

Signal and Telecom

Signalling

To increase Efficiency and to enhance Safety in train operations, Advanced Signalling System with Panel Interlocking/Route Relay interlocking/ Electronic Interlocking (PI/RRI/EI) along with Multi Aspect Colour Light Signals have been progressively provided at 5,584 stations covering about 88% of the interlocked Broad Gauge stations on Indian Railways, replacing the obsolete Multi Cabin Mechanical Signalling system involving a large number of human interfaces. Route Relay Interlocking (RRI) at 12 major stations namely, Kurla, Akola, Erode Jn, Villupuram, Palakkad Jn, Dindigul, Tiruchchirapalli Jn, Vijaywada, Gamharia, Hajipur, Jhajha and Aligarh with Panel Interlocking at 169 Stations and Electronic Interlocking at 165 stations have been provided during the year 2016-17.

Complete Track Circuiting: has been done upto 100%, 99.8%, 99.6% and 97.8% on A, B, C and D routes respectively. Fouling Mark to Fouling Mark track circuiting on 'A', 'B', 'C', 'D Special' and 'E Special' routes, where permissible speeds are more than 75 kilometers per hour on passenger line, has been completed.

Block Proving Axle Counter (BPAC): To enhance safety, automatic verification of complete arrival of train at a station, Block Proving Axle Counter (BPAC) is being provided at stations having centralized operation of points and signals. As on 31.03.2017 Block Proving Axle Counter (BPAC) has been provided on 4,976 block sections.

Axle Counter for Train detection: Conventional D.C. track circuits are dependent on track and other engineering parameters. Therefore axle counters are being provided to improve reliability of train detection in line with Kakodkar Committee recommendations.

Intermediate Block Signalling: Provision of Intermediate Block Signalling (IBS) has proved very useful in enhancing line capacity without extra recurring revenue expenditure in the form of manpower and amenities required while developing and operating a block station. As on 31.03.2017, Intermediate Block Signalling has been provided in 501 block sections on Indian Railways.

Automatic Block Signalling: For augmenting line capacity and reducing headway on existing High Density Routes on Indian Railways, Signalling provides a low cost solution by provision of Automatic Block Signalling. As on 31.03.2017, Automatic Block Signalling has been provided on 2,866 Route Kms.

Besides, mini Integrated Power supply (IPS) has been developed to provide stable source of power supply for Signalling system at interlocked Level Crossing Gates, Intermediate Block Signalling and Automatic Signalling Goomties.



Relay Room of Gamharia station, SER



Relay Room of Gamharia station, SER



VSAT Hub at New Delhi

Automatic Train Protection (ATP)

Train Protection & Warning System (TPWS): Train Protection & Warning System (TPWS) has capability to control the speed of train in accordance with the sectional permitted speed and signal aspect ahead, by automatic actuation of brakes, in case loco pilot fails to do so in time. Thus, it mitigates safety risk of accidents/collisions due to loco pilot's error of Signal Passing at Danger or over speeding. TPWS also reduces delay during foggy weather. It is based on a proven European train protection technology which is deployed extensively on World Railways. TPWS based on this proven technology has been operationalized on 342 RKMs on Indian Railways.

Introduction of this technology on high density network of Indian Railway is being given priority. TPWS works have been sanctioned on 3,330 RKM for Automatic Signalling/High Density Routes on Eastern, South Eastern, Western, North Central, Central, Northern, Southern and South Central Railways.

Train Collision Avoidance System (TCAS): TCAS is an indigenously developed Automatic Train Protection System. A developmental project is being undertaken on a limited section of Lingampalli-Vikarabad-Wadi-Bidar section (250 km) and 40 locos on South Central Railway. Operational deployment of TCAS on Railways in Absolute Block Signalling sections will be taken-up after successful conclusion of the extended field trials and safety certification of system by ISA (Independent Safety Assessor).

Centralized Traffic Control (CTC) in Indian Railways: In a first of its kind on Indian Railways, a Centralized Traffic Control (CTC) with electronic interlocking and automatic signalling system is being set up on the Ghaziabad-Kanpur route-one of the busiest sections of Indian Railways.

CTC System provides for remote operation of signals from a centralized control office and will help in real time monitoring and better management of trains.

Train Management System (TMS): TMS helps in real-time monitoring of trains in the control room. The arrival status of local trains is displayed on indicators installed on platforms in the form of a countdown timer (in minutes) to the train's arrival on the platform accompanied by automatic announcements on platforms.

TMS has been provided on Mumbai suburban section of Western and Central Railway. On WR, it covers the section from Churchgate to Virar extending over 60 km covering 28 stations and on CR it covers suburban section from CST Mumbai to Kalyan extending over 54 km covering 26 stations. TMS work is also nearing completion on Howrah Division of Eastern Railway.

Interlocking of Level Crossing Gates: This has been a major area of concern. Indian Railways have provided interlocking with Signals at 10,826 Level Crossing Gates to enhance the safety at Level Crossings.



TMS Screen in Mumbai

Initiative has been taken to Interlock Level Crossing gate with Train Vehicle Units of 20,000 and above.

Sliding Boom: Provision of Interlocked Sliding Boom has become very effective in minimising disruption to train services when Level Crossing Gates get damaged by road vehicles specially in suburban areas. 2,991 Nos. of busy interlocked gates have been provided with Sliding booms.

Earth Leakage Detector (ELD): To overcome the problem of getting blocks for cable meggering due to increasing traffic density, ELDs have been developed and are being provided over Indian Railways. ELD will detect low insulation in cables on line, so that signal staff can check the health conditions of that cable group in advance and prevent a possible failure in future.



Model of Train Protection and Warning System at Electrical Signalling lab, IRISSET

Growth of Signalling

Growth of deployment of Signalling on Indian Railways:			As on 31.03.2017	
Item	March'14	March'15	March'16	March'17
Panel Interlocking (Stations)	4,200	4,195	4,107	4,155
Route Relay Interlocking (Stations)	276	280	281	281
Electronic Interlocking(Stations)	735	842	1,005	1,148
PI/RR/IEI (Stations)	5,211	5,317	5,393	5,584
MACLS (Stations)	5,658	5,772	5,832	6,000
Track Circuiting (Locations)	30,509	31,073	31,737	33,054
Block Proving Axle Counter (Block sections)	4,175	4,585	4,640	4,976
LED Lit Signals (No. of Stations)	5,449	5,599	5,732	5,917
Data logger(Stations)	5,292	5,460	5,587	5,758
Automatic Signalling (Route Kms)	2,623	2,715	2,752	2,866
Intermediate Block Signalling (Block sections)	449	475	489	501
Interlocked Gates (No.)	10,493	10,513	10,776	10,826

Telecommunication

Telecommunication plays an important role in train control, operation and safety on IR. Indian Railways has set up a State of the Art, nationwide telecom network for meeting its communication needs. RailTel, a Railways Central Public Sector Enterprise formed in September, 2000 is successfully exploiting surplus capacity of IR Telecom network commercially.

As on March 2017, Indian Railways has about 51,247 Route Kilometers of Optical Fibre Cable (OFC) that is carrying Gigabits of traffic. Railways Control Communication which is quintessential for train operation and control



Model view of ICF Regional Rail Museum



Route Relay Interlocking cabin

is also being transferred to OFC system. Till date, control communication on 48,893 Rkm has been shifted on OFC system. This OFC network is also contributing significantly in building National Knowledge Network through RailTel. It is also planning to provide Broadband connectivity to Panchayats through this OFC network. Railways have planned Wi-Fi facility to be provided at 709 stations to passengers which will aid in “Digital India” initiatives of Govt. of India. RailTel Corporation of India in association with Google has planned for providing Wi-Fi internet facility at 405 stations without any expenditure by Ministry of Railways and with revenue sharing model.

To enhance the security of passengers & premises and to work as a strong deterrent to crime in station premises particularly those against women and children, IR has planned to provide Video Surveillance System at 983 A1, A, B & C category stations chargeable under ‘Nirbhaya Fund’. In addition to these 983 stations, Video Surveillance System at 202 more stations has been sanctioned under ISS works, out of which 71 stations have been commissioned so far i.e. upto 31.8.2017.

Indian Railways have planned to provide a centrally managed Railway Display Network (RDN) at 2,000 stations consisting of more than one lakh display screens at stations. This system is useful for providing Train Information, Disaster Management through centrally broadcasted emergency messages, socially relevant messages and advertisements to generate revenue. Presently Proof of Concept (PoC) at 16 stations has been done. Indian Railways have decided to adopt Global System of Mobile Communication-Railways (GSM-R) based Mobile Train Radio Communication. The same has already been provided on 2,461 Route Kms and is being extended in balance ‘A,’B’ & ‘C’ routes.

Indian Railways has its own satellite hub that is being utilized for connecting remote locations for Freight Operation Information System (FOIS), Unreserved Ticketing System (UTS), Disaster Management System as well as for other critical communication needs. Besides, IR network uses 16,318 data circuits that power its various data and voice networks across the country.

Railways have also established Multi-Protocol Level Switching (MPLS) based Next Generation Network (NGN) for voice traffic. This Next Generation Network (NGN) has been used to interconnect more than 100 exchanges of Railways carrying the administrative voice traffic. Common User Group (CUG) mobile phones have also been hired to enable communication while on the move to enhance safety, reliability and productivity. IR is also using 1.44 lakh VHF walkie-talkies sets to ensure safety and enhance reliability. Broadband has recently been provided on IR in all its major colonies in zonal and divisional headquarters. Telecom also plays a major role in ensuring passenger comfort. For the convenience of passengers, Train Information Boards have been provided at 1,090 Stations, Public Address (PA) Systems at 4,893 stations and Coach Guidance System at 556 stations.



LED Signals - front and back view

RailTel Corporation is speeding the adoption of latest telecom technologies in Railways. Besides earning revenue from the spare capacity of Telecom Network of Railways, it is also modernizing the same. It has set up a State-of-the-Art MPLS network that is used for providing Internet and L3-VPN services. The Enterprise WAN of Railway- Railnet Works as an L3-VPN on this MPLS network. It has also setup STM-4, STM-16, STM-64 and DWDM networks to carry data across the length and breadth of the country. It is involved in major Government projects like National Knowledge Network (NKN) & National OFC Network (NOFN), thereby contributing to the growth of the nation.

RailTel has also setup a next-generation- network to carry voice across the country. Point-of-interconnect has been established with all major telecom operators of the country. All zonal and divisional railway exchanges have also been connected to the NGN thereby modernizing the Railways voice STD network.



A view of IRISSET building, Secunderabad

Important Telecom assets are tabulated below:

S. No.	Installation	Units	As on	As on
			31.03.2016	31.03.2017
1.	Optical Fibre Cable	Rkms	49,434	51,247
2.	Quad Cable	Rkms	58,980	60,458
3.	Railway Telephone Subscribers Lines	Nos.	3,95,816	3,95,816
4.	No. of Control Sections provided with Dual Tone Multiple Frequency (DTMF) Control equipment	Nos.	322	322
5.	Mobile Train Radio communication System (Route kms)			
	a. GSM (R) based	Rkms	2,461	2,461
	b. TETRA based	Rkms	53	53
6.	Digital Microwave (7 GHz)	Rkms	1,852	1,812
7.	Public Address System	No. of Stns.	4,780	4,893
8.	Train Display Boards	No. of Stns.	1,090	1,090
9.	Coach Guidance System	No. of Stns.	534	556
10.	VHF Sets			
	a. 5 Watt sets (Hand held)	Nos.	1,45,947	1,44,040
	b. 25 Watt sets (At Stations)	Nos.	9,461	9,425
11.	V SAT	Nos.	1,117	881
12.	Railnet Connections	Nos.	1,30,185	1,30,185
13.	UTS/PRS Circuits	Nos.	10,760	10,839
14.	FOIS Circuits	Nos.	2,209	2,219
15.	NGN & Exchange Circuits	Nos.	2,429	2,536