RESEARCH, DESIGN & DEVELOPMENT

Development of Multi Section Digital Axle Counter

Project for development of DAC (SSDAC & MSDAC) is in progress in collaboration with CSIR and CEL. SSDAC has been developed and being supplied to Zonal Railways on regular basis.

Field trial of Multiple Section Digital Axle Counter (MSDAC) developed by M/s CEL is undergoing at Faridabad (Northern Railway). After analyzing failures, certain modifications like software of SM reset panel, higher transmission level of modem module have been done by CEL from time to time. To properly monitor the performance in comparison to existing track circuits, approval was given vide letter dated 24.7.2008 to shift the track devices closer to insulation joints of track circuits. The same has been carried out by M/s CEL. Software validation has been completed. Type testing has been completed in RDSO lab. Last phase of trials to start at Jaitapur station in Kanpur-Lucknow section. MSDAC system is installed at Jaitapur and performance is being monitored.

Development of Block proving by Axle Counter (BPAC)

Provision of BPAC will reduce dependence on human element in train operation and thus will improve safety. The existing design of BPAC with Analogue axle counter and MUX is not so reliable and therefore Block Proving by Axle Counter using UFSBI & SSDAC for single line & double line has been developed by M/s Deltron/Kolkata who is an approved vendor. One more source (M/s Webfill, Kolkata) is also developed and approved as per RDSO/SPN/188/2004 specification under limited supply for Double line section.

Further, Solid State Block Proving by Axle Counter (SSBPAC) is under development by M/s Efftronics as per RDSO/SPN/175/2005. In this system, the relay logic has been replaced by solid state logic thereby reducing the total number of relays from about 40 to 10 which is expected to improve the reliability. Field trials of prototype equipments, one each in double line & single line section, are completed and system is ready for standalone Field trial on Vijayawada division of S.C.Rly. Hardware/software validation of the system has been completed. Standalone field trials shall be started shortly. SC Railway is processing for CRS clearance for trials.

Development of High Availability SSDAC

SSDAC is used in block proving and other applications where availability requirement is high. To increase the availability, a system has been developed using redundant architecture having duplicated electronics and redundant communication channel. This system will remain operational even if one part of electronics or one communication channel has failed. In most scenarios, the working system will automatically reset the failed system without any intervention from operator or maintainer. This system has been deployed for field trial and will be approved shortly based on field trial results.

Design & Development of Electronic Interlocking (EI) System

With development of modern fault tolerant and fail-safety techniques, electronics and particularly microprocessors have found acceptance in the area of Railway signalling world over including Electronic Interlocking. The features like software based interlocking logic, less wiring, easy alterations, self diagnostic, in-built data logger etc. make it maintainer friendly. Two types of indigenous EIs are being developed.

Indigenous 2 out of 2 EI with hot standby has been developed by M/s. Medha Servo Drives Pvt. Ltd., Hyderabad. After successful completion of functional testing of these types of modules and functional & acceptance tests on the field model, the field trials in...
parallel with existing Panel Interlocking started from January 09. After receipt of feedback from South Central Railway and validators, the parallel trials were completed in June 2009. After receipt of environmental tests reports and scheme for Phase II series mode field trial by RDSO, the field trials in standalone series mode have started in August 2009 and completed in January 2010. After successful field trial, provisional approval has been given to the firm to supply 10 equipments in Sept.10 for performance assessment.

Development of 2 out of 3 EI with Object Controller is being done by M/s HBL Power Systems, Hyderabad against a sanctioned project. The field trials for the EI were started at Falaknuma station of S.C. Railway in May 2007. The trial of EI in parallel to existing RRI was completed during September 2008. Field trials in standalone series mode have been completed in April 2009. Also, Lab model has been commissioned in RDSO during March 2009. The extended standalone series trial has been completed and reports are being analysed.

New specification of EI for big yards (more than 200 routes) has been discussed in SSC and approved by Railway Board as per SSC recommendations.

**Development of Battery Operated LED Based Torch Cum Hand Signal Lamp**

A Hand Signal Lamp is a hand held device which is very useful for various categories of railway staff to properly discharge their duties related to safe train running. Display of either red or green light can be done to exchange safety related information among various railway staff. Hand signal lamp can also be used as a torch at night. Existing HS lamps suffer from poor illumination, low visibility and low battery life besides other quality related problems. Hence, development of battery operated LED based torch cum hand signal lamp was taken up by RDSO. Specification No. RDSO/SPN/195/2008 Revision: 2.0 (draft) has been issued. Based on new RDSO Specification, prototype samples have been developed and evaluated by RDSO. The developed Battery operated LED Based Torch Light-cum-Hand Signal Lamp is a lightweight, rugged, maintenance-free and user-friendly device with better visibility and ease of operation. This is powered by commercially available dry cell batteries. After successful passing of type tests, four vendors have been cleared for field trial. Trials are undergoing for equipments from 3 vendors and performance feedback for one vendor has so far been received from railways and is generally good.

**Development of Battery operated LED based Tail Lamp**

Tail lamp used at the last vehicle is to alert any vehicle in rear of a train. Development of an improved version of flashing tail lamps with improved visibility and better life was undertaken by RDSO and RDSO specification no. RDSO/SPN/200/2010 (draft) was issued for development of LED based flashing Tail Lamps. Based on new RDSO Specification, prototype samples have been developed and evaluated by RDSO. The developed Tail Lamp is powered by commercially available dry cell batteries and is better in construction quality, visibility and is user friendly. After successful passing of type tests, two vendors have been cleared for field trial.

**Review of present design of LED signals for interchangeability among various makes and enhancement in reliability**

Existing main LED signals suffer from the limitation that LED signal of one make/ version is not replaceable by another make/ version due to discrete modules of LED lighting unit, current regulator and HMU. Also reliability of current regulators is a concern.

To overcome existing limitations and improve reliability, development of the improved LED signal lamp with integrated current regulator for main colour light signal to enable one to one replacement of lamp irrespective of make/ version with improved reliability was taken. Prototype samples of LED signal lamp with integrated current regulator for main colour light signal have been developed and evaluated. Three vendors are cleared for trial at one station each of Central, North Western and Eastern Railways. Performance feedback has so far been obtained from Eastern Railway which is satisfactory.

Several design improvements like inclusion of line filter to suppress power surges, diodes and capacitors of bridge rectifier circuit in series-parallel combination for redundancy, replacement of external load resistance by standard SMD resistances in series-parallel combination for redundancy and better heat dissipation, improvement in design of body for better heat dissipation, removal of jumper selection/ separate unit of current regulator/ connectors have been incorporated based on failure analyses and feedback.
from railways and vendors over the period to improve reliability. HMU is removed. Instead, terminal blocks of international standard with fuse link of 400mA and a MOV are provided. LED signal lamps are designed for use with AC LED ECR only to avoid unnecessary power wastage, confusion at site and for simplification in design and improvement in reliability. Recommendations of a working group formed for this purpose have been sent to Railway Board for approval. 

Development of Train Protection & Warning System (TPWS)

Train Protection & Warning System (TPWS) provides a network of loco & station TCAS units communicating with each other within certain range of communication, to avoid collision between the trains. Trials of Anti Collision Device (ACD) of KRCL without Guard & LC Gate units were recently carried out on S.Rly. In Sep. 2010 & again in Jan. 2011. Further modification in ACD software is being done by KRCL based on these trials.

RDSO has revised existing specification of TCAS in the light of removal of Guard & LC gate units and the experience gained during the ACD trials. The draft specification was uploaded on RDSO's website. The comments received have been examined & draft specification has been modified. EOI has been floated for finalizing the specification & developing the vendors for TCAS.

Reliability improvement of IPS

Based on analysis of failures given by Railways, approved firms and technical audits conducted by RDSO, following steps have been taken to further improve reliability of IPS as per RDSO/SPN/165/2004 -

- Provision of Alarm & indication as and when 110V battery gets disconnected from the circuit.
- Provision of changeover arrangement of Inverters using Static switch instead of relay /contactor based changeover arrangement with reduction in changeover time from 250ms to <60ms.
- To reduce / rationalise types of DC-DC converter modules used in IPS, development of 12-40V/5A,10A and 40-100V/1A Converters done for overall reduction in types of modules from 15 nos. to 06 nos.
- Separate wall mountable output distribution box developed for terminating all AC & DC supplies from IPS alongwith suitable class C/D SPDs. Drawing has been issued for standardisation.

Reliability improvement of Electric Lifting Barrier

Several Railways in the recent past have reported failures/complaints related to frequent poor strength of existing Al boom. The booms were getting damaged/out of shape due to vehicles crossing beneath the gate as well as due to wind pressure. In order to improve the strength and reliability, RDSO has developed a standard drawing RDSO/S 11600 of boom of GI material in Octagonal shape with tapering cross section and
telescopic jointing arrangement. The weight of the boom is approx. same as that of present Al boom for ease of replacement. 05 firms have been given approval for supply of improved GI booms.

Other major failure reported by Zonal Railways in Electric Lifting Barrier was related to magnet proximity switch for boom detection and locking lever & solenoid based locking/ unlocking arrangement. In order to improve reliability, motorized locking/ unlocking arrangement with limit switches has been developed. 05 firms have been given approval to supply improved motorized locking/unlocking arrangement.

Further, the specification of Electric lifting barrier RDSO/SPN/180/2005 has been modified to incorporate the above two improvements including following other improvements and the modified specification shall be issued shortly:

- Powder coating of all the mechanism cases and boom made mandatory to ensure quality of painting.
- Use of stainless steel nuts and bolts made mandatory.
- Provision of rubber grommats at cable enterance in mechanism cases to prevent chaffing of insulation of cables.
- Sheet thickness for mechanism case standardized as CRC of 1.6mm thickness.
- Use of hard chrome electroplated or powder coated main shaft to prevent rusting/ wearing out.
- Provision of adequate spares and tool kit with each set of Electric lifting barrier.
- Introduction of certificate of fitness of installation by OEM for each Electric lifting barrier being commissioned.

**Code of Practice for Earthing & Bonding System for Signalling Equipments**

Signalling equipments with solid state components are more susceptible to damage due to surges, transients and over voltages being encountered in the system due to lightning, sub-station switching etc. These signalling equipments include Electronic Interlocking, Integrated Power supply equipment, Digital Axle counter, Data logger etc.

An effective, low resistance earthing & bonding system is essential to efficiently dissipate fault currents and electrical surges to protect equipment being damaged and to also protect the personnel who work within the area from electrical shock.

Hence, Code of Practice RDSO/SPN/197/2008 for Earthing & Bonding system for signalling equipments have been issued. After successful field trial at few locations on Zonal Railways, 02 vendors have been approved for supply of material and installation as per specification.

**Development of Line Silver Contact**

In the existing design of plug-in type (Metal to Carbon) relay, dome shaped silver contacts are being used, in which point contact is made with SIG contact. To avoid the problem of high contact resistance silver line contact having more area of contact are being tried out. Sample relays with line silver contact have been tested for 6 lakhs operations and results are encouraging. Further, 50 sample relays have been manufactured and installed for observing performance in the field.

**Guidelines for Using Weld Material for Track Circuit Applications**

With a view to increase the reliability and performance of track circuits, weld material for track circuit applications to make reliable & permanent electrical bond connection between two conductors as per IRS:S 103/2004 is being used by Zonal Railways. Proper installation of bonds with rail using weld material is also
very important aspect for reliability of track connections. Therefore, the "Guidelines for using weld material for track circuit applications" have been issued for the benefit of users in the field.

**Procedure for Competency Certificate of Welding Technician for Track Circuit Application**

Proper installation of exothermic/pin brazing bonds with rail using weld material is very important aspect for reliability of track connections as well as integrity of rail. Welding technicians of the firms doing the welding in the field are trained by the RDSO recommended firms themselves. However, a competency certificate to welding technicians trained by these firms shall be issued by RDSO. The procedure for ascertaining competency of welding technician for track circuit application has been finalized with M&C Directorate. The competency of welding technicians of 6 firms have been completed.

**IMPORTANT ACTIVITIES IN SIGNAL LAB**

**Increase of 41% in no. of Tests Completed in Two Years**

Increase of 41% in no. of tests completed is recorded in last two years. Appreciably, large no. of test reports i.e. 404 of vital signalling safety items submitted during the year 2010-11. The rigorous testing of these items includes life test and all type of climatic/ environmental tests apart from performance tests. The tests including initial/ developmental test, maintenance type test, investigation tests and climatic tests.

**Type of Tests**

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<tr>
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**Earnings increased by 100% over last two years**

Earning of Rs.110 lakhs realized against testing charges of signalling items as against Rs.56 lakhs in 2008-09.

**Modernization of Signal Lab**

- With the upcoming of advance signalling items like SSI, Digital Axle Counter, AFTC, LED Signal lamp etc., it is necessary to provide testing facilities in Signal Lab for testing of these advance signalling items in addition to the existing signalling safety items. Work of modernization of signal lab at the cost of Rs.2.73 Crores is prepared and included in Pink Book 2008-09.
- Detailed estimate has been sanctioned at the cost of Rs. 3.34 crores.
- Indents of Rs.2.17 Crores have been forwarded to Stores for the work of 'Modernisation of Signal Lab'. Technical suitability of 112 cases completed and submitted to Store. Purchase Order of 108 items of value Rs.165 lakhs have been issued. 86 equipments of value Rs.105 lakhs have been supplied so far.