.0 Background:

1.1 In Service Rail/ Weld breaks are common phenomena, which mostly occur either due to abnormal temperature variations and/or unfavorable operating conditions. Timely detection of Rail Break with least possible delay before passage of a train over it is very important to prevent unsafe operating conditions. In present system, visual inspection by resorting to manual patrolling in extremely cold weather conditions is organized. Unfavorable climatic condition coupled with very poor visibility pose a serious challenge to desired level of reliability. Therefore, a reliable technical solution at reasonable cost is need of hour.

1.2 RDSO has conducted a survey of international journals /magazines to observe development on the subject at global level for "Track-mounted Rail Fracture Detection System".

2.0 Various Technologies identified in Literature survey:

2.1 Fiber-optic technology :
The fiber-optic detection technology uses a standard single-mode fiber-optic fiber attached to the rail with epoxy or tape under the head along the entire length of track segment. A light source of a wavelength of 1550 nanometers is applied at one end of the fiber and is received at the other end. The light at the receiving end is converted to an electrical signal, which is monitored by a computer system. If a rail fracture occurs, fiber will break, the light will be stopped from reaching the receiver, and an appropriate indication will alert the signal system.

2.2 Strain gauge technology:
This technology uses a number of strain gauge sensors micro welded to the rail web on the gage side of the rail at intervals of 30m to 70m. Master station receives the signals transmitted from each of the sensors. Through the use of proprietary analysis techniques, the stress and temperature variations at adjacent measurement locations are evaluated and compared. Certain combinations of stress and temperature can indicate a rail break, buckled track, or both.

2.3 Traction Return Current Technology:
Electrified rail systems use the running rails for the traction current return circuit. The current flow in any one of the running rails can only be interrupted if either the rail or a rail joint bond is broken. In either case, an abnormal flow of current takes place in the adjacent rail cross-bonds to circumvent the discontinuity in the return circuit. If the resulting current imbalance can be reliably detected under all operating conditions, then the development of rail break monitoring system is possible.

2.4 Railsonic Ultrasonic Broken Rail Detector:
IMT South Africa developed an Ultrasonic Broken Rail Detector (UBRD) to warn rail operators when breaks occur. The rail is excited with pulsed ultrasonic signals at one point, and monitored for the presence of these signals some distance away. The system continuously monitors rails using ultrasound waves, and reports breaks at time intervals down to a few minutes. It interrogates continuously welded rail in sections up to 1 kilometer long.

2.5 Track Circuit Based Systems

The number of track circuit based patented broken rail detection systems have been found to exist. Some of which are as under:

2.5.1 Broken rail detection system invented by Frielinghaus (1989), and owned by General Signal Corp.

2.5.2 System invented by Anderson (2007), under the ownership of General Electric Company (US)

2.5.3 Grappone Technologies (2003)

2.5.4 Broken Rail Detection system by Global Rail System.

2.6 Locomotive-based system :

A loco based system patented by Bombardier Transportation GMBH employs a current signal or a voltage signal or a low frequency audio signal circulating in the railway track for detecting broken rails. It comprises at least one locomotive and wayside monitoring equipment. The locomotive comprises a receiver, a transmitter, and a processing unit that is in communication with the receiver. The processing unit operates by detecting a characteristic of the track signal, and generating a signal indicative of a potential broken rail in response to a change in the characteristic of the track signal.

2.7 Broken Rail Detection without Track Circuits:

This system depends on electrically detecting the continuity of the rails using wayside equipment. The extremities of the detection zone are defined by two low impedance connections between the rails, and these behave as electrical short-circuits. A source of electric current is applied between these connections, so that electric currents flow in both rails. The rail currents are monitored, typically by a pair of current sensors attached to the low impedance connection at one end of the detection zone. A detection device compares the signals from the current sensors. If both rails are unbroken, the current divides equally between the two rails i.e the rail currents are balanced and the detector interprets this condition as an indication that the rails are unbroken. If either rail is broken, the current in that rail is reduced, and most of the current flows in the other (unbroken) rail. In this case, the signals from the current sensors are unequal, and the detector interprets this unbalanced condition as an indication that one of the rails is broken.

3.0 Current Status:

3.1 The trials of Ultrasonic Broken Rail Detection System (UBRD) developed by IMT South Africa is planned in two sections of IR (25 Km stretch each).

3.2 Other technology needs to be developed indigenously for a cost-effective solution considering the vast network of Indian Railways.