Research and Development

RDSO is the sole R&D organisation of Indian Railways(IR) and functions as the technical advisor to Railway Board, Zonal Railways and Production Units. One of the major roles that RDSO has played is that of developing and maintaining standards and specifications which ensure that all different technologies are able to work together as a system, in turn making it possible for IR to operate seamlessly without any technology limitations.

RDSO also offers international consultancy services in matters pertaining to design, testing and inspection of railway equipments as well as survey for construction of new lines. The significant accomplishments of RDSO in the sphere of research & development have always attracted worldwide attention. Some of the important activities and projects undertaken/completed by RDSO during the year 2014-15 are given below:

**Safety**
- Development of Radio Based Advance Warning System (RBAWS) for Unmanned Level Crossing
- Specification of Brake Interface Unit (BIU) for Train Collision Avoidance System and Distributed Power Control System for locomotives fitted with IRAB Class of Brake System
- Modification Sheet for relocation of horn from roof mounted to near the head light in ALCO class of Diesel Electric Locomotives for field trials
- Development of specification for Loco Cab Video and Voice Recording System for Diesel Electric Loco
- Mod Sheet for disabling Vigilance Control Device reset through VCD reset push button from the non-working control stand/desk of single cab Diesel Electric Locomotives (ALCO and HHP Loco)
- Provision of Additional Spring Catcher to prevent the main raising spring to fly off in case of breakage of spring for High Speed Pantograph Type IRO3H
- Safety against fire in IR coaches
- Safety at Unmanned Level Crossing- provision of hoarding to warn road users
- Development of Crashworthy Design of Coach
- Drawing and Speed Certificate for transportation of 20 rail panel loaded in five tiers on End Unloading Rake

**Passenger Amenities**
- Development of Double Decker Coach Design
- Development of integrated Passenger Information System (PIS) for Mainline and EMU Coaches
• Roof Mounted Ventilation Units (RMVUs) for 3-Phase AC EMU of MRVC Phase-II project for Mumbai Sub-urban Services
• Development of Hotel Load Converter
• On-Board Wireless Public Address System
• Code of practice for improved passenger amenities to be provided at Adarsh Stations on IR
• Energy Audit Manual for IR

**Infrastructure**

• Wagon to carry bulldozer for Accident Relief
• Investigation of ballastless track problems in tunnels on Konkan Railway
• Development of high rise OHE
• STT-49 maintenance schedule of MTRC system for GSM-R
• TAN for providing Short Message Services (SMS) in existing GSM-R network of IR
• Thermo-shrink jointing kit for Quad Cable
• Remote Unmanned Data Logger
• 128 channels DAQ system for Stress Investigation Test

**Operational Efficiency**

• Detailed oscillation and EBD trial of 3-coach HS-SPART (with voith transmission) up to maximum speed of 135 kmph on track maintained to C&M-I, Vol.-1 Standard
• Design & development of 1400/1600hp fuel efficient Multi Gen Set WDS6G locomotive for shunting
• Development of specification for 2200hp Diesel Engine for DMUs over IR
• Running trial of 16 LHB AC-CC coaches with 2 Hotel Load HHP locomotives without power car
• Specification for 4500/5000 HP Dual Mode locomotive for passenger service
• Preparation of draft specification for Dual Mode Goods Locomotive
• Development of Microprocessor controlled Brakes System (Type ILS- EIR12) for the 3-phase Electric Locomotive
• Design & development of 7,775 KVA transformer with two separate winding and up rated hotel load capacity
• Alternate Drive Gear System suitable for 200 kmph
• New Insulation Scheme used for EMU/MEMU (Type-4601)
• Approval of modified design of DE Bearing (NU2236 of M/s FAG)
• Development of V-Belt driven PM alternator for LHB and Conventional Coaches
• Development of High Capacity Power Car for 24 coach operation of Rajdhani/Shatabdi trains
• Introduction of EMU train sets
• Design & development of 25T open wagon
• Design & development of 25T container flat wagon
• Development of Low Weight-Low Height (LWLH) Bogie (25Tons axle load)
• Development and patenting of higher capacity steel coil carrying flat wagon of 22.9T axle load capacity
• Modification and improvement in the design of Heat Treated Welded Crossing

**Indigenous Development**

• Improvement in ride quality and speed potential of WDG5 locomotives
• Design & development of HTSC Mark-I light weight cast truck frame for EMD locomotive
• Design modification of HTSC FAB-II fabricated bogie frame for HHP locomotives
• HTSC fabricated bogie frame with TBU application for HHP locomotives
• Design & development of Cast ALCO Engine Block
• Development of indigenous vendor for ‘Bearings for Traction Motor, ALCO Locomotives-(NU328 & NH318 Rivetless)’
• Development of indigenous vendor for ‘Auxiliary Generator for EMD Locomotives’
• Special Purpose Wagon for transportation of salt
• Developments in Auto Car Wagons (BCACBM)
• Development of CBC with balanced Draft Gear
• Design & development of air spring at secondary suspension stage of bogie in IR
• Development of air spring for LHB coaches
• Amendment of the specification for Power Saver in lighting system for IR
• Amendment of the specification for Stand Alone Solar Photovoltaic LED based street lighting system for Level Crossing Gates
• Amendment of the specification for fault tolerant Uninterrupted Power Supply (UPS) system for PRS, EDP centers and other similar requirements
• Standardization of drawing for Automatic Banner Flag on Manned Level Crossing
• Development of 1:10 Movable Switch Diamond
• Rail Free Fastening System (RFFS) of RDSO’s design
• Development of Rail Free Fastening System, Development of two types of indigenous EMUs with better safety features, better passenger comfort and energy efficient technology
• Key Features of the indigenous EMU with roof mounted Ventilation Units
• Development of light weight Push Trolley

**Inspection and Quality Audit**
• Streamlining the procedure of approval of Quality Assurance Plan (QAP) for Mobile Flash Butt Welding Plants
• Checklist for inspection of AT Welding and USFD testing in the field

**Consultancy**
• During the year, nine (9) Consultancy Reports/Inspection Reports have been issued to Zonal Railways for various track-formation related problems at different locations

**Tests and Trials**
• Field Trial of Low Lube Oil Power Assembly (LLOPA) for HHP Locomotives: To overcome problems of Zonal Railways regarding the failures of power assembly components viz. cylinder liner, piston valve and reported high lube oil consumption (LOC), on the directions of RDSO, M/s GE have developed Low Lube Oil Power Assembly (LLOPA) to enhance reliability and to reduce lube oil consumption.
• High Speed Trial of Train: High speed trial of train at 160 kmph utilizing 3-phase WAP5 electric loco was carried out between New Delhi to Agra on 03.07.2014. Trial was carried out to verify all parameters of safety and compliance of all was found within limit. This was the highest speed recorded by a train in the country.
• Speed Certificate of WAP-5(MU): Final speed certificate no.SD. WAP5.11 for operation of 2WAP5 (MU) class of locomotive up to a maximum speed of 160 kmph with single pantograph working on track maintained to C&M–I vol-I standard has been issued.
• To address the problem regarding fitment of CCB Panel in-fringing scavenging blower mounting assembly, performance tests were conducted of the modified CCB system and results were found within specified limit and the installation drawing of the modified CCB has been approved.
• Three Phase Propulsion System for EMU: Subsequent to successful introduction of 115,12 car AC-DC energy efficient 3-phase AC EMUs in Central & Western Railway under MRVC Phase-I project, 72 new ACEMU rakes with State of the Art Technology with regeneration of more than 30% will be introduced under MRVC Phase-II project during the year 2014-15 & 2015-16. IGBT based microprocessor controlled three phase propulsion
& other equipment for this project are being supplied by M/s Bombardier. After successful completion of test & trials, two prototype rakes have been put into commercial services and performing satisfactorily from the date of inception in services i.e. 18.03.2015.

- Track Recording as per stipulated frequency: Track Machines directorate monitors the health of the track on IR through Track Recording Cars and sends the details to concerned Zonal Railways so that the track can be attended to timely, thus reducing failures during service. In the year 2014-15, total 1,11,477 Kms. has been recorded while during the year 2013-14, a total of 85,589 track Kms. was recorded by Track Recording Cars. Two high speed laser contact less sensor based Track Recording Cars (TRCs) capable of recording rail wear along with track geometry parameters serving at maximum speed of 160 kmph have been procured for monitoring health of IR track at high speed.

**Trials to assess the riding behavior of Rolling Stock:**

RDSO has conducted various trials to assess the riding behavior of rolling stock for safe running. Such trials are conducted on all new designs of rolling stock as well as all major design modifications affecting safety of running. Some are given as under:

- AC EMU MRVC Phase-II coaches with M/s Bombardier electrics
- Three coach high speed “SPART” with two power packs manufactured by ICF, Chennai fitted with Voith transmission
- 1600 hp HHP DEMU coaches fitted with pneumatic suspension at secondary stage manufactured by ICF Chennai
- BOXN HL wagon to RDSO Drg. No. Wd-05086-s-02 alt.8 having axle load of 22.90 ton fitted with Non Metallic MS-25 side bearers/spring loaded side bearers to Drg. no.WD-12008-s/1WAG5 Taachi converted locomotive
- 25 tonne axle load broad gauge bogie open wagon type “GONDOLA 25”

**Emergency braking distance trials of:**

- WDG4D (dual cab) loco on BRC-ST section
- WDG5 loco on BRC-ST section
- WDP4DD loco on DD-MMR section
- 12 LHB coaches with WAP5 loco at 160 kmph
- AC EMU MRVC phase-II coaches with M/s Bombardier electrics
- 3 coach High speed SPART with two power packs

**Squeeze load test of:**

- BRN (22.9t) BMBS wagon
- BLC “B” wagon manufactured by Golden Rock Workshop, Trichy,
• BCNHL Wagon (Design–E) by M/s Jindal Rail Infrastructure Limited, Vadodara.
• BOXNHL Wagon by M/s Amtek Railcar Industries Pvt Ltd. Sadhugargh, Punjab

**Coupler Force trials:**
• 21 air braked LHB type coaches fitted with EP assist brake system
• 12 car AC EMU MRVC Phase-II (4 units) fitted with M/s Bombardier Electrics
• Coupler force trial of 24 ICF loaded coaches and Controllability, EBD & coupler force trials of 58 BOXN loaded wagon in Lumbding-Silchar section

**Metro stock:**
• Oscillation and EBD trials of Jaipur Metro Rail Corporation Ltd. (JMRCL) coaches
• Oscillation and EBD trials of Chennai Metro Rail Ltd. (CMRL) coaches
• Oscillation and EBD trials of Hyderabad Metro Rail Ltd. (HMRL) coaches
• Various trials have been conducted successfully for improving passenger amenities on rakes / stocks are given as:

**Longitudinal jerk trials of:**
• Train comprising of 24 AC/Non AC coaches hauled by WDP4 loco over Lucknow-New Delhi
• Train comprising of 24 AC/Non AC coaches hauled by WDP4B loco over Lucknow-New Delhi
• Duronto express (12220 & 12219) hauled by WDM3D locomotive over Secundrabad –Lokmanya Tilak Terminus-Secundrabad upto a maximum speed of 110 kmph
• Ahmedabad -Ajmer Intercity Express rake of LHB coaches over Ahmedabad-Gandhidham
• Delhi-JammuTawi Express of LHB coaches
• Mumbai –New Delhi LHB Rajdhani rake hauled by WAP5 locomotive upto a maximum speed of 130 kmph

**Conduct of various trials to improve Operational Efficiency:**
• Haulage capacity controllability and EBD trials of 8 wheeler self-propelled overhead (OHE) inspection car (DETC/US) manufactured by ICF Chennai over Palakkad-Podanur section
• Dynamometer Car tests to prove Tractive effort/Braking effort/ Speed characteristics of WAG9H locomotive having IGBT based propulsion system of M/S MEDHA over Dornakal-Karepalli-Bhadrachalam Road section
• Vibration testing of WDP4D class of locomotive up to maximum
test speed of 105 kmph on Lucknow-Sultanpur section of Northern Railway

- Oscillation trials, Coupler force, Negotiability, Emergency Braking Distance and Service Braking trials of EUR rake composed of 21 BRN/BRNA/BRNAHS wagons carrying total 60 rail panels of 260 m length each loaded in 5 layers and one 8-wheeler covered wagon over Daund-Manmad section

**Route clearance study trials:**

- Rake of 10 nos. of coaches on Kacheguda-Guntur- Kacheguda-Tirupati section
- Rake of 10 nos. of coaches and 02 nos. of LHB generator van on Lokmanya Tilak Terminal and Madgaon section
- Rake of 14 nos. of coaches with 03 LHB Power car between Kacheguda-Vijayawada section
- Rake of 14 nos. of coaches with 03 LHB Power car between Kacheguda–Guntur and Kacheguda-Tirupati section
- Rake of 12 nos. of coaches with 02 LHB Generator vans hauled by a single WDP4B diesel locomotive between Lucknow-Anand Vihar section

**Confirmatory Oscillograph Car run of:**

- Delhi-Lucknow Shatabdi Express at 160 kmph
- Rajendranagar-New Delhi Rajdhani express rake fitted with M/s Faiveley make centre buffer couplers and Floating plate type draft gear hauled by WAP4 locomotive.
- 12 LHB AC EOG coaches fitted with “H” type tight lock Couplers in Shatabdi Express and similar trains over New Delhi-Agra section Validation of draft gear modelling and comfort criteria in New Delhi-Lucknow Shatabdi Express during its service run
- Testing of Brake interface unit for TCAS loco interface developed by M/s Kernex, Hyderabad in Air Brake laboratory.
- Haulage capacity, controllability and EBD Trial, of ‘8-Wheeler Self-propelled Overhead Equipment (OHE) Inspection Car’, with double engine version, manufactured by M/s BEML, fitted withall Coil BEML Bogie alongwith two vehicles (having maximum gross load of 65 tonne), upto maximum test speed of 65 kmph, over Palghat – Podanur Section of Southern Railway, have been successfully completed, during 15.06.2014 to 30.06.2014.
- Track monitoring runs are conducted every six months of four Rajdhani routes i.e New Delhi-Chennai, New Delhi- Mumbai and New Delhi-Howrah to ensure operational efficiency and passenger comfort. Track Monitoring runs of New Delhi-Agra is conducted every four months at the maximum speed of 150 kmph.