

**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

**LOK SABHA
STARRED QUESTION NO. 82
TO BE ANSWERED ON 08.02.2017**

SAFETY TECHNOLOGY

***82. SHRI T.RADHAKRISHNAN:
SHRI S.R. VIJAYAKUMAR:**

Will the Minister of RAILWAYS be pleased to state:

- (a) whether the Railways has decided to procure latest safety technology on 'war footing' in the wake of two recent derailments to ensure passenger safety and reduce dependency on manual systems;**
- (b) if so, the details thereof and the expenditure likely to be incurred thereon;**
- (c) the time by which the technology is likely to be put into use;**
- (d) whether the Railways also proposes to seek foreign assistance in assessing and augmenting safety mechanism; and**
- (e) if so, the details thereof and the present status of special railway safety fund?**

ANSWER

MINISTER OF RAILWAYS

(SHRI SURESH PRABHAKAR PRABHU)

(a) to (e): A Statement is laid on the Table of the House.

STATEMENT REFERRED TO IN REPLY TO PARTS (a) TO (e) OF STARRED QUESTION NO. 82 BY SHRI T. RADHAKRISHNAN AND SHRI S. R. VIJAYAKUMAR TO BE ANSWERED IN LOK SABHA ON 08.02.2017 REGARDING SAFETY TECHNOLOGY

(a) to (c) : Indian Railways accord highest priority to safety in train operations. Consequential train accidents have declined from 195 in 2006-07 to 135 in 2014-15 and further to 107 in 2015-16. Number of consequential train accidents remained at a level of 95 during 2015-16 and 2016-17 (from 1st April 2016 to 6th February 2017). Accidents Per Million Train Kilometres, an important index of safety, has come down from 0.23 in 2006-07 to 0.11 in 2014-15 and further to 0.10 (approximately) in 2015-16. All possible steps are undertaken on a continual basis including up-gradation of technology to aid safe running of trains.

Railways are inducting modern technology on regular basis.

Safety Measures taken to reduce accidents on Indian Railways:

Indian Railways classify accidents in the following broad categories:

- i) Collisions**
- ii) Derailments**
- iii) Accidents at Level crossings**
- iv) Fire in Trains**
- v) Miscellaneous/ Other Accidents.**

1. COLLISIONS:

Collision is an accident in which two trains collide due to over shooting of signals, failure of signaling systems or due to human failures.

Measures taken to reduce collisions including various new technologies:

Technological aids of Automatic Train Protection System to drivers (loco pilots) to avoid collisions have been progressively adopted on Indian Railways keeping priority for high density routes/ suburban sections within the constraints of resources. These technological aids are:

Vigilance Control Device (VCD) for avoiding collisions and checking alertness of Loco Pilots

- **Vigilance Control Device is a system provided in the locomotives. This device monitors the alertness of the driver through all normal actions performed by him while driving, such as use of throttle handle, braking, horn, etc. If the Loco Pilot performs no action for a certain time interval, he gets audio-visual indications, and if still, he does not react, emergency brakes get applied automatically. All the diesel and electric locomotives on Indian Railways have now been provided with VCDs.**

Simulator based training of loco pilots: Simulator based training is being imparted to loco pilots to improve their driving skills and reaction time.

Automatic Train Protection (ATP) System:

Train Protection Warning System (TPWS)

- **Train protection and Warning System (TPWS): Train Protection and Warning System (TPWS) is based on proven European train control system (ETCS L-1) Technology for mitigating safety risk arising due to driver's error of Signal Passing At Danger (SPAD) or over-speeding which may lead to collision.**

- i. TPWS is functional on Chennai to Gummidipundi (50 RKM) and Chennai (Basin Bridge) to Arakkonam (67 RKM) on suburban section of Southern Railway.**
- ii. Non Suburban section of Delhi to Agra (200 RKM) and**
- iii. On Kolkata Metro from Kavi Subhash to Dumdum (25RKM) section.**

TPWS works have been sanctioned on 3330 RKM. In first phase, work on Suburban sections covering 1240 RKM on Eastern, South Eastern, Northern, Southern and South Central Railways have been taken up for implementation.

Train Collision Avoidance System (TCAS):

Research Designs and Standards Organization (RDSO) in association with Indian Vendors has taken up a pilot project for indigenous development of a cost effective safety system called Train Collision Avoidance System (TCAS). TCAS deploys radio communication for transmission of movement authority from track side to the Locomotive. This system is aimed at providing capability of preventing train accidents caused due to Signal Passing at Danger (SPAD) or over speeding by train drivers. The system has a feature of reflecting signal system in the locomotive cab.

After successful Proof of Concept trials of TCAS, RDSO has taken up extended field trials of TCAS on a pilot section Lingamapalli-Vikarabad-Wadi-Bidar (250 Route km) section of South Central Railway. After completion of all field works equipment deployments trials on seven pair of passenger trains have already commenced. Safety validation of the system has also been taken up by the Independent Safety Assessor (ISA).

Other Measures to Prevent Collisions

- **Electrical/Electronic Interlocking System with centralized operation of points and signals to eliminate human failure and to replace old outdated mechanical systems Electrical/Electronic Interlocking has been provided at 5551 stations upto December 2016.**
- **Complete Track Circuiting of the station to enhance safety by verification of track occupancy by electrical means instead of human element is completed at about 5751 stations upto December 2016.**
- **Axle Counter for Automatic clearance of Block Section (BPAC), to ensure complete arrival of train and that no left over vehicle has left in the station before granting line clear is provided on 4894 block sections upto December 2016.**
- **Interlocking of Level Crossing Gates, to protect L.C Gate with signals to avoid accidents has been progressively done at 10929 gates upto December 2016.**
- **Interlocking of Signalling to Std-II(R): Upgradation of interlocking of signalling system from Std-I to Std-II(R) at 4854 stations has been done as on September 2016.**
- **Modified Automatic Signalling; Modified Automatic Signalling was provided all Automatic Block Signalling Sections on North Central Railway and Northern Railway to handle train operations safely during fog.**

2. DERAILMENTS:

Derailments are accidents where a train leaves its guided path i.e. track.

Measures to Reduce Derailments including new technology:

i) TRACK AND BRIDGES

- **Track Renewal – Track renewal is an ongoing process which is undertaken as and when a stretch of track becomes due for renewal on age-cum-condition basis. Track Renewal works are planned in advance every year and their execution is prioritized according to the condition of track and overall availability of funds ensuring all the time that track is in a sound condition for safe running of trains. In case, if any stretch of track is not renewed in time due to various reasons including scarcity of funds, material etc., suitable speed restrictions are imposed to ensure safe running of trains. The achievement of track renewals during last two and current year is as under:**

Year	Physical Progress (in Km)	
	Target	Achievement
2014-15	2200	2424
2015-16	2500	2794
2016-17 (Upto October 2016)	2668	1306

- **In order to improve safety, modern track structure consisting of Prestressed Concrete Sleeper (PSC), 52 kg/60kg, 90 or higher Ultimate Tensile Strength (UTS) rails, fanshaped layout on PSC sleepers, Steel Channel Sleepers on girder bridges is used while carrying out primary track renewals. Further it has been decided to lay Thick web switches, Weldable Cast Maganese Steel crossings on identified routes. Presently, percentage track laid with PSC sleepers, 60 kg rails etc. is as under:**

ITEM	All Gauge	BG
Track on Concrete sleeper	93.34%	98.96%
Long Welded Track	83.50%	89.12%
Track on 52kg Rails	52.16%	55.47%
Track on 60kg Rails	41.01%	43.95 %

- **Technology of Alumino Thermit (AT) welds has been upgraded by introduction of Auto weigh method, pre-heating with compressed air petrol and 3 piece moulds, so as to upgrade the quality and reliability of welds.**
- **Long rail panels of 260 M/130M. Lengths are being manufactured at the steel plant to minimize number of Alumino Thermit/Flash Butt welding joints in the track.**
- **Provision of Thick Web Switches (TWS) is planned for all important routes of IR. To expedite provision of TWS, procurement of Thick Web Switches has been decentralized to zonal railways.**
- **Indian Railways have developed design and drawings for weldable Cast Manganese Steel (CMS) crossings on existing PSC sleepers for 60 kg 1 in 12 & 60 kg 1 in 8.5 Turnouts which eliminates fish plated joints for its connection with adjoining rails. It is planned to provide Weldable CMS Crossings on all important routes on Indian Railways.**
- **Head Hardened Rails have been planned to use at sharp curves, steep gradients and on predominantly freight routes with 25 t axle load regular operation.**
- **To enhance asset reliability of rails, policy guidelines have been issued to zonal railways. AT welding of rails is being reduced and Flash Butt Welding of rails is increased to reduce weld failures.**

Ultrasonic Flaw Detection (USFD) Testing of Rails/Welds :

Analogue type of machines for Ultrasonic Flaw Detection (USFD) testing of rails have been replaced with digital type of machines which are more reliable. Presently USFD testing is being carried out as per laid down frequency.

Progress of USFD testing during current year and previous three years has been as under :

YEAR	TARGET IN TRACK KILOMETERS (TKMS)	PROGRESS IN TKMS
2013-14	358255	353967
2014-15	347205	356268
2015-16	363634	364356
2016-17 (upto December 2016)	269677	285334

Vehicular USFD System, Self Propelled Ultrasonic Rail Testing (SPURT Car):

Decision to use Vehicle bound USFD testing has been taken to ensure faster as well as more reliable testing as it would cover larger cross-sectional area of rail. One tender has been called by Northern Railway for 30400 Tkm of USFD testing on Rajdhani routes between New Delhi-Mugalsarai and New Delhi- Ratlam sections of Indian Railways. Initially 6 nos. SPURT (Self Propelled Ultrasonic Rail Testing) Cars will be used for USFD testing of rails on Indian Railways. Procurement of these 6 nos. SPURT cars have been included in Rolling Stock Program 2017-2018 at total cost of ₹186.24 crores.

- **An elaborate schedule of inspections of track has been laid down for Keymen, Mate, Junior Engineer (Permanent-way), Section Engineer (Permanent-way), Assistant Engineer and Divisional Engineer. Higher officials not only conduct technical inspections but also keep check on quantity and quality of inspections conducted by their juniors. Similarly, a well defined system exists for inspection for bridges.**
- **Electronic monitoring of track geometry is carried out with Track Recording Cars (TRC) and Portable Oscillation Monitoring (OMS) Systems to detect track geometry defects for planning maintenance as per laid down frequency based on Gross Million Tonne (GMT) of the section.**

Further, two more TRCs with axle box mounted accelerometer with video recording have been included in Rolling Stock Program 2017-18 at a cost of ₹39.2 crores.

Maintenance inputs are given to track and bridges as per requirement noticed during manual inspections, TRC & OMS runs and USFD testing to keep track in safe condition.

Composite Sleepers:

Based on the performance of composite sleepers during field trials and on recommendation of a special committee, composite sleepers have been adopted for regular use over IR to be used mainly over steel girder bridges. Accordingly a global tender for “Manufacturing and Supply” of 2.53 lac composite sleepers to various Zonal Railway by setting up plant in India, under “Make in India policy” has been invited, which is due for opening on 20.02.2017.

Trial of Ultrasonic Broken Rail Detection System (UBRDS) for detection of in service Rail & Weld Failure:

Ultrasonic Broken Rail Detection System (UBRDS) used by South African Railway is under trial on Northern Railway and North Central Railway since November 2016. This system works on principle of guided Ultrasonic waves and interrogates continuously welded rail in sections up to one kilometer long using ultrasound waves, and reports breaks at time intervals down to a few minutes.

The approx. Cost of trial for above 50 KM Track Length is USD 833496 (₹5.56 Cr). The locations of trial are as under :

SN	Railway	Major Section	Block Sections	Km	
				From	To
1	Northern Railway	Moradabad - Saharanpur	Roorkee-Hindon Cabin (Up line)	1559	1584
2	North Central Railway	Allahabad-Kanpur Section	Bamhraul-Bharwari (Up Line)	835	860

- **Modern Bridge Inspection and Management System: Modern bridge inspection and management system has been adopted, which includes non-destructive testing techniques, under water inspections, intelligent water level monitoring system, mapping unknown foundations and integrity testing, etc.**
- **Patrolling of Railway Tracks: During adverse weather conditions patrolling of railway tracks including night patrolling is carried out at vulnerable locations regularly.**

ii) ROLLING STOCK

- **Centre Buffer Coupler: Progressive fitment of tight lock Centre Buffer Coupler (CBC) in lieu of screw coupling on new manufacturing of ICF design coaches has been carried out with a view to prevent the coaches from climbing over each other in unfortunate event of an accident. So far, 2900 Linke Hofmann Busch (LHB) coaches, 425**

Hybrid Stainless Steel Coaches and 1340 Conventional ICF Design Coaches have been manufactured with Centre Buffer Couplers. Design of CBC has been upgraded to mitigate problem of jerks during acceleration/deceleration of trains.

- **Proliferation of LHB coaches for improving Safety: *A policy decision has been taken to manufacture only LHB coaches from 2018-19 onwards.* It has been decided to completely switchover to production of LHB type coaches in future. It has been decided to manufacture 3025 LHB coaches in 2018-19 as against 1697 LHB coaches in 2016-17. LHB type coaches have interior crashworthy and anti climbing features. Hitherto these coaches were inducted into premier services such as Rajdhani, Shatabdi and Durantoos but now these are also being inducted into Mail & Express trains as well. Thus proliferation of LHB coaches and development of new variant coaches on LHB design platform would enhance safety in train operation in the long run.**
- **Retro fitment of CBC on ICF coaches: A policy decision has been taken to retro fit CBC ICF coaches in a phased manner. The inherent anti-climbing features of CBC will prevent overriding of coaches one over the other.**
- **Progressive use of Air springs: To maintain constant height at variable load, air spring are being used in secondary suspension of EMU/DMU coaches. These springs shall also be introduced in mainline and LHB coaches to enhance safety and reliability.**

3. MEASURES TAKEN TO CURB UNMANNED LEVEL CROSSINGS

ACCIDENTS (UMLC):

To Curb Accidents at Unmanned Level Crossings elimination of UMLCs through various means has been attempted:

- It has been decided to progressively eliminate all unmanned level crossings by (i) closing unmanned crossings having NIL/negligible Train Vehicle Units (TVUs), (ii) merger of unmanned level crossing with nearby unmanned/manned gates or Road Under Bridge or Road Over Bridge or Subway by construction of diversion road, (iii) provision of Subways/Road Under Bridges. The Unmanned Level Crossings which cannot be eliminated by the above means, will be progressively manned based on the volume of rail road traffic (TVU) and visibility conditions.

Total No. of Level crossings on Indian railways (as on 1-4-2016)

On Broad Gauge (BG) : 6388 nos.

On Metre Gauge (MG)/Narrow Gauge (NG) : 2952 nos.

Total : 9340 nos.

Target for elimination of UMLC in 2016-17 : 1440 nos.

Year wise elimination UMLC (in nos.)

2013-14	2014-15	2015-16	2016-17 Upto December 2016
1102	1148	1253	992

It has been announced in the Railway Budget 2016-17 that Indian Railways will eliminate all existing UMLCS on BG within the next 3-4 years.

- **Containing the proliferation of Level Crossings (LCs) at source: A policy decision has been taken not to permit any new LC either on existing line or any new line/ gauge conversion to be commissioned henceforth. However only in exceptional cases, retention of unmanned**

LCs on new line or gauge conversion can be permitted with the approval of Railway Board.

Ensuring Basic Infrastructure:

- **Provision of basic infrastructure on all unmanned level crossings which includes provision of appropriate visibility, width, gradient, level surface on either side from centre of the nearest track, whistle boards, road warning boards, surface of the approach road and speed breakers/rumble strips as per laid down standards.**
- **Periodic inspection of such crossings to ensure the above and for taking corrective action, if any.**
- **Instructions have also been issued to zonal railways to install a 2nd Whistle Board (Repeater) for level crossings at a distance of 250 meters in advance of the level crossings for the loco drivers to whistle while approaching UMLC/ MLC to warn the road users.**

Education of road users:

- **Social awareness campaigns to educate road users with the use of various print and electronic media for observance of safe practices prescribed in Motor Vehicles Act and Indian Railways Act and joint ambush checks along with civil police to counter misadventure in front of approaching trains.**
- **Zonal railways have also been advised to deploy Gate Mitra/ Gate Counselors to counsel the road vehicle users for observance of safe practice while negotiating UMLCs. As on 1st April, 2016, about 4326 Gate Mitra/Counselors have been deployed on Indian Railways.**

4. MEASURES TAKEN TO PREVENT FIRE IN TRAINS

- **Improving Fire Retardancy in Coaches:**

Coaches are being provided with fire retardant furnishing materials such as Fire retardant curtains, partition panelling, roof ceiling,

flooring, seat and berths along with cushioning material and seat covers, Windows and UIC Vestibules etc. The specifications of these items are being upgraded from time to time as as a part of continual improvement. In the recent past, another parameter called 'Heat Release Rate (HRR)' has been added in the material specification of all major interior furnishing materials used in coaches as per latest European norms.

- **Provision of Automatic Fire and Smoke Detection System in Coaches: Automatic Fire and Smoke Detection System has been provided in 200 coaches running in 9 rakes. As per the latest specification the air brake system has been interfaced with the Fire and Smoke Detection System for stopping the train in emergent situation.**
- **Provision of Water mist type Fire Suppression in pantry cars and power cars:**
Power cars and Pantry cars are relatively more prone to fire and therefore Fire suppression system based on water-mist technology has been decided for a limited numbers of coaches before large scale proliferation.
- **Provision of Fire Extinguishers: Dry chemical powder type fire extinguishers are being provided in all mainline Trains. These are portable fire extinguishers and are easy to use by on board staff or passengers in case of emergency. Fire extinguishers are being provided in all Air-conditioned coaches, Second class – cum – guard and luggage van, Pantry cars and train locomotives.**
- **Use of improved materials for electrical fittings and fixtures such as MCB, light fittings, terminal boards, connectors, etc.**
- **Inspection of Electrical & LPG Fittings in Pantry Cars: Detailed instructions have been issued to zonal railways for observance of**

safe practices in handling of pantry cars and for ensuring periodical inspection of electrical and LPG fittings in the pantry cars.

- **Publicity Campaigns: Intensive publicity campaigns to prevent the travelling public from carrying inflammable goods are regularly undertaken.**

Expenditure for safety is in-built in various relevant plan-heads of Railways. An assessment of the Ministry indicates the following expenditure on safety:

(₹. in crores)

Actual 2015-16	Revised Estimate 2016-17	Budget Estimate 2017-18
45516	63063	69530

(d) & (e): Yes, Madam. Ministry of Railways has entered into Memorandum of Understandings/Agreements with Canada, Japan, Russia and Italy for technical cooperation in rail sector, which inter alia include railway safety as one of the cooperation areas. On invitation of Ministry of Railways, safety experts from Korea have visited India from 15.01.2017 to 24.01.2017 to review and discuss various safety and operational practices. A Japanese delegation comprising of track and signal experts have also come to India on 09.01.2017 to share their expertise on safety. On 31st of January, 2017 an Memorandum of Understanding (MOU) has been signed between Indian Railways and Italy for cooperation on various subjects including railway safety.

In the Budget 2017-18, setting up of a 'Rashtriya Rail Sanraksha Kosh' (RRSK) has been announced with a corpus of ₹1 lakh crores over a period of 5 years. A provision of ₹20,000 crore has been made in Budget Estimate 2017-18 towards 'RRSK' to fund essential safety works. These funds will be used for modernization of track, rolling stock, acquisition of vehicle based USFD machines, on board rolling stock monitoring systems and proliferation of other safety technologies.
