Report of the Comptroller and Auditor General of India

on

Maintenance of track on heavy traffic sections over Indian Railways

for the year ended March 2017

Laid in LokSabha/RajyaSabha on _____

Union Government (Railways)

No.45 of 2017

Preface

This Report has been prepared for submission to the President of India under Article 151 of the Constitution of India.

This Report of the Comptroller and Auditor General of India contains the results of audit of 'Maintenance of tracks on heavy traffic sections over Indian Railways'. The instances mentioned in this Report are those which came to the notice in the course of test audit for the period April 2016 to March 2017 as well as those which came to the notice in earlier years, but could not be reported in the previous Audit Reports.

The audit has been conducted in conformity with the Auditing Standards issued by the Comptroller and Auditor General of India.

Contents

Abbreviations

Abbreviation	Full form
ADEN	Assistant Divisional Engineer
AT Weld	Alumino Thermite Weld
BCM	Ballast Cleaning Machine
CRS	Commissioner for Railway Safety
CTE	Chief Track Engineer
CTR	Complete Track Renewal
CWR	Continuous Welded Rail
DEN	Divisional Engineers
ECR	East Central Railway
FB Weld	Flash Butt Weld
GPS	Geo Positioning System
HDN	High Density Network
LWR	Long Welded Rail
NCR	North Central Railway
OHE	Overhead Equipment
PCE	Principal Chief Engineer
PDA	Personal Digital Assistant
POH	Periodical Overhaul
PSR	Permanent Speed Restriction
PWI	Permanent Way Inspector
RDSO	Research, Designs and Standard Organization
ROH	Routine Overhaul
SER	South Eastern Railway
SR	Southern Railway
SWR	South Western Railway
SEJ	Switch Expansion Joints
SSE	Senior Section Engineer
STM	Small Track Machine
TKM	Track Kilometer
TM	Track Machine
TMO	Track Machine Organisation
TMS	Track Management System
TRC	Track Recording Car
TSR	Through Sleeper Renewal
USFD	Ultrasonic Flaw Detection
UTS	Ultimate Tensile Strength
WILD	Wheel Impact Load Detector

Executive Summary

Indian Railway has 92,084 running track kilometers (as on 1 April 2016). Track or Permanent Way (P-way) is the rail-road on which the trains run. Track structure includes two parallel rails at a specified distance, fastened to sleepers which are embedded in a layer of ballast of defined thickness spread over the formation.

The railway track should be maintained properly in order to enable trains to run safely at the highest permissible speeds and to provide passengers a reasonable level of comfort during the ride. Due to the constant movement of trains, the packing under the sleepers and track geometry gets disturbed, the fittings of the track get undone, there is heavy wear and tear of the track and its components and the gauge and alignment of the track gets affected adversely. The track and its components also get worn out as a result of the weathering effect of rain, sun, and sand. Therefore, if the track is not maintained properly, it will cause discomfort to the passengers and in extreme cases may even give rise to hazardous conditions that can lead to derailments and a consequential loss of life and property.

Track maintenance involve preventive maintenance (periodic maintenance activities), condition monitoring (through inspections and use of technology) and repair of defects noticed. Maintenance activities are carried out using machines as well as manually through a group of railway personnel called track maintainers (trackmen, keyman, gangmen).

The Audit was conducted with a view to assess whether the maintenance of tracks was planned and undertaken following the laid down norms and instructions. Audit also assessed whether the resources/infrastructure required for maintenance of tracks was available and used efficiently and effectively. For this purpose, Audit reviewed 37 selected sections (29 high density routes (HDN) and eight non-HDN routes) of the five Zonal Railways (NCR, ECR, SER, SR and SWR). These section were running with line capacity of 100 *per cent* to 168 *per cent* in 2015-16, except four sections where line capacity was between 90 *per cent* and 99 *per cent*.

Audit observed that track maintenance activities needed to be strengthened and undertaken following the laid down instructions and guidelines. Shortfalls in inspections of tracks by railway officials as per laid down frequency were noticed in the selected sections. Prescribed methods for preventive maintenance of tracks were not being followed effectively/not done adequately. This included ultrasonic flaw detection testing to detect flaws in the track, monitoring of track using track recording cars, installation of wheel impact load detectors to monitor impact of wheels on track in sections where enhanced loading has been permitted, use of GPS based foot plate inspection device etc. There were arrears in periodical maintenance activities such as deep screening of ballast and more efficient methods of welding were not used in all selected sections. Audit noticed that track maintenance activities

were not completely mechanized in all the selected sections. No communication equipment was provided to track maintainers to report any failure, fracture or damage immediately. The formula for assessment of requirement of manpower for track maintenance was frame long back in 2000 and needed revision. Though there were shortages of track maintenance staff in the selected Zonal Railways, many of them were diverted for works other than track maintenance. The block demanded by Engineering Department for maintenance works were not fully made available, and where made available, these were not optimally utilized by the Engineering department.

Important Audit findings

- In NCR and ECR, perspective maintenance plans were not prepared. Though maintenance schedule prescribes planning maintenance works as a preventive measure, SER was doing rectification of deficiencies on inspection. In NCR, ECR and SER, concerned P-way Inspectors who are primarily responsible for maintenance of tracks in the sections were not communicated the Annual Plan in advance for actual deployment of track machines in their sections. Pre-monsoon and post-monsoon inspection activities were not mentioned in the Annual Plan and only need based inspection was carried out in monsoon season in NCR, ECR and SER.

  Para 2.1.1, 2.1.2 and 2.1.3

- In NCR, SER and SWR, the beat of the patrol men was not restricted to one km length of UP and DN line on double line section and it was more than one kilometre on both sides in some of the sections checked in audit. Patrol men were not equipped with any communication equipment to report any failure, fracture or damage immediately from the section where shortcomings and defects in track were observed. Indian Railways has a laid down mechanism through which the track is inspected either visually or using equipment/machines in order to detect flaws in various component of track. Audit noticed shortfalls and deficiencies in inspections carried out at different levels. GPS based foot plate inspection device was not procured by any of the selected five Zonal Railways and inspection of track was carried out through traditional means.

  Para 2.2.1.1, 2.2.1.2 and 2.2.1.3

- Testing of rails using Ultrasonic Flaw Detection (USFD) machines was not being carried out as per the prescribed norms. Test check of five *per cent* of the USFD testing done by the contractor was to be done by railway staff, which was not found to be done in selected sections of NCR and SWR. Also, while provision for capturing scanned images/peak patterns exists in the USFD machine, same were not saved and utilized for scrutiny/analysis during successive USFD tests.

  Para 2.2.1.4

- The Track Machines and Monitoring Directorate of Research, Designs and Standard Organisation (RDSO) is required to monitor the track using Track

Recording Cars (TRC) for assessment of the condition of track, identification of locations needing maintenance and providing data to Railway Board and Zonal Railways. During 2016-17, out of the availble four TRCs, none of the TRCs were run whole of the year in the planned section due to remaining under repair for long period. Further, TRC did not have an uninterrupted run at uniform speed in the planned sections due to heavy traffic, due to which it was not possible to obtain comparable results between successive recordings.

Para 2.2.1.5

- In Indian Railways dual detection system comprising of track circuiting as well as axle counters simultaneously are used on the same track length of the automatic block section. The use of dual detection system ensures that signal remains in a clear position, even if there is an electrical discontinuity in the circuit due to power failure/rail fracture. As long as either of the two i.e. track circuiting or axle counter gives a clear signal, the signal to the locomotive driver would be clear. From the control panel located at the station, the Station Master would know if there is a failure of track circuiting without knowing the reason for the same. In such circumstance, he can switch over the system to axle counter mode only and allow the train movement on the basis of signal based on axle counter mode. The existing operation instructions do not require the Station Master to look into the reasons for failure of track circuiting and take any action like imposing speed restriction on the movement of the trains or issue any alert. Audit noticed that an accident of Train no. 12987, Sealdah-Ajmer Express occurred at Rura on 28.12.2016 at 5:30 hrs in which over 50 persons were injured. Though DC track circuit failure incident occurred at 2:16:47 on 28 December 2016, no follow up action was taken by Station Master on the incident of failure of track circuiting. A number of trains travelled on the track between 2:16 to 5:30, before the Train no. 12987 derailed. As per the records of joint observation note of supervisors on accident, the probable reason was rail fracture.

Para 2.2.1.6

- Deep screening of ballast is required to restore the resiliency and elasticity of the ballast bed and for improving running quality of track. Audit noticed significant arrears in deep screening work and found that deep screening was overdue for one to 22 years in the sections of five Zonal Railways test checked.

Para 2.2.2.1

- The safety of track is vitally affected by locked up thermal stresses, which can result in rail buckling or fractures. De-stressing is a technique to avert rail track problems in long welded rails/continuous welded rails. Audit noticed deficiencies in de-stressing in the selected sections, which may lead to stress getting locked up in the rails and may result in rail buckling or fractures.

Para 2.2.2.2

- In respect of maintenance by departmental staff, there is a requirement of the concerned staff being trained and skilled, however, similar, requirement is not there in respect of maintenance being done through contractors.

Para 2.2.2.3

- Audit noticed 274 cases of rail fractures and 465 cases of weld failures during 2015-16 and 2016-17 in the selected section of five Zonal Railways. During this period, seven accidents occurred due to rail fractures/ weld failures in these five Zonal Railways.

Para 2.2.3.1

- Operation of wagons with load in excess of carrying capacity of 8 tonnes with tolerance of 2 tonnes (CC+8+2t) was permitted in certain sections from August 2006 with a set of strict conditions and instructions issued in this regard. Though instructions were issued eleven years ago, Wheel Impact Load Detectors (WILD) system were yet to be installed at all identified locations. Where installed, corrective action was not being taken on the basis of the information/data generated from WILD as Railway Administration ignored most of the critical alarms generated through WILD in Mughalsarai.

Para 2.2.3.2

- Track Management System (TMS) provides benefits in the form of prioritization of works, need based deployment of Gang and Machine, overall economy in Track Maintenance, monitoring of overdue inspections, listing of features needing attention, optimization of maintenance inputs by virtue of centralized database. In NCR, asset, store, caution orders, traffic block, ballast supply and insertion and accident reporting modules were not working in TMS. In SER, updation of data in TMS was not regular as internet connection was poor. ECR was not uploading the reports of inspection done at Senior Section Engineer / Permanent Way level and compliance thereof at all the levels in the system was being done selectively.

Para 2.2.3.3

- Audit noticed 294 permanent speed restrictions imposed on the selected sections of five selected Zonal Railways because of track vulnerability.

Para 2.3.1

- During 2014-15 to 2016-17, 16 accidents/derailments took place due to deficient track maintenance in the selected five Zonal Railways. The reasons were rail fracture, weld fracture, track defects, defects in point, track buckling, etc.

Para 2.3.2

- As per Indian Railway Vision 2020, Railways has to develop infrastructure in maintenance of tracks. The upgrdation of infrastructure and using of modern mechanized techniques in maintenance activities was assessed by Audit.

- In ECR and SER, Rails were not being procured in long panels of 120 meters, which increases the number of welds. AT welds were used more than the flash butt welding, though weld failure percentage is significantly high for AT welds.
- In NCR, ECR, SER, track maintenance activities in selected sections were not completely mechanised.
- Human dependence in the form of push trolley inspection, foot-plating, patrolling, etc. for detection of flaws and deficiencies in track parameters were not eliminated/reduced.

Para 3.1

- A formula for assessment of requirement of manpower for track maintenance was derived by the railways in 2000. The formula was not being used by the five Zonal Railways checked in Audit, to assess the manpower requirement and fill the gap for tack maintenance activities during the past three years. This criteria may not be relevant after 17 years due to significant changes in methods of track maintenance and introduction of mechanised means in a larger number of activities. A maintenance gang consist of 10-15 track maintainers who are responsible for protecting the line during regular maintenance work and in emergency. Audit observed shortages of staff in different safety categories responsible for track maintenance in selected Zonal Railways ranging from nine to 22 *per cent*. The situation was made worse by diverting available track maintainers to works other than track maintenance. Further, the jurisdiction of SSEs varied from 16.65 kms to 149 kms in various selected sections. The sanctioned strength of track maintainers per km also had wide variations and the criteria on the basis of which the sanctioned strength had been assessed was not objective and scientific. More track maintainers have been posted to bigger cities than remote locations though the requirement for the whole section may be uniform.

Para 3.3.1

- Check of competency certificate in selected sections of NCR, SER, ECR and SWR revealed that no system existed to ensure that only trained staff was posted in the section responsible for maintenance work. 37 *per cent*, 15.7 *per cent* and 4.6 *per cent* of the total staff of NCR, SER and SWR respectively, deployed in LWR/CWR section had not been imparted training. Similarly, 60 *per cent* of staff deployed for operation of small track machines were not trained.

Para 3.3.2 and 3.3.3

- There was sub-optimal utilisation of track machines due to reasons such as non-availability of block, under repair/breakdown/ maintenance, no fuel, machine under shifting, etc. Further, the small machines were not available in the selected sections as per requirements. Where available, these could not be used optimally due to various constraints such as frequent breakdowns, non-availability of blocks, non-availability of utility vehicles

for transportation of these machines at work sites, non-availability of spares, non-availability of imprest to handle repair and maintenance of these machines etc.

Para 3.4

- Audit noticed shortage of about 50 *per cent* blocks against the block demanded by engineering department for track maintenance work. The time allotted was also less than the prescribed norms. In all these selected sections, line capacity utilisation of 2013-14 to 2015-16 ranged between 90 per cent and 168 per cent. As such, these sections required adequate blocks for proper track maintenance. However, blocks provided were much less than blocks demanded which impacted track maintenance.

Para 3.5

Recommendations

Planning and monitoring

1. ***All Zonal Railways should prepare integrated track maintenance plans for day to day as well as periodical maintenance and condition monitoring using machines/ equipment such as USFD machine, Track Recording Cars, etc., duly incorporating timelines and resource requirement/ availability. The plan should include mechanised and non-mechanised components of track maintenance. It should also incorporate addressing arrears of deep screening of ballast, de-stressing and prescribed requirements for operations of CC+8+2 / 25t.***

2. ***The integrated annual maintenance plan for track maintenance of a Zonal Railway should be promptly communicated to the divisional and field formations for its effective implementation.***

3. ***Patrolling and inspections should be done as per norms and the teams should be equipped with GPS enabled devices. Output of patrolling, inspections should be incorporated into Track Maintenance System through GPS based devices, which can be used for monitoring of patrolling, inspections, etc.***

4. ***Monitoring of preparation and implementation of integrated annual maintenance plan for track maintenance over Zonal Railways should be treated as a key results area for Principal Chief Engineer and key performance area for the Chief Track Engineer for Zonal Railways. Co-ordination issues between departments related to monitoring of preparation and implementation of integrated track maintenance plan***

should be a key performance area for Divisional Railway Managers and key results area for the General Managers.

<u>Strengthening the process of track maintenance</u>

5. ***RDSO prescribed guidelines regarding storage of USFD output and subsequent review / test check / post check should be implemented. Output of USFD should be uploaded to a centralised data base in real time and analysed for monitoring the conditions of the rails.***

6. ***Availability, maintenance and operations of Track Recording Cars should be ensured for checking track parameters at prescribed frequency.***

7. ***Dual detection has been provided to improve the reliability of signals and decrease the failure of signals. As a side effect, it allows the signals to remain green even when there is a rail fracture and the track circuit has dropped. In such a case when the signal would be green and the train would be moving at maximum permissible speed, there is a risk of accident. Track circuiting system has the potential for detecting rail fractures. Safety Committee had recommended that the signal should be put to yellow aspect as soon as track circuit drops in the dual detection territory so that the train speed is controlled to lower speed while passing the affected zone, which may have rail fracture. Railways may consider using this feature of track circuiting effectively to avert accidents. When a track circuit fails due to any reason, the signal could be put to yellow and the train could be passed only at cautious speed, till the track is certified fit by the P-Way Inspector and there is no rail fracture.***

8. ***Application system like the TMS should be used efficiently to its full potentiality. Need based access to TMS should be provided to all related functional departments and units namely Operating, Safety, Accounts and Signal & Telecommunication, instead of restricting to the Engineering department only. This will enable effective planning by these departments and enable them to align their operations and maintenance activities to the integrated maintenance plans for the track maintenance. This will also enhance efficiency and effectiveness of block utilisation.***

<u>Adequate provision and effective utilisation of resources</u>

9. ***Railways may consider revising/re-working the formula for calculation of manpower requirement for track maintenance and re-assess the manpower requirement in view of the changed scenario, wherein, more***

and more mechanised means are going to be used for track maintenance. Diversion of man power provided for maintenance of track for other work should not be permitted. Selection criteria for track maintainers may be aligned with the requirement of their job which includes physical work as well and persons with defective attitude should be adequately sensitized. Deployment of man power should be monitored to ensure proper maintenance of the entire route length.

10. ***To ensure effective co-ordination between various departments involved, it may be considered to entrust Divisional Railway Managers with the responsibility of monitoring block availability and utilization for regular and periodical maintenance activities.***

11. ***The routes, where enhanced loading over and above the carrying capacity has been permitted, should be equipped with necessary infrastructure. This would include installation of Wheel Impact Load detectors (WILD) to assess impact of enhanced loading on the track structure, installation and utilisation of weighbridges to detect and prevent overloading, up-gradation of track infrastructure, addressing concern of rail grinding, weld protection through joggled fish plates and USFD testing of rails at shorter intervals.***

12. ***Officials of the field formations engaged in track maintenance should be equipped with mechanised and digital equipment including Personnel Digital Assistants, GPS enabled communication devices and small track machines. Necessary skills and training should be imparted to the personnel engaged in track maintenance. Appropriate funds in the form of imprest should be provided to enable expeditious maintenance of these machines and equipment. Availability of spares for these machines should also be ensured.***

Chapter 1 - Introduction

1.1 Track and its components

Figure 1: Railway Track

Indian Railway (IR) has 92,084 running track kilometers[1] (as on 1 April 2016). Track or Permanent Way (P-way) is the rail-road on which the trains run. Track structure includes two parallel rails at a specified distance, fastened to sleepers, which are embedded in a layer of ballast of defined thickness spread over the formation.

The track on a railway also known as the P-way is the structure consisting of the rails, fasteners, sleepers and ballast plus the underlying sub-grade[2]. Track enables trains to move by providing a dependable surface for their wheels to roll upon.

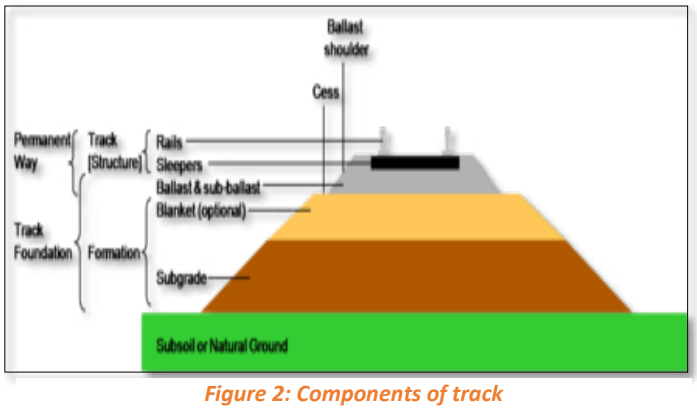

Figure 2: Components of track

Rail: Modern track typically uses hot rolled steel with a profile of an asymmetrical rounded **'I'** shaped cross-sectional beam. Unlike some other uses of iron and steel, railway rails are subject to very high stresses and are made of very high quality steel alloy. The stronger the rails and the rest of the track, the heavier and faster trains it can carry. Rail is graded by weight over a standard length. Heavier rails can support greater axle loads[3] and higher train speeds without sustaining damage than lighter rails.

Rails are produced in fixed lengths and need to be joined end to end to make a continuous surface on which trains run. The traditional method of joining the rails is to bolt them together using metal fishplates[4], producing jointed track. Because of the small gaps left between the rails, when trains pass over jointed tracks they

[1] The length of all running tracks excluding tracks in sidings, yards and crossings.
[2] *Sub – grade* is layer of small crushed stones, which gives a solid support for the top ballast, and reduces the seepage of water from the underlying ground.
[3] The *axle load* of a wheeled vehicle is the total weight felt by the Permanent way for all wheels connected to a given axle.
[4] Metal fishplates is a metal bar attached by means of bolts to the rails on either side of the joint

make a clack sound. Unless it is well-maintained, jointed track does not have the ride quality of welded rails and is less desirable for high speed trains. However, jointed track is still used in railways on lower speed lines and sidings[5] due to the lower cost for its installation and maintenance.

Where higher speeds are required, the lengths of rail are welded together to form Long Welded Rail[6] (LWR) or a Continuous Welded Rail[7] (CWR) that may be 250 meter to several kilometers long. Because there are few joints, this form of track is strong, gives a smooth ride and needs less maintenance; trains can travel on it at higher speeds and with less friction. Welded rails (presently used methodology of laying of rails) are more expensive to lay than jointed tracks, but have much lower maintenance costs.

Alumino Thermite (AT)[8] welding is used to repair or splice[9] together existing CWR segments. This is a manual process which uses molten iron to weld the gap between rails. AT bonded joints are less reliable and more prone to fracture. The preferred process of Flash Butt (FB) welding involves an automated track laying machine running a strong electrical current through the touching ends of two un-joined pieces of rail. The ends become white hot due to electrical resistance and are then pressed together to form a strong weld.

Sleepers: Sleepers are the transverse ties that are laid to fix and support the rails. The sleeper has two main roles, viz. to transfer the loads from the rails to the track, ballast and the ground underneath and to hold the rails to the correct width apart.

Several types of sleepers are in use on Indian Railways which includes wooden sleepers, cast iron sleepers, steel channel sleepers and concrete sleepers. Sleeper density is the number of sleepers per rail length and is determined based on various factors such as axle load and speed, type and section of rails, type and strength of the sleepers, type of ballast and ballast cushion and nature of formation. The spacing of sleepers is fixed depending upon the sleeper density. Spacing is not kept uniform throughout the rail length. It is closer near the joints because of the weakness of the joints and impact of moving loads on them.

[5] Siding is a low speed track section distinct from a running line or through route such as a main line or branch line
[6] Long Welded Rail (LWR) is a welded rail, the central part of which does not undergo any longitudinal movement due to temperature variations. A length of greater than 250 meter on Broad Gauge (BG) will normally function as LWR. The maximum length of LWR under Indian conditions shall normally be restricted to one block section.
[7] Continuous Welded Rail (CWR) is a LWR which would continue through station yards including points and crossings.
[8] Alumino Thermite (AT) welding is a process involving exothermic reaction between aluminium and iron oxides which results in the production of molten steel which is poured into a mould around the gap to be welded. The superheated molten metal causes the rails to melt at the edges of the gap to be welded, and it is also the filler metal, so that the material from the rails coalesces with and joins the added molten steel as it solidifies to form a weld.
[9] Join or connect by interweaving the strands at the end

Bed and foundation: Ballast forms major component of track sub-structure and plays a dominant role in the track performance and its maintainability. Track ballast forms the track bed upon which railway sleepers are laid. It is packed between, below and around the sleepers. It also keeps down vegetation that might interfere with the track structure. It is typically made of crushed stone. The thickness of a layer of track ballast depends on the size and spacing of the sleepers, the amount of traffic expected on the line, speed of the trains to be run on the track, etc. It is essential for ballast to be piled as high as the sleepers, and for a substantial 'shoulder' to be placed at their ends, the latter being important, since this ballast shoulder is, for the most part, the only thing restraining lateral movement of the track. Ballast acts as a shock absorber and provides lateral resistance against longitudinal movement of sleepers. While providing lateral stability to track it facilitates distribution of weight of rolling stock[10], it also serves as a drainage system for the formation. Better riding comfort and safe passage of trains are achieved through provision of adequate quantity of quality ballast.

1.2 Track maintenance

The railway track should be maintained properly in order to enable trains to run safely at the highest permissible speeds and to provide passengers a reasonable level of comfort during the ride. Due to the constant movement of trains, the packing under the sleepers and track geometry[11] gets disturbed, the fittings of the track get undone, there is heavy wear and tear of the track and its components and the gauge[12] and alignment of the track gets affected adversely. The track and its components also get worn out as a result of the weathering effect of rain, sun, and sand. Thus, track undergoes vertical stresses (due to locomotive, wagons, coaches being run on the track) and longitudinal stresses (due to environmental factors such as temperature, floods, rain, sun, sand, etc.). If the track is not maintained properly, it will cause discomfort to the passengers and in extreme cases may even give rise to hazardous conditions that can lead to derailments and a consequential loss of life and property. Inadequate maintenance may also lead to 'speed restrictions'. Proper track maintenance ensures that such situations are avoided. It also ensures that the life of the track as well as that of the rolling stock gets enhanced and leads to reduction in operating costs and fuel consumption. High speed and heavy axle load operations on IR has also necessitated up-

[10] Locomotives, carriages, wagons, or other vehicle used on a railway are called *rolling stock*

[11] *Track geometry* is three-dimensional geometry of track layouts and associated measurements used in design, construction and maintenance of rail road tracks

[12] The *Gauge* of a railway track is defined as the clear minimum perpendicular distance between the inner faces of the two rails

gradation of the track structure and increased requirement for maintenance and monitoring.

Track maintenance ensures availability of track of desired standard for smooth running of trains. It was at one time, hard manual labour, requiring teams of labourers or trackmen, who used lining bars to correct irregularities in horizontal alignment of the track and tamping[13] and jacks[14] to correct vertical irregularities (surface). The track structure has become sturdier and less amenable for manual maintenance due to continuous developments in various track components namely rails, sleepers, fastenings[15], points[16], crossings[17], etc. This has led to gradual proliferation of use of track machines for mechanized maintenance of track. Over the years, mechanized maintenance has gained importance for reliable track maintenance with high degree of precision and quality with lesser dependence on manual labour. Inspections are also carried out by officers of various levels to detect flaws requiring preventive maintenance in track, either through manual inspection or using specialized machines.

Track maintenance involves preventive maintenance (periodic maintenance activities) through deep screening of ballast, de-stressing of rail joints, condition monitoring of track structure through regular inspection/patrolling and repair of defects, tracking parameters to assess quality of track structure through use of Track Recording Cars, using Ultrasonic Flaw Detection (USFD) machines for assessing condition of rail (for detecting/identifying rails likely to be affected by buckling[18]and welds likely to fail), Wheel Impact Load Detector (WILD) for identifying wagons/coaches exerting higher vertical stresses on the rail (for detachment and repair of such wagon/coaches) and monitoring track maintenance activities using Track Management System (TMS).

Preventive maintenance also includes periodical changing of sleepers, lubricating and adjusting switches[19], tightening loose track components, and surfacing and lining[20] track to keep straight sections straight and curves within prescribed limits. Sleepers and rails are replaced where they have passed their life or on condition basis. Over time, ballast is crushed or moved by the weight of trains passing over

[13] Tamping means packing of (or tamp) the track ballast under the railway tracks to make the tracks more durable
[14] The hydraulic track jack (non–infringing type) is used for lifting of track in track maintenance/construction work
[15] Various types of nuts / bolts used to fasten rails to sleepers
[16] Point comprises of one pair of tongue rails and stock rails with necessary fittings to guide the train for change in direction. This works along with crossing element.
[17] *Crossings* is a device introduced at the junction where two rails cross each other to permit the wheel flange of a railway vehicle to pass from one track to another.
[18] *Buckling* is formation of large lateral misalignments in continuous welded rail (CWR) track. Buckles are typically caused by a combination of three major factors: high compressive forces, weakened track conditions, and vehicle loads.
[19] *Switch* or turnout is a mechanical installation which enables railway trains to be guided from one track to another.
[20] *Surfacing* (tamping) and *Lining* are track maintenance activities which restore the desired track geometry and smoothness of vehicle running.

it, periodically requiring re-leveling (tamping) and eventually to be cleaned (deep screening). If this is not done, the tracks may become uneven causing swaying, rough riding and possibly cause derailments. In the alternative, ballast can be reinserted beneath the rails and sleepers after lifting them. Maintenance activities are carried out using machines as well as manually through a group of railway personnel called 'gangs'.

Track maintenance activities (preventive and others) along with the responsibility centres are given below:

Table 1 – List of maintenance activities and their responsibility centres

S. no	Maintenance related activity	Detailed activities	Responsibility Centre
1	**Inspection of Track**	Patrolling by Track maintainers (Gang man, Track man, Key Man) Inspection by Junior Engineer Inspection by Senior Section Engineer(SSE) Inspection by Assistant Divisional Engineer(ADEN) Inspection by Divisional Engineer(DEN)	As per jurisdiction of sectional, sub-divisional and Divisional offices of Railways
		Daily inspection	Keyman, Senior Section Engineer
2	**USFD testing**	USFD testing of welds	Senior Section Engineer/ USFD team, Assistant Divisional Engineer and Divisional Engineer, Track
		USFD testing of Rails	
3	**Track monitoring**	Rail Profile Measurement by Track Recording Cars (TRC)	Track Machines and Monitoring Directorate of Research Design & Standards Organization for deployment of TRC. Assistant Divisional Engineer should accompany the TRC in his jurisdiction and take down notes regarding the spots needing attention
4	**Wheel Impact Load Detector**	Monitoring of impact of load on track by 'wayside detection system' through Wheel Impact Load Detector (WILD) system	Zonal Railway
5.	**Preventive and Periodic maintenance activities**	Deep Screening	Divisional and Sub – divisional offices
		De-stressing	Divisional and Sub – divisional offices
		Others	Senior Section Engineer (overall charge)
		Training	Principal Chief Engineer and Senior Divisional Engineer
		Co-ordination with other Departments	Assistant Divisional Engineer
		Track on Bridges	Assistant Divisional Engineer
		Ballast	Assistant Divisional Engineer

Detailed information regarding maintenance activities along with the prescribed periodicity are given in **Appendix I.**

1.3 Organisational Structure

At Railway Board, Member Engineering (ME), assisted by Additional Members (Works & Civil Engineering), Executive Directors (Works, Civil Engineering, Track Machines, General and Planning), Directors (Works, Civil Engineering Bridges & Structures and Planning) and Joint Directors (Works, Track Machines) are responsible for formulating policy relating to track and P-way.

At the Zonal level, the Chief Track Engineer (CTE), working under the control of Principal Chief Engineer (PCE), is responsible for implementing the policy guidelines / orders of the Railway Board. The Track Machine Organisation (TMO) is headed by the Principal Chief Engineer (PCE) and assisted by the Chief Engineer (Track Machines), Deputy Chief Engineer (Machines) and Executive Engineer (Machines). At the divisional level, the Senior Divisional Engineers / Divisional Engineers (Sr. DEN / DEN), aided by Assistant Divisional Engineer / Assistant Engineers (ADEN/AEN) / Senior Section Engineers (SSE)/Section Engineers (SE) (P-way) take care of day to day operations, repair and maintenance of the track.

Track Machines and Monitoring Directorate of RDSO is responsible for Track Monitoring by Track Recording Cars and Rail Profile Measurement System[21], Testing of track components like Sleepers, Fastening, welds, etc. Entire length of track of Indian Railways is monitored by Track Recording Cars of RDSO.

1.4 Audit Objectives

The review was carried out with a view to assess:

1. Whether the maintenance of tracks was planned and undertaken following the laid down norms and keeping in view the instructions of Railway Board?
2. Whether the resources/infrastructure required for maintenance of tracks were available and used efficiently and effectively?

1.5 Audit Criteria

The provisions laid down in the following manuals/documents were adopted as Audit Criteria:

- Indian Railway Permanent Way Manual (IRPWM)
- Indian Railway Small Track Machine Manual (IRSTM)
- Indian Railway Track Machine Manual (IRTMM)

[21]Rail profile measurement is a system of inspection and monitoring of track by mechanical means in which laser based contactless track recording cars, portable accelerometers and optical rail profile measurement etc. are used.

- Indian Railway Code for the Engineering Department
- Vision 2020 Document of IR
- Manual of instructions on long welded rails (Long Welded Rails/ Continuous Welded Rails)
- Ultrasonic Flaw Detection (USFD) Manual
- Guidelines/ instructions issued by Railway Board / Zonal Railway relating to track maintenance

1.6 Audit scope, methodology and sample

The review covered the period from 01 April 2016 to 31 March 2017. Audit assignment was aimed at studying maintenance of track vis-à-vis provisions of different codes/ manuals, safety measures prescribed and other related orders and instructions issued by the Railway Board from time to time. The focus of the study was primarily on maintenance of tracks on selected 29 sections of High Density Network (HDN) Routes. Eight sections non-HDN routes were also selected for study and comparison.

Audit methodology consisted of examination of records at the Zonal / Divisional Headquarters and field offices relating to action for compliance to plan/ policies framed by the IR and their implementation at the field level, examination of records maintained in Assistant Divisional Engineer/Senior Section Engineer (P-way) offices of selected sections, Zonal and Divisional Engineering Department, Safety Department and at Research Designs & Standards Organisation (RDSO), Lucknow.

In Indian Railways, a common rail track is used for both passenger and freight traffic. With increase in passenger and freight traffic over the recent years, the rail network has experienced severe capacity constraints. The major hub of activity, namely the Golden Quadrilateral and its diagonals connecting the major metros – Mumbai, Delhi, Chennai and Kolkata constitute merely 25 *per cent* of the total network; but carry around 70 *per ce*nt of total freight resulting in consequent over-saturation in levels of capacity utilisation in a number of stretches. There are seven High Density Networks over Indian Railway:

1. Delhi-Howrah along with the alternative 'B' route on Northern Railway and its extension towards Shakurbasti-Bhatinda-Suratgarh and Andal Sainthia for the coal routes
2. Mumbai-Howrah along with the link route of Bilaspur-Anuppur-Katni-Bina-Kota and Jalgaon-Surat

3. Delhi-Mumbai via Kota-Ratlam including alternative route of Delhi-Rewari-Phulera-Ajmer-Chittorgarh and Gandhidham-Palanpur-Bhildi-Samdari-Jodhpur Bhatinda and Panvel JNPT
4. Delhi-Guwahati via Moradabad–Sitapur-Burhwal-Gonda Gorakhpur-Chhapra Barauni-Katihar
5. Delhi-Chennai via Jhansi-Bhopal-Itarsi-Nagpur-Ballarshah
6. Howrah-Chennai along with alternative route via Jharsuguda-Sambalpur-Titlagarh-Vizianagram including 3rd line between Vizianagram and Kotavalasa and 4th line between Kotavalasa and Simhachalam North
7. Mumbai-Chennai along with link route Guntakal – Hospet Hubli-Vasco (iron ore circuit)

In respect of three HDN routes viz. HDN 1, 2 and 7, 100 *per cent* sections with more than 150 *per cent* capacity utilisation and 50 *per cent* of the sections with 100 to 150 *per cent* capacity utilisation were selected for a detailed review in audit. Besides, a few sections with utilization in excess of 90 *per cent* line capacity were also included. Eight non-HDN sections with more than 100 *per cent* line capacity utilisation were also selected. The following 37 sections were selected over five Zonal Railways:

Table 2– Details of sample selection

S.no	Zonal Railway	Name of the section	Route KM	Line Capacity in 2015-16
		HDN-1 Delhi-Howrah		
1.	NCR	Dadri-Dankaur	17.6	140
2.	NCR	Tundla-Shikohabad	36.4	156
3.	NCR	Shikohabad-Panki	183.4	154
4.	NCR	Panki-Juhi	7.4	154
5.	NCR	Juhi-Kanpur	1.4	158
6.	NCR	Juhi-Chandari	2	99
7.	NCR	Allahabad-Naini	7.48	125
8.	NCR	Naini-Cheoki	1.4	120
9.	NCR	Jeonathpur-Mughalsarai	7.8	128
10.	ECR	Mughalsarai-Dehri-on-Sone	117.1	106
11.	ECR	Dehri-on-Sone-Sonenagar	5.7	120
12.	ECR	Sonenagar-Gaya	79.4	93
13.	ECR	Gaya-Gomoh	169.1	103
		HDN-2 MUMBAI-HOWRAH		
14.	SER	Jharsuguda-Rourkela	101	106
15.	SER	Rourkela-Bondamunda	8.5	102
16.	SER	Tata-Kharagpur	134	96
17.	SER	Santragachi-Tikaipara	5.6	104
18.	SER	Tikiapara-Howrah	2	113
		HDN-7 MUMBAI-CHENNAI		
19.	SR	Arakkonam-Tiruvallur	26.83	111
20.	SR	Pattabiram-Avadi	3.91	103

Table 2– Details of sample selection				
S.no	Zonal Railway	Name of the section	Route KM	Line Capacity in 2015-16
21.	SR	Avadi-Villivakkam	11.61	119
22.	SR	Villivakkam-Vyasarpadi	5.8	123
23.	SR	Basin Bridge- Chennai Central	2.22	128
24.	SWR	Vellary-Hospet	64.84	126
25.	SWR	Hospet-Gadag	85.14	114
26.	SWR	Gadag-Hubli	58.08	139
27.	SWR	Hubli-Dharwar	20.09	119
28.	SWR	Dharwar-Londa	70.36	141
29.	SWR	Londa-Castle Rock	24.48	99
NON-HDN ROUTES				
30.	ECR	Patna-Danapur	9.00	120
31.	ECR	Danapur-Ara	39	127
32.	ECR	Ara-Buxar	69	125
33.	ECR	Buxar-Mughalsarai	94	128
34.	SER	Nimpura – Gokulpur	6	137
35.	SER	Panskura – Haldia	70	148
36.	SER	Burnpur – Asansol	5.6	139
37.	SER	Muri – Barkakana	58	165

In addition, on these five Zonal Railways, sections where accidents/derailments, etc. have taken place for reasons attributable to track or where final investigation report and reason for accident was yet to be known, during the past three years (2014-15 to 2016-17) were also checked in detail. Data regarding reasons for accident, rail weld failure, etc. for one year i.e. 2016-17 was also collected and analysed. Audit findings and recommendations were discussed with the Ministry of Railways during an Exit Conference on 30 August 2017. Their responses have been duly incorporated in the Audit Report.

The audit was conducted in selected heavy traffic routes over five Zonal Railways (NCR, ECR, SER, SR and SWR), on which traffic much more their line capacity was being handled. Similar deficiencies and issues may be prevalent in other Zonal Railways as well. The basic purpose of this audit was to identify the weakness in track maintenance work and highlight systemic weakness, which are required to be addressed by Indian Railways.

1.7 Acknowledgement

Audit acknowledges the co-operation extended by the Railway Board and the Zonal Railway Administrations during the field audit.

Chapter 2 - Planning and execution of track maintenance

Audit Objective 1: Whether the maintenance of tracks was planned and undertaken following the laid down norms and keeping in view the instructions of Railway Board?

2.1 Planning track maintenance

Maintenance planning include planning for manual as well as mechanised maintenance of track sections. These include activities to be undertaken on a regular basis within a year (regular maintenance) and activities which are undertaken after a year (periodical). The compliance of the prescribed procedures relating to planning for manual as well as mechanised maintenance of tracks was examined in the selected 37 sections of five Zonal Railways (NCR, SWR, SR, ECR and SER). The audit findings are discussed below:

2.1.1 Perspective Plan for manual track maintenance by sectional officials

As per laid down provisions[22], every P-way Inspector must prepare a perspective maintenance plan of his section one month in advance. The plan should include, apart from normal inspection, inspection of point and crossings, curves and level crossings, realignment of curves, deep screening, casual renewal, renewal of points and crossings, welding of joints, de-stressing of long welded rails, etc. so that optimum utilization of time and labour resources becomes possible. It was observed that

- In selected sections of SWR and SR, perspective maintenance plan and annual inspection plan were being prepared by the P-way Inspectors.
- In NCR advance perspective maintenance plan were not prepared. Advance monthly planning for realignment of curves, adjustment of creep, deep screening, casual renewal of points on crossing, welding, distressing, etc. was not carried out.
- In ECR, perspective maintenance plans were not prepared. Maintenance Schedule prescribes planning maintenance works as a preventive measure, whereas, SER was doing rectification of deficiencies on inspection.

2.1.2 Annual Plan for mechanised maintenance through Track Machines

For sections nominated for mechanized maintenance, annual plan for deployment of various track machines is to be finalized by Chief Track Engineer (Machine)/ Chief Track Engineer of the Zonal Railway who are required to arrange deployment of machines accordingly. Concrete sleeper track is required to be

[22]Para 205 of Indian Railway P-way Manual

maintained by heavy on-duty track tampers[23]. An annual machine deployment programme is to be drawn by Zonal Railway and circulated to the divisions before the beginning of the year. Compliance of these laid down provisions was checked in the selected sections and it was observed that

- In NCR, Annual Plan 2016-17, for deployment of various track machines was delayed and circulated to Divisional offices on 29 April 2016. Further, deployment plan of various track machines was not intimated in advance to concerned ADEN and SSE by the Divisional offices.
- In ECR, Annual Plan 2016-17, for deployment of various track machines was prepared and finalized division wise instead of section wise as per the norms.
- In SER, Annual Plan 2016-17, for deployment of Track Machines was prepared and finalized by Chief Engineer at headquarters level and communicated to the Divisional Engineers, but not to the concerned Sectional P-way Inspectors.

As a result, P-way Inspectors of selected sections who are primarily responsible for maintenance of tracks in the sections assigned to them were not aware of the Annual Plan in advance for actual deployment of track machines in their sections. In SWR and SR, annual plan for deployment of track machines were being prepared in advance and as per the norms.

It was further seen that in selected sections of NCR, maintenance activities were not fully mechanized. Maintenance activities like de-stressing of LWR, laying and welding of rails and deep screening of ballast were carried out both with the machines and manually.

The Expert Group for Modernisation of Indian Railways in its report recommended (February 2012) 100 *per cent* mechanised track maintenance on routes[24] A and B for superior quality of track laying and maintenance. However, all the selected sections covered in Audit are of route A or B, but track maintenance of these sections was yet to be fully mechanised.

2.1.3 Annual Programme for track maintenance

As per laid down rules[25], the annual programme of regular track maintenance and works incidental thereto includes the following:

[23] Track tamper is a machine used to pack the track ballast under railway tracks to make the tracks more durable (Para 1408 (3) of Indian Railway P-way Manual)
[24] Para 202 of IRPWM classifies broad gauge line of IR into six groups A to E on the basis of future maximum permissible speed (RB letter no. 2003/CE-II/TS/2 Part I dated 15 Feb 2008)
[25] Para 203, 204 of Indian Railway P-way Manual

Table 3– Annual Programme for track maintenance		
S. no	**Period**	**Work**
1.	***Post monsoon attention***: For about six months after end of monsoon	a. Attention to run down lengths in the entire gang beat to restore the section to good shape. b. One cycle of conventional systematic through packing/systematic directed track maintenance from, one end of the gang length to the others including overhauling of nominated sections. c. Normally four to five days per week should be allotted for works under item b and the remaining days for picking up of slacks, attention to bridge approaches, level crossings and points and crossings over the entire gang beat. Works such as lubrication of rail joints, joint gap adjustments as required and realignment of curves should be done during this period.
2.	***Pre monsoon attention***: For about 2 months prior to break of monsoon.	Normally two to four days in a week should be devoted to clearing of side and catch water drains, earthwork repairs to cess, clearing water ways and picking up slacks. In the rest of the days normal systematic maintenance will be carried out.
3.	***Attention during monsoon:*** For about four months	Attention to track as required. This will consist primarily of picking up slacks and attention to side and catch water drains and water ways. During abnormally heavy rains, patrolling of the line by gangs should be carried out in addition to regular monsoon patrolling.

Further, scattered renewals and earth work repairs is to be done as necessary. For maintenance schedule on Long Welded Rails (LWR)/Continuous Welded Rails (CWR)[26], special instructions in the LWR/CWR Manual[27]are to be followed.

During the review of records related to selected sections of five Zonal Railways, audit noticed that

- In NCR, all schedules and frequency of inspection and maintenance were fixed in Track Management System (TMS). Pre-monsoon and post-monsoon activities were not mentioned in the Annual Plan and only need based inspection was carried out in monsoon season. However, no cases of delay in lubrication of rail joints, joint gap adjustments and realignment of curves were noticed in selected sections of NCR.
- In ECR, specific inspection programme for pre-monsoon, post-monsoon and during monsoon were not prepared. However, work like lubrication of rail joints, joint gap adjustment and realignment of curve, etc. were included in

[26]Long Welded Rails (LWR) of length 260 meters are joined together through welding to make Continuous Welded Rails (CWR) of longer lengths

[27]LWR / CWR sections require closure monitoring, inspection and maintenance due to variation and impact of temperature. Thus, Special instructions for Track Maintenance in LWR /CWR Section given in Manual of instructions on Long Welded Rails - 1996.

the gang chart and additional patrolling of tracks by gangs during abnormally heavy rains were conducted.

- In selected sections of SWR, regular track maintenance activities were conducted as per prescribed provisions. However, in Gadag-Hospet section and Kanginhal station the lubrication of rail joints was due during August and October 2016, but not done up to April 2017.
- In selected sections of SR, Annual Track Machines programme was prepared and circulated as per norms. Pre-monsoon and post-monsoon patrolling/maintenance activities were carried out. Lubrication of rail joints, adjustment of rail joint gaps, etc. were done. Track Tampers were used wherever necessary in the maintenance of track.
- In SER, it was noticed that there was no annual programme of track maintenance.

During Exit Conference (30 August 2017), Railway Board stated that in the present scenario, where track maintenance has become more and more mechanized, perspective planning for track maintenance entails machine deployment, identification of areas for deep screening, casual attention of track, etc. This is required to be done at Zonal Headquarter level (by CTE and CE (TM)) and then disseminated at the level of division and further communicated to sectional level viz., AEN/SSE. It was further stated that preparation of perspective plan by P-way inspector is not relevant for such activities. P-way inspector is required to plan locally for manual maintenance works such as oiling, greasing, etc. Audit is of the view that perspective planning in advance is required for both non-mechanized maintenance (to be conducted by the sectional officials) as well as for mechanized maintenance (to be conducted by the Zonal Headquarters). The mechanized maintenance requires the assistance of official in-charge of section. Further, as all items for mechanized maintenance have not been completely implemented over the high density network as seen during audit of selected sections and a mix of mechanized and non-mechanized maintenance is undertaken, a comprehensive advance perspective maintenance plan is required. This is required to be communicated timely to the official in-charge of sections who shall then prepare the comprehensive advance perspective plan incorporating the information received from Zonal Headquarters. This advance perspective plan is a functional requirement for planning, implementation as well as monitoring of track maintenance activities.

Thus, planning for track maintenance needed to be done comprehensively. Efforts to expeditiously cover maximum sections and maximum activities under

mechanized maintenance should be made both at planning and implementation stage.

2.2 Undertaking track maintenance

Besides, preventive and periodical maintenance, condition monitoring of track is undertaken by IR using a variety of means (both manual and mechanized). Officials and equipment with RDSO, Zonal Headquarters, Divisional Headquarters, Sectional formations are used for the purpose. This includes condition monitoring of track, detection of flaws in track conducted both through inspections as well as through use of machines/equipment. Monitoring of various track parameters such as rail fractures and weld failures also enables undertaking measures to address the deficiencies and defects noticed/detected by replacing rails, sleepers, ballast, etc. or imposing speed restrictions till the flaws are rectified.

2.2.1 Periodical maintenance activities - condition monitoring

Indian Railways has a laid down mechanism through which the track is inspected either visually or using equipment/machines in order to detect flaws in various component of tracks. This includes patrolling by patrolmen. Periodic inspections are required to be done by ADEN and SSE to check track conditions. They also use equipment such as Ultrasonic Flaw Detection machine, Track Recording Car, etc. to detect flaws in the track. Corrective actions are initiated to rectify the flaws detected during inspection and through use of these machines/equipment.

2.2.1.1 Patrolling of track

Railway tracks are patrolled to ensure the safety of the track and of the traffic moving over it. Patrolling basically involves to and fro movement of the patrolman/ watchman along the track as per the specified programme in order to look out for any unusual occurrence that may threaten the safety of the track.

Various types of patrolling include daily patrolling, patrolling during abnormal rainfall or storm, night patrolling during monsoon, hot weather patrolling, cold weather patrolling etc. The patrolling is done by track maintainers (keyman, gangman, trackman) also called patrolman, as per the beat allotted to them.

Beat is the portion of the track that a patrolman patrols. Beat of two kms in single line and one km in double line has been fixed for cold and hot patrolling as per Indian Railway P-way Manual. The patrolman walks over his beat slowly along one rail in one direction and on the other rail in the return direction. On double lines, he repeats this procedure alternately on the Up and Down tracks. He watches out for rail and weld fractures. He also keeps an eye on the gaps at the switch expansion joints at the ends of the LWR. The walking speed of a patrolman may

be taken as 3 kms per hour and the maximum distance covered by a patrolman should not normally exceed 20 km in a day.

Audit reviewed patrol books maintained in the SSE offices over the selected sections of five Zonal Railways to analyse the extent of beat allotted to track maintainers for patrolling. Audit noticed that

(i) In NCR, patrolling chart maintained in the office of SSE/Firozabad revealed that beat of the patrol men was not restricted to one km length of UP and DN line on double line section. The beat of patrolman was up to 2.75 km (UP and Down line - 5.5 km). However, in other SSE offices, beat were restricted as per the norms.

(ii) In SER, the beat of patrol men was not restricted to one km in the office of SSE/Santragachi and SSE/Kolaghat and ranged between two kms and five kms in Up, Mid and Down line.

(iii) In SWR, in all the sections reviewed in audit, beat of patrol men was not restricted to one km length of Up and Down line section and it was up to five kms per person with two rounds per day.

(iv) In SR and ECR, no deficiency was noticed in the allotment of beat to the patrolmen.

(v) Audit further noticed that patrol men were not equipped with any communication equipment to report any failure, fracture or damage immediately from the section where shortcomings and defects in track were observed.

During Exit Conference (30 August 2017), Railway Board stated that the beat of patrol men could not be restricted to one km due to shortage of patrol men in all Zonal Railways.

Audit is of the view that the shortfall of patrolmen is within the control of Railways and being a safety related aspect needs to be seriously addressed.

2.2.1.2 Inspection by Section Engineer (also called P-way Inspectors)

Rules[28] prescribe routine inspection of track of the entire section by SSEs by push trolley at least once in a month or more often as necessary. Inspection of the SSE include

1. Inspection of Gangs covering
    a. Check of the work done by gang, their recording and to ensure prompt action on items requiring attention

[28] Para 124 of Indian Railways P-Way Manual

b. Examination of small machines (fortnightly) and examination of gang tool (monthly) including arrangement for their repair and replacement.

2. Inspection of level crossings to examine the condition of rails, sleepers and fastenings and ensuring the defects are rectified; check the equipment with the Gateman and their knowledge of safety rules; and

3. Inspection of Points and Crossing and Curves

The SSE is required to maintain an inspection diagram of all the inspections carried out during the month as per the schedule and to submit the same to the Divisional Engineer through Assistant Engineer every month bringing out the reasons for shortfall in adhering to schedule of inspections, if any.

As per laid down rules[29], SSE is directly responsible for the safety of the track. He shall be vigilant to locate faults in the P-Way and promptly rectify them. He should bring to the Assistant Engineer's notice, track defects which are beyond his powers to rectify. Rules[30] also provide that SSE should arrange for patrolling of track as laid down through suitable gangmen and to arrange for necessary equipment. SSE should check the night patrolman once a month by train and by trolley during monsoon as per the prescribed schedules.

During the review of the compliance of schedule of above inspections in the selected sections of five Zonal Railways, the following was observed:

(i) In NCR, routine inspection of SSE was carried out and inspection notes were submitted to ADEN. However, surprise test check of patrolling was not conducted at all.

(ii) In SER and ECR, Inspection Note of SSEs were not prepared. In ECR, action taken and compliance of Inspection Reports was not entered in the TMS whereas in SER action taken and compliance of Inspection Reports was not found on record. Thus, compliance of inspection could not be monitored by Assistant Engineer.

(iii) In SWR, all SSEs carried out routine inspections of Track as per the Indian Railway Permanent Way Manual (IRPWM) and irregularities noticed, if any, were recorded and reported to ADEN, during the review period. All SSEs deputed suitable men from gangs and required Patrol Books and necessary equipment such as Simplex Jacks, tools, flags, detonators, torches, etc. - were provided to the gangs.

[29]Para 125 of Indian Railway P-Way Manual
[30] Para 126 of Indian Railway P-Way Manual

(iv) In SR, routine inspection of track, reporting of deficiencies to higher level officials, conduct of patrols, check of patrolmen by SSE, pre-monsoon and post-monsoon patrol, etc. were carried out as per schedule.

During Exit Conference (30 August 2017), Railway Board stated that inspection shortfall are mainly due to shortage of SSEs.

Audit is of the view that the shortfall of SSEs being a safety related aspect needs to be properly addressed.

2.2.1.3 Inspection by Assistant Divisional Engineer (ADEN)

Rules[31] provide that the ADEN shall conduct inspection in his jurisdiction as per the schedules laid down by the Zonal Railway Administration from time to time. He should maintain the records of the results of his inspection and ensure compliance of the instructions within a reasonable time. He should submit copies of the inspection diagram at the end of every month to the Divisional Engineer indicating the inspection carried out during the month. He should also scrutinise the registers maintained by P-way Inspector and see whether the schedules of inspection are being adhered to by the Inspectors and whether the necessary follow up action is being taken.The following inspections are prescribed[32] to be carried out by the ADENs:

Table 4 – Inspections schedule for ADENs

Type of Inspection	Details of inspection
Trolley Inspection	Entire sub-division once in two months. Work of minimum one gang in each SSE's jurisdiction every quarter
Fast Train Inspection	Entire sub-division once in a month.
Checking of curves, points and crossings	One curve in each SSE's jurisdiction every quarter and all points and crossings once a year on passenger lines
Monsoon Patrolling	Work of Patrolman at night once in a month
Inspections of LWR/CWR Track	Switch Expansion Joints (SEJs)/Buffer rails provided in the LWR/CWR track once in every six months.This implies that every SEJs/Buffer Rail[33] within the jurisdiction of ADEN should be inspected after every six months. This gets converted to number of LWR to be inspected every month.

(a) Shortfall in inspections

During the review of records in connection with the adherence to the inspection schedule as mentioned above, the following was noticed:

[31] Para 106 of Indian Railways P-Way Manual
[32] Para 107 of Indian Railways P-Way Manual
[33] SEJs/Buffer rails are used at the end of LWRs for thermal expansion. Butter rails are ordinary rails of a much higher standard. SEJs involve use of switch for the purpose.

- Check of records of monthly inspection charts of ADEN revealed that there were shortfalls in inspections conducted by ADENs in NCR as given below:

Table 5 – Deficiencies noticed in conducting inspections by ADENs during 2016-17[34] in NCR

Name of the Selected Section	Related ADEN	Types of inspection	Details of inspections not done along with section
Jeonathpur – Mughalsarai /	ADEN, Chunar	*Push Trolley inspection*	UP line of Jeonathpur – Kailahat section in January to April 2016
		Curve inspection	Entire jurisdiction of ADEN during January to March 2016.
Naini - Cheoki	ADEN, Mirzapur	*Push Trolley inspection*	UP main line section of Meja Road - Naini during January and February 2016 and DN line of Vindhyachal – Unchdhi section during January to April 2016.
		Foot plate inspection	DN line of Jhingura – Naini during January and February 2016 by ADEN, Mirzapur.
Allahabad - Kanpur	ADEN, Line, Allahabad	*Push Trolley inspection*	UP line of Bharwari – Shujaatpur and DN line of Bamhrauli – Manoharganj during January – February 2016
			UP line section of Bharwari – Sath Naraini in the month of March and April 2016
		Foot plate inspection	Allahabad- Sath Naraini in DN line in the month of January 2016 to April 2016
Juhi – Kanpur, Panki – Jhuhi, Jhuhi – Kanpur and Panki - Shikohabad	ADEN, Line, Kanpur	*Push Trolley inspection*	Goods Marshalling Yard Kanpur (GMC) – Rura section during January – February 2016 and in DN line during March – April 2016.
		Foot plate inspection	GMC – Rura section in January – February 2016
		Inspections of LWR	For the Year 2016 out of 110 inspections of LWR 40 inspections were carried out in same month of planning. Remaining 70 inspections were not done in planned month and conducted in later months.
		Inspections of Curve	Out of 48 curve inspection planned in 2016 only one inspection of curve was not delayed. Remaining were delayed by a month.
Shikohabad - Panki	ADEN, Etawah	*Push trolley inspection*	Phaphund – Ghasa during March – April 2016.
Tundla - Shikohabad	ADEN, Firozabad	*Push trolley inspection*	UP main line section between Bhadan – Shikohabad during January –February 2016
		Foot plate inspection	UP main line section of Jaswantnagar – Shikohabad during January – February 2016

As seen in Audit, inspections were not carried out as per scheduled plan in the above sections of NCR. All the above sections are heavy traffic route and required frequent and regular inspections to detect flaws in track. Audit further noticed that in the selected sections, though inspections of SSE offices,

[34] Inspection programmes of ADEN are prepared and updated in TMS on the basis of calendar year i.e. January – December. Therefore, shortfall in inspection noticed in Audit during January 2016 to March 2016 were included in Audit findings. The results of inspection of last quarter of 2015-16 consequently fall in 2016-17 and that of 2016-17 (last quarter) in 2017-18.

stores and small machines were conducted by the ADEN as per the plan, the inspection notes were not updated in TMS.

- In ECR, in respect of non-HDN route, 415 inspections were done out of 1834 inspections due, leaving a shortfall of 1425 inspections (78 *per cent*), which were mainly in inspection of LWR, points and crossings. In respect of HDN routes, out of total 793 inspections due to be done (LWR, Points & Crossings, Curves, etc.) 767 inspections were done. However, there was a shortfall of 11 *per cent* in inspection of LWR.
- No shortfalls in inspection of ADENs were noticed in the selected sections of SER, SWR and SR during 2016-17.

During Exit Conference (30 August 2017), Railway Board stated that though ADENs are responsible for maintenance of track, they are also given the responsibilities relating to punctuality, cleanliness, protocol duties, special drives, etc. This results in arrears in their scheduled activities of inspection. Audit is of the view that Railways need to address this issue so that ADENs are able to provide due attention on their primary responsibility of track maintenance.

Shortfall in conducting inspections as per prescribed norms, deficiencies in conducting inspections and not preparing notes of inspections in the HDN routes test checked in Audit are areas of concern, which Railways need to address expeditiously.

(b) Use of GPS based device for safety inspections

It was further seen during foot plate/ brake van/ inspection car/ Push trolley/ motor trolley inspections, a GPS based device can be used for marking and storing the location of track defects. The GPS based foot plate inspection device[35] consists of a GPS receiver and a recording unit. The device stores the location ID of defects which can be retrieved on graphic LCD display in terms of latitude and longitude. Defects of un-evenness of track, ballast deficiency, bad weld, weeds on cess, loose packing, etc., are some of the defects which can be marked through the device. These devices are thus useful for effective monitoring of safety inspections. It was observed that GPS based Foot plate inspection device was not procured by any of the selected five Zonal Railways and inspection of track was carried out through traditional means.

During Exit Conference (30 August 2017), Railway Board stated that assets of Indian Railways are not on GPS platform.

[35] RDSO has finalized the specifications for this device vide specification no. TM/SM/326 dated 03.07.2012

Audit is of the view that Railways need to use GPS based inspection device for inspection purpose. This would also facilitate effective monitoring of safety inspections.

2.2.1.4 Testing using Ultrasonic Flaw Detection (USFD) machine

The USFD manual prescribes a need-based concept of USFD testing[36] of rails, under which the rails already laid in track will be tested after the passage of eight gross million tonne (GMT) of traffic. In this method, by sending an ultrasonic signal directly into the rail and measuring the time it takes for the signal to bounce back, cracks can be located. Since a crack prevents the signal from reaching the base of the rail, it will bounce back more quickly, alerting the inspector to its presence.

Departmental USFD testing of rail is carried out under control of Sr. Divisional Engineer, Co-ordination. He is assisted by Divisional Engineer Track and SSE, USFD. At the field level USFD team headed by Senior Section Engineers take care of day to day operations of USFD testing. Further, quality check of USFD testing is carried out by the concerned ADEN by 5 *per cent* test check of the section. Rules[37] provide that the Inspectors carrying out the ultrasonic testing of rails shall be trained by RDSO, in the techniques of USFD testing. Each Zonal Railway shall create adequate number of *ex-cadre* post of Inspectors to ensure that entire track length in their jurisdiction is ultrasonically tested as per laid down periodicity. Railway Board (May 2015) also instructed to train all DENs/ADENs handling USFD Machines independently. In April 2015, Railway Board expressed[38] concern over increasing arrears in the USFD testing due to non-finalization of agency for outsourcing. Railway Board also expressed serious concern on outsourcing of safety critical USFD work and felt that outsourcing by Zonal Railways may be resorted to only as an interim measure to clear the increased workload due to increase in frequency on account of increased traffic density, etc. and not as a regular measure.

(i) Audit reviewed the utilisation of USFD machines over 37 selected sections of five Zonal Railways. It was observed that

- Over selected sections of NCR, USFD testing was carried out by ten departmental teams under the control of DEN/Track Allahabad**.** Workshop for training and working of USFD testing was organised and all Sr**.** DEN/DEN /ADENs were trained to handle USFD machines**.** In SWR, only DENs/ADENs of Hubli Division were trained in the Workshop organized in February 2017.

[36] Analog and digital
[37] Para 3 of Revised USFD manual
[38] Railway Board letter No.Trackl21/200410902/7/Vol. Il dated 22 April 2015

- As per rules[39], no rail untested by USFD is to be laid in the track whether for new lines or layouts or renewals or for repair works. For repairs and casual renewals a location wise creation of stock of tested rails of various lengths has been prescribed for each SSE. These USFD tested rails should be kept segregated in a lot and each such rail should be paint marked on the flange from each end as 'USFD tested'. In NCR, instructions for preparation of location wise stock of USFD tested rail was issued from time to time by divisional and Zonal offices. However, check of records of SSE and ADEN offices of selected section revealed that location-wise stock of USFD tested rails was not made and no system existed to ensure that only USFD tested rails were used for repair and casual renewal work.
- As per provisions[40], railway staff should test check five *per cent* of the testing done by the contractor, within 25 *per cent* time period of frequency of USFD testing done in that section or one month whichever is earlier. Further, if any new flaw is detected which was left out by the contractor during testing; the whole length of track (Track length of 50 kms) should be tested again by the contractor without getting any extra payment for the same**.** In all selected section of NCR (ADEN – Allahabad, Firozabad, Kanpur, Mirzapur, Aligarh, Etawah, Chunar) and SWR where the USFD testing was carried out by the contractor, five *per cent* test check was not conducted by the concerned ADEN. Consequently, this impacted the assurance of the quality of USFD testing carried out through outsourcing. This check was carried out in SER and not required in SR and ECR, as USFD testing was done departmentally.
- As per RDSO's guidelines, provision for capturing scanned images/peak patterns should exist in the USFD machine to save the scanned data for use as and when required by the operators**.** However, over selected section of NCR and ECR, scanned images /peak patterns was not saved by the USFD teams**.** Thus, scrutiny/analysis by concerned supervisory officers was also not possible during successive USFD tests**.** As such, the system of 5 *per cent* test check by ADEN has been rendered redundant, as post check comparison of output of the USFD test by the outsourcing agency between the two tests was not possible. In SR, the USFD was being done departmentally and in regard to capturing of scanned images/peak patterns, no failure was noticed. In SER and SWR, scanned images/peak patterns of USFD Testing were saved for the test conducted by contractors. In respect of Departmental USFD Team, Scanned images/

[39]Para 252(4) of Indian Railways P-way Manual
[40]Para 16 of Special Condition of the Contract

peak patterns were saved only in cases of welds and rails requiring immediate replacement. The non-saving of other images/peak patterns were attributed to shortage of staff. This is not convincing as no additional manpower is required to save images/patterns.

(ii) Further, as per codal provisions, new weld should be tested as soon as possible through USFD and after 1st testing it should be entered in USFD schedule for next testing. It was seen that

- In Kharagpur Division of SER, 3299 new welds were done contractually during April 2016 to Dec 2016. Of these, only 763 welds were USFD tested and balance 2536 welds were not tested till March 2017.
- In SWR and NCR, in selected sections, cases were noticed where new welds were not tested by USFD within 30 days of welding. In SWR, testing of 40 welds out of 350 welds (during the period covered in Audit) was done beyond 30 days with delays ranging between four to eight months. In NCR information regarding date of testing of new weld was not recorded in the jurisdiction of ADEN/Kanpur in all cases and by ADEN/Chunar in 23 cases. Information was also not maintained over NCR by ADEN/Mirzapur and ADEN/Etawah. In jurisdiction of ADEN/Mirzapur and ADEN/Etawah, three and two welds respectively were seen from weld failure report where delays were up to 19 days. In ECR the new welds were being tested by USFD machine within 30 days.
- In SR, USFD testing was done as per schedule and the same was monitored by SSE/USFD nominated for the purpose.

(iii) A number of cases of failure of rail facture/weld failure during 2016-17 were detected within 30 days of these having undergone USFD testing. The details of these are given below:

Table 6– Number of rail fracture/weld failure within one month of USFD testing during 2016-17 over selected sections

Zonal Railway	Numbers	Remarks
NCR	50	--
SER	21	In 19 cases, the result of USFD testing was found satisfactory during the course of USFD testing
SWR	10	The USFD test preceding the event indicated the result of such a test as good.
ECR	6	--
SR	1	--

Incidence of failure was seen within three to 30 days of USFD testing, which showed deficiency in quality of USFD testing. In one particular case of ECR, where a train accident occurred on Buxar – Ara section on 25 July 2016, Audit noticed that USFD testing of the section was carried out at a twelve month interval,

whereas USFD testing of the section should have been carried out every three months as per provisions[41] as the GMT of Buxar – Ara section (non – HDN route) was 39.274. It was further seen that enquiry report of the accident mentioned the final cause as 'Multiple rail fracture and slackness in supervision'.

During Exit Conference (30 August 2017), Railway Board stated that at present, the USFD testing plan are uploaded in the TMS and results/ report of testing are also put into the system. The alert for the arrears is also displayed in the dashboard for monitoring purposes. It was also stated that there is an option to save scanned images/ peak patterns of the USFD test undertaken. The response does not address the audit findings specifically. As observed in audit, despite existence of the facility for saving the images, the same was not being utilized in the selected sections of NCR and ECR.

Thus, there were shortcomings in USFD testing being done. Timely USFD testing could help detect the vulnerable points and accidents can be avoided.

2.2.1.5 Recording of track using Track Recording Cars

The Track Machines and Monitoring Directorate of RDSO monitors the track using Track Recording Cars[42] (TRC). The main purpose of these special carriages is assessment of the condition of track, identification of locations needing maintenance and providing data to Railway Board and Zonal Railways. While track geometry monitoring of Metre Gauge routes[43] is not to be done by TRCs, the Broad Gauge routes should be monitored by TRC as per the following frequencies (except for the routes where track recording has been dispensed with):

Table 7 – Frequency of track recording prescribed	
i) Routes with existing speeds above 130 kmph	Once in 2 months
ii) Routes with existing speeds above 110 kmph and up to 130 kmph	Once in 3 months
iii) Other Group 'A' and 'B' routes	Once in 4 months
iv) Group 'C', 'D' and 'D Special' Routes	Once in 6 months
v) Group 'E' and 'E Special' Routes	Once in 12 months

On receipt of track recording car programme from the RDSO, the Zonal Railways should arrange for suitable power and path along with telecommunication arrangement between the track recording car and the locomotive[44]. The Headquarters should advise the Divisions concerned for making necessary arrangements to ensure that the Track Recording Car has an uninterrupted run.

[41] Para 3 of Revised USFD Manual- where GMT is between 30 and 40, the USFD testing should be done quarterly
[42] These include five Microprocessor Based Track Recording Cars, one LASER based contact less sensors TRC and one Rail Profile Inspection & Analysis System
[43] Para 606 ofIndian Railway P-way Manual
[44] Para 609 of Indian Railway P-way Manual

The Divisional Engineer, Assistant Engineer and P-way Inspector of the section and nominated officer/staff of Headquarters office should accompany the Track Recording run[45]. The recording speed range of a Broad Gauge car is 70-80 kmph. The recording done below these speeds are taken as 'non-recorded'. For obtaining comparable results between successive recordings, it is necessary to run the TRC at a uniform speed. The TRC must run on through lines of all stations. Recording should be done during day light hours. Spots (kms) requiring immediate attention, indicated by large peaks should be noted down by the Assistant Engineer/P-way Inspector accompanying the car and immediate attention should be given to these spots without loss of time[46].

(i) Check of records of annual deployment plan of TRC at Track Machine & Monitoring Directorate, RDSO, Lucknow for the year 2016-17 revealed that track recording was not conducted as per plan due to non-availability of adequate number of TRCs. There were only four[47] TRCs in the RDSO for recording of entire track of Indian Railways. The details of functioning of these four TRCs during the year 2016-17 are mentioned below:

Figure 3: Track Recording Car

Table 8 - Deployment of Track recording Cars over BG sections of Indian Railway during 2016-17

Month	Track recording in Km			
	TRC 7965	*TRC 7967*	*TRC 7968*	*TRC 7969*
April 2016	3604	3185	3658	Under repair
May 2016	2784	3332	Under repair	Under repair
June 2016	1292	915	Under repair	4626
July 2016	3149	3582	Under repair	3171
Aug 2016	1993	Under repair	Under repair	Under repair
Sep 2016	2619	Under repair	Under repair	3631
Oct2016	3441	Under repair	Under repair	2650
Nov 2016	Under repair	Under repair	Under repair	Under repair
Dec 2016	4575	3080	Under repair	Under repair
Jan 2017	5037	Under repair	Under repair	4934
Feb 2017	4115	3835	Under repair	871
Mar 2017	2895	6309	Under repair	Under repair
Recording plan cumulative (kms)	**36581**	**24621**	**3645**	**20265**

[45]Para 610 of Indian Railway P-way Manual
[46]Para 611 of Indian Railway P-way Manual
[47]TRC 7965, TRC 7967, TRC 7968 and TRC 7969

Table 8 - Deployment of Track recording Cars over BG sections of Indian Railway during 2016-17				
Month	Track recording in Km			
	TRC 7965	*TRC 7967*	*TRC 7968*	*TRC 7969*
Actual run cumulative (kms)	**35504**	**24238**	**3658**	**19883**
Short/excess cumulative (kms)	***-1077***	**-383**	**13**	**-382**

From the above table, it can be seen that three of the four TRCs available with RDSO were under repair for substantive part of the year and one TRC was run only during one month in 2016-17 and remained under repair for the entire year. Out of the total recording plan of 85112 km, the four TRCs covered 83283 kms with only a shortfall of 1829 kms, because no track recording was planned in the months when TRCs were under repair. As per the report for the year 2016-17 of the Track Monitoring Directorate of RDSO, total liability of track recording on IR was around 1,95,000 track kms.

(ii) Audit further observed that

- In NCR track recording was conducted once against required four runs in 2016-17. TRC did not have an uninterrupted run over selected sections of NCR and the speed of TRC was also not uniform**.** Thus, comparable results between successive recordings were not produced by TRC**.**
- In SER, TRC was run once in selected sections against four scheduled runs to be conducted in a year in HDN route (A route). No TRC run was done during the last three years in Santragachi-Tikiapara and Tikiapara – Howrah section as the TRC starts its journey from Santragachi onwards. TRC run was not done in the selected non-HDN routes during the year 2016-17.
- In ECR, track recording were not conducted as per frequency prescribed. In both HDN sections (A route) and non-HDN sections (B route), TRC was run two times during the year 2016-17 against the provision of once in four month for both A and B routes.
- In SWR, no TRC run was done during the year 2016-17 in 'D Special' route.
- In SR, against three track recordings to be done in a year, only two track recordings were conducted during the year 2016-17.

During Exit Conference (30 August 2017), Railway Board stated that the results of track recording data are handed over to division for uploading in TMS and the same is used as one of the inputs for planning track maintenance activities in the section. They however, agreed with audit observation regarding TRCs not having an uninterrupted run in Zonal Railways and stated that it is desirable to have an uninterrupted run, but it may not be possible due to heavy traffic density in the sections. It was also stated that all four TRCs are at present working, but are not adequate for the entire Indian Railways. It was mentioned that RDSO has placed

an order for one more TRC and preparation of specification for three more TRCs was in process for procurement.

Thus, TRCs could not be used optimally due to frequent breakdowns and repairs. Non-deployment of TRCs over the planned sections led to non-checking of track parameters viz., position, curvature, alignment of track, smoothness, rail profile, etc. as per laid down frequency.

2.2.1.6 Track circuiting for detection of rail fractures

a) Track Circuits

Track circuits are electrical circuits, that are set up in such a way that when a train is on the tracks that are part of the track circuit, the circuit is altered in some way (usually, by current that normally flows in the track circuit being shunted through the conductive body of the train), thereby activating a detector which may then be used, e.g., to set signals at danger for the section.

In substance, Track Circuit is a low powered electrical circuit in which running rails are used as a part of the circuit. With the help of track circuit, one can identify whether the particular section is clear or occupied by a train / vehicles or track circuit is in failed condition. It is highly reliable for effective and safe running of trains. A Direct Current (DC) track circuit has mainly two ends i.e. feed end and relay end. A track circuit gives two indications:

Table 9 – Indications in track circuiting

1. Yellow / White / No light indication	When track circuit portion is clear i.e. when line is unoccupied.
2. Red indication	When track circuit portion is occupied by a vehicle or track circuit is in failed condition. Reason of failure of track circuit could be fracture in rail or failure in power supply.

Track circuits work by running a circuit using the rails to connect a power source at one end of the block with a relay at the far end. The relay and power source are connected to each rail by cables. As long as the circuit is complete the relay will be energized, which keeps signals in the “clear” position. When the circuit is broken due to occupation by a vehicle the track circuit system gives reports with red indication. The track circuit system also reports a red indication when the circuit gets interrupted for other reasons which primarily could be weld failure / rail failure due to fracture or non-availability of power supply.

b) Axle Counters

Axle counters are devices that can count the number of axles of vehicles passing through them on the track. Axle counters are installed at either end of the section of track of interest; when the number of axles counted at entrance to the section

is the same as the number of axles counted exiting the section, it means the train has passed through the section intact. Axle counters are used in some cases where track circuits are hard or impossible to operate (e.g., where metal sleepers are provided or where conditions are such that there is too much electrical noise and conductivity problems that make track circuits unworkable).

c) Provision of Dual Detection - Digital Axle Counter in parallel with AFTC /DC track circuits

The availability of track vacancy detection equipment in station section (DC track circuits) and in Automatic Block Sections (Audio Frequency Track circuit) is increased by providing Axle counter to work in parallel with DC track circuits / AFTCs. This arrangement is called as 'dual track vacancy detection' (AFTC or DC track circuits + Axle Counter) which in turn ensures less disruption of train traffic.

During failure of DC track circuit / AFTC, the axle counters will be available and signal will continue to display, red/yellow/green depending upon whether the section is occupied by a train/vehicle. Similarly, during axle counter failure, DC track circuits / AFTC is available in order to avoid traffic disruption.

Thus, it is essential to provide continuous track circuiting or axle counters in the Automatic Block System[48]. The Automatic Block System controls the movement of trains between the blocks using automatic signals. In this system, signals are designed to allow trains operating in the same direction to follow each other in a safe manner without risk or rear-end collision. Continuous track circuiting not only helps in improving the capacity with automatic block signaling where more than one train can be sent in a block section, but also improves safety. If double rail track circuit (audio frequency track circuit) is adopted, it can detect electrical discontinuity in rails due to rail/weld failures or acts of sabotage, etc. and thus can be used for detection of rail fracture/weld failure.

In Indian Railways dual detection system comprising of track circuiting as well as axle counters simultaneously is used on the same track length of the automatic block section. The use of dual detection system ensures that signal remains in a clear position, even if there is an electrical discontinuity in the circuit due to power failure/rail fracture. So a red indication in the signal requiring restricting the movement, would arise, when both axle counter and track circuiting simultaneously satisfy the condition that the concerned track length is occupied by the train. In other words as long as either of the two i.e. track circuiting or axle counter gives a clear signal, the signal to the locomotive driver would be clear. From the control panel located at the station, the Station Master would know if

[48] Both the axle counters as well as track circuiting can work simultaneously in an Automatic Block System

there is a failure of track circuiting without knowing the reason for the same. In such circumstance, he can switch over the system to axle counter mode only and allow the train movement on the basis of signal based on axle counter mode.

Thus, as long as Railway Administration assures itself that error signal by the track circuiting system is not related to track occupancy and hence the collision of the trains is not an area of concern, the error signal of the track circuiting is bypassed by switching over to axle counter mode. As the error signal in the track circuit could also be an indication of a rail fracture among other reasons, there is a need to explore the possibility of using the same for detection of potential rail fracture and putting in place a control mechanism like speed restrictions, for ensuring safety for rail operations. Audit observed that the operation instructions did not require the Station Master to look into the reasons for failure of track circuiting and take any action like imposing speed restriction on the movement of the trains or issue any alert.

In NCR, Allahabad-Ghaziabad section has Automatic Block Signaling System. An accident of Train no. 12987, Sealdah-Ajmer Express occurred at Rura on 28.12.2016 at 5:30 hrs in which over 50 persons were injured and a loss of ₹ 5.16 crore was estimated on account of damages to assets. The enquiry by Commissioner for Railway Safety (CRS) was still going on. The preliminary report which is required to be given after one month and Final report which is due from CRS within six months of the date of accident, were yet to be given. (June 2017)

Audit reviewed the records of joint observation note of supervisors on accident and found that though DC track circuit failure incident occurred at 2:16:47 on 28 December 2016, no follow up action was taken by Station Master on the incident of failure of track circuiting. A number of trains travelled on the track between 2:16 to 5:30, before the Train no. 12987 derailed. As per the Supervisors Joint note of Rura accident, the probable finding was rail fracture. The current approach in Indian Railways is not to use the output of track circuiting for detecting rail fracture and bypass such indication, till the time it is not related to track occupancy and hence could result in collision. Had the Railway Administration used this failure indication of track circuiting for examination of potential rail fracture, this rail accident could have been prevented. Since track circuiting failure have the potential of identifying rail fractures on real time basis, directives to use it for identification or ruling out of rail fractures should be considered.

During Exit Conference (30 August 2017), Railway Board stated that track circuiting is a reliable method of detecting defects in track. In the dual detection

system, axle counters are used as an alternative in case of failure in track circuiting. In the particular accident case pointed out by Audit, when the track circuiting failed, mode of train operation was shifted to axle counter without ascertaining the cause of failure of track circuiting. It was further stated that world over Railways only use one methodology viz., track circuiting for train operation and do not use dual detection system. However, due to traffic density, Indian Railways use dual detection system.

It was also stated that while using dual detection system, utmost caution is required. In case of failure of track circuiting while switching over to axle counters, speed restriction with caution order need to be imposed. Safety Review Committee (Para 20.5.7) had also recommended that the signal should be put to single yellow/double yellow aspect as soon as track circuit drops in dual detection territory, so that train speed is controlled to lower speed while passing the affected zone, which may have rail fracture.

Audit is of the view that Railways need to put a mechanism in place to examine the reasons for the failure of track circuiting and only after being satisfied that the reason is not rail fracture, should the train be allowed to move further. In such circumstances, the error signal of track circuit should be examined for rail/ weld fracture and till such time, a speed restriction should be prescribed for the identified track length.

2.2.2 Periodical maintenance activities - Preventive measures

In order to maintain the track in good condition, Railways undertake various preventive measures. These include Deep Screening of ballast and De-stressing of Long Welded Rails (LWR)/ Continuous Welded Rails (CWR) following the prescribed procedures.

2.2.2.1 Deep Screening of ballast

It is essential that track is well drained for which screening of ballast should be carried out periodically[49]. Due to presence of bad formation, ballast attrition, excessive rain fall and dropping of ashes and ore, ballast getting choked up, the track drainage is impaired. In such situations, it becomes necessary to screen the entire ballast right up to the formation level /sub-ballast level. Further, thorough screening restores the resiliency and elasticity of the ballast bed, resulting in improved running quality of track. Such screening is called 'deep screening', as distinguished from the shallow screening, which is done, during overhauling. The work of deep screening should be carried out continuously from one end of the

[49]Para 238 of Indian Railways P-Way Manual

section to the other. Deep screening should be carried out by providing full ballast cushion prior to Complete Track Renewal (CTR) and Through Sleeper Renewal (TSR), where the caking of ballast has resulted in unsatisfactory riding, before converting existing track, fish plated or Short welded Rail (SWR) into LWR or CWR; or before introduction of machine maintenance, unless the ballast was screened in recent past. The entire track must be deep screened at least once in ten years.

The activities of deep screening of ballast over selected sections of five Zonal Railways were reviewed and it was observed that

- Over selected sections of NCR deep screening of ballast was carried out manually on contractual basis and mechanically with the help of Track machines. Over the selected sections (total length 228.28 kms) of NCR, deep screening was not done in 214 locations covering 65 kms (28.47 *per cent*) though it was due since the 1995 to 2016. The range of delay in deep screening was one year to 22 years over these 214 locations. Further, in 18 locations covering 4.98 kms, the deep screening was overdue for more than 10 years; in four locations (between Shikohabad-Tundla, Panki-Etawah, Govindpuri-Panki and Kanpur-Govindpuri sections) covering 1.35 km, deep screening was overdue for more than 20 years. The main reasons for delay in deep screening was attributed to non-availability of block, delay in approval of proposal, shortage of contractual labour and use of manual method of deep screening, etc.
- In SWR, over the selected section (total length 242.07 kms), deep screening was not done in 86 locations covering 51.51 kms (21.28 *per cent*) though it was overdue for a period ranging from three to 66 months. The reasons for not carrying out deep screening was stated as not included in the annual plan, delay in execution of works, sanction of Through Fitting Renewals (TFR) works in the subsequent immediate period, etc. In Heavy Traffic Sections, Deep Screening was done by machines.
- In SR out of three selected section (124.59 kms), in two sections[50] covering 100.43 kms, deep screening of ballast was not done in 5.18 kms, which were due during 2010-11 and 2011-12 respectively and carried out during 2016-17 after a delay of five years.
- All the deep screening work in selected HDN and Non-HDN routes was done mechanically during 2016-17. In selected non-HDN route of ECR (total length 211 kms), the deep screening was done only in 0.924 kms as against the 62.218 kms due in 2016-17 leaving shortfall of 98.5 *per cent*. The reasons for shortfall were non-availability of Ballast Cleaning Machine due to shifting of

[50]SSE/P Way/AVD -Down Slow EMU Line and SSE/P Way/TRL – Down slow EMU line

base of machines to other locations; machine remained under maintenance, non-availability of blocks, etc. In selected HDN routes, deep screening of 228.57 kms was due but only 37.14 kms was planned and done during 2016-17. The reason for non-inclusion of all the due portion of deep screening of track in annual programme of 2016-17 was not found on record. For HDN sections in ECR, as on 31 March 2017, deep screening was overdue at 63 locations ranging from one to nine years. The main reasons for delay in deep screening were non-availability of block, delay in approval of proposal, etc.

- In SER, in all the selected sections (total length 396.20 kms), deep screening of ballast was not carried out regularly. In 16 locations covering 78.87 kms deep screening was overdue. In some sub-sections of seven sections (Kharagpur-Tata, Mecheda-Panskura, Jharsuguda-Rourkela, Rourkla-Bondamunda, Panskura-Haldia, Santragachi-Tikiapara and Tikiapara-Howrah), last deep screening was done more than 10 to 16 years back. However, the deep screening work in these sub-sections was not done in 2016-17. The reasons for the same were non-sanctioning of work, non-finalization of tender, non-availability of block, shifting of machine, non-availability of sleepers, etc.

Annexure I

During Exit Conference (30 August 2017) Railway Board agreed with the audit observations and stated that non-availability of blocks is the main reasons for overdue deep screening of ballast. Audit is of the view that availability of blocks is within the control of Indian Railways and the same should be provided for track maintenance works.

Thus, there were significant arrears in deep screening work, which impacts the resiliency and elasticity of the ballast bed with consequent impact on running quality of tracks.

2.2.2.2 De-stressing of LWR/CWR

The safety of LWR track is vitally affected by locked up thermal stresses, which can result in rail buckling or rail fractures. De-stressing is a technique to avert rail track problems in LWR or CWR. When installing a new rail, or before the onset of hot weather, the rail is pulled or stretched by hydraulic tensors[51] or heated along its entire length to an equivalent length to that the rail would be at the stress free temperature. As per rules[52] de-stressing is undertaken with or without rail tensors to secure stress free conditions in the LWR/CWR at the desired/specified rail

[51] A rail tensor is a hydraulic or mechanical device use for stretching the rail physically to keep rail free from thermal stress
[52] Para 1.9 of Manual of Instructions on LWR

temperature. Railway Board further instructed (21 February 2012) that track works should not be undertaken manually on A B C & D special routes without the approval of Additional Member/Civil Engineering.

As per rules[53], de-stressing shall be undertaken whenever the abnormal behaviour of LWR/CWR gets manifested in the form of gap between Switch Expansion Joint (SEJ) beyond limits, after Through Fittings Renewal (TFR), deep screening /mechanized cleaning of ballast, lowering/lifting of track, major realignment of curves, sleeper renewal other than casual renewals, rehabilitation of bridges and formation causing disturbance to track, after restoration of track following an unusual occurrence and if number of locations where temporary repairs have been done exceed three per km.

The activity of de-stressing of LWR/CWR was examined in the selected sections of five Zonal Railways. It was observed that

- In NCR, need based de-stressing was carried out without using rail tensors. Further, in Tundla – Shikohabad section, the work of de-stressing was overdue in two locations of main line section between Sarai Bhopat and Shikohabad which became due after use of Ballast Cleaning Machine (BCM) in one location and in other location, de-stressing was done on high temperature early due to which extra stresses were developed in LWR. Proposal for de–stressing was sent (July 2016) to Divisional offices by the ADEN / Firozabad but the same was yet to be approved by the Divisional office till the date of audit (June 2017).
- During the check of records maintained in SSE offices of selected sections of SER, it was noticed that
  - In four sections (Kharagpur-Tata, Mecheda-Panskura, Jharsuguda-Rourkela, Muri-Barkakana), though special track maintenance was done during 2004 to 2015, the de-stressing work was not done in these sections after maintenance work of Deep Screening and Complete Track Renewal works.
  - In Kharagpur-Tata, under SSE, Jhargram, de-stressing was done in 2009, but due to absence of any record, it could not be ascertained whether further de-stressing was done.
  - In Santragachi-Tikiapara and Jharsuguda-Rourkela sections under SSE, Santragachi and Rajganpur, de-stressing was done during 2003 and 2004 respectively, no further de-stressing was done. Even in Santragachi-Tikiapara, de-stressing was done in one LWR in 2007 and four LWR in 2010. No further de-stressing was done in this section till date.

[53]Para 6.4.1 of Manual of Instructions on LWR

- In SR, SWR and ECR, the de-stressing of rails was carried out in the sections checked.

During Exit Conference (30 August 2017), Railway Board stated that main constraint is non-availability of required block. It was mentioned that Rail tensors are used while de-stressing of rails only when the required temperature is below the prescribed threshold. As the time required for de-stressing using rail tensors is more and usually longer maintenance blocks are not available, manual de-stressing is resorted to. They further stated that arrear on account of de-stressing gets accumulated, if the blocks are not provided when the de-stressing temperature is available.

Thus, delay in de-stressing in selected sections after special maintenance work, may have a bearing on the safety as thermal stress gets locked up in the LWR which may result in buckling or fractures. Railways need to provide required time of block for de-stressing work to avoid cases of rail fractures/buckling.

2.2.2.3 Contractual works for track maintenance

Proposal for contractual works in connection with the repair and maintenance of permanent way is initiated by the PWI (Permanent Way Inspector) office and sent to division for approval. This could involve multiple activities of regular and periodical maintenance in the section to be undertaken through outsourcing.

During the review of records related to contractual works such as change of damaged track due to derailment, deep screening of ballast, turnout renewal, de-stressing of track on main line, etc. for track maintenance over selected sections of five Zonal Railways, the following was observed

- Review of tender document and contract agreements in NCR and SER showed that in all the selected sections, the clause for employment of skilled staff by contractor was not incorporated in the agreement. However, in ECR, the same was incorporated and certificate for the purpose was collected from the contractors.
- In SER, as per the special conditions of contracts, the contractor is supposed to engage Supervisors and send them for training to a railway training centre and bear the cost of training payable to the railways. It was observed that the contractors were not sending their supervisors for training for acquiring required skill set. There was no penalty clause in the contract for not adhering to this specific condition of contract.

During Exit Conference (30 August 2017), Railway Board stated that normally there is a clause in the contract for skilled supervision. Audit stated that in respect of maintenance by departmental staff, there is a requirement of the concerned

staff being trained and skilled. Similar requirement, however, is not there in respect of maintenance being done through contractors.

Thus, Railways need to ensure incorporation of a clause for deployment of skilled labours under the supervision of trained personnel and provision for penalty in case of non-compliance, for ensuring quality of work done by the contractors.

2.2.3 Corrective actions based on condition monitoring

Using the detective and preventive methodologies discussed above, Railways monitor various track parameters and take necessary corrective actions. These parameters include rail fracture, weld failure and other defects in rails, crossings, sleepers, etc.

2.2.3.1 Rail fractures and weld failures

The life of rails, sleepers, and fastenings gets adversely affected due to the extra stresses created by the impact of moving loads on the rail joint. The rail ends particularly get battered and hogged and chances of rail fracture at joints are considerably high due to fatigue stresses in the rail ends. ***Rail fractures*** occur when a small crack turns into a larger one and they occur in the season when there is a significant difference between the maximum and minimum temperatures in the day, since those cause the tracks to expand and contract. Poor maintenance and fitting could also be the cause of a small crack that over time could lead to a separation of rails. This results in a break in the tracks, which causes the bogie to go off the rails, affecting all the coaches behind it. The Ultrasonic Flaw Detection Manual[54] identifies the most common cause of rail failure as the fatigue fracture, which is due to imperfections present in the material or due to crack formation during service.

Figure 4: Rail fracture

(a) Process of welding of rail joints

Rails are produced in fixed lengths and need to be joined end to end to make a continuous surface on which trains may run. For joining of the rails welding of ends of two rails is carried out. A ***weld failure*** could be a result of poor quality of welding. As envisaged in the Corporate Safety Plan (2003-13) and Vision 2020 of

[54]Chapter 1 of Revised USFD Manual

Indian Railways, to improve the quality of welds and enhance safety, the population of Alumino Thermite Welds was to be gradually reduced and replaced by Flash Butt (FB) welds with the help of mobile flash butt welding plants. The advantages of FB welds over an Alumino Thermite weld are as follows:

Table 10 – FB welds versus Alumino Thermite welds

	FB weld	AT weld
Principles of welding	Welding is done by passing a 35,000A electric current between two rails ends.	Welding is done by initiating an exothermic chemical reaction between iron oxide and aluminium
Quality of welding	Excellent	Good
Strength of welding	Good in fatigue	Weak in fatigue
Time required for welding	About 3-6 minutes	10-12 minutes for SKV[55] and 30-45 minutes for conventional
Place of welding	Welding normally done in workshop, but can be done on-site using mobile plant	Welding done onsite
Cost of welding	₹ 400-600 per weld	₹ 700-1200 per weld
Tolerance	Very high	Normal
Control on the quality of welding	Quality can be controlled with the help of a welding recorder	Quality control is possible only by working diligently and no monitoring is possible.

Slow progress in induction of mobile flash butt welding was attributed to mobile flash butt welding plants being bulky requiring more space and long spells of traffic blocks.

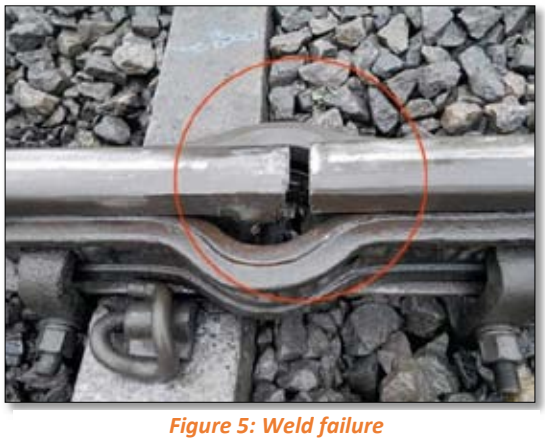

Figure 5: Weld failure

In April 2014, Railway Board instructed[56] that all the tenders of Alumino Thermite Welding were to be only with single shot crucible[57] after 1 April 2015. The use of multi-shot in Alumino Thermite welding after 1 April 2015 was to be discontinued and permitted only as an exception. Railway Board further instructed[58] (March 2015) that one weld in every division will be got executed by Chief Track Engineers (CTEs) in their

[55] SKV is the short form of the German phrase Schweiss-Verfahranmit Kurzvorwarmung meaning the short preheat welding method. The technique is therefore also termed SPW (short preheat welding).
[56] Railway Board's letter no .Track/21/2007/0110/AT Welding dated 2 April 2014
[57] Single shot crucible is an improved AT welding technology in which a portion of welding material is directly set on top of the mould without any hardware.
[58] Railway Board letter no .Track/21/2002/090S/7IVol.II dated 18 March 2015

presence, observing all instructions of checklist of Alumino Thermite Welding. Similarly, initial testing of one new weld per division was to be got executed by CTEs in their presence observing all instructions of checklist of Ultrasonic Flaw Detection testing and report sent to Railway Board. In case of the work being done by a contractor, provisions exist for re-welding of failed welds free of cost by the contractor within the guarantee period. For failure beyond a prescribed criteria, a penalty is to be paid by the contractor.

Audit examined relevant records pertaining to the rail fracture/ weld failure over the selected sections of five Zonal Railways. The details are given below:

Table11 – Rail fractures and weld failures in selected sections during 2015-16 and 2016-17

Zonal Railway	Accidents due to rail fractures/ weld failures	Number of rail fractures		Number of Alumino Thermite weld failures		Number of Flash Butt weld failures		Reasons
		2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	
SWR	01	30	95	89	220	05	12	One accident occurred in 2015-16 due to rail fracture. No casualties were reported.
SR	Nil	11	12	4	4	4	1	Liner seat corrosion and corrosion at weld area
ECR	5	39	34	9	11	6	5	Sudden rail fracture
SER	0	10	9	2	3	1	2	--
NCR	01	15	19	31	35	10	11	Final report of investigation still awaited.
Total	**07**	**105**	**169**	**135**	**273**	**26**	**31**	

From the above table, it can be seen that

- Seven accidents occurred in the selected 37 sections over five Zonal Railways due to rail fracture/ weld failure during the past two years.
- In SWR and SR, number of rail fractures increased as compared to the previous year. Further, number of Flash Butt weld failures was much less than that of Alumino Thermite weld failures.
- In SWR, the reasons of sudden increase in rail/weld failures in 2016-17 were attributed to change in the method of reporting[59] since October 2016.

[59]From October 2016 onwards all incidents of weld/rail fractures are being reported to Railway Board. Earlier, rail/weld fractures only of a serious nature were reported to Railway Board.

Further, Flash Butt Welding was yet to be taken up in a big way and hence, no comparative study could be made between Flash Butt Welding and Alumino Thermite Welding works/failures.

(b) Flash Butt welding versus Alumino Thermite welding

A comparison of defects in the Alumino Thermite weld population and Flash Butt weld population was done in selected sections of five Zonal Railways. It was observed that percentage defects in Alumino Thermite weld were much higher than FB weld as can be seen from the table below:

Table 12 – Weld failures in selected sections of NCR during 2016-17

ADEN / SSE	AT weld population	Defective weld in USFD testing	Percentage	FB Weld population	Defective weld in USFD testing	Percentage
			NCR			
ADEN – Etawah	4953	1323	26.71	15747	67	0.43
ADEN - Kanpur	6999	1844	26.35	12746	132	1.01
ADEN - Chunar	6785	957	14.10	5393	26	0.41
ADEN - Firozabad	21490	1105	5.14	18261	71	0.39
SSE - Naini	543	99	18.23	1524	15	0.98
SSE - Allahabad	514	153	30.93	175	7	4
SSE - Dadri	1965	121	6.16	4183	3	0.07
Total	**43,249**	**5,602**	**12.95**	**58,029**	**321**	**0.55**
			SER			
ADEN/PKU	*5437*	*58*	*1.07*	*12176*	*38*	*0.31*
ADEN/JGM	*12931*	*111*	*0.86*	*12978*	*44*	*0.34*
ADEN/Satragachi	*11724*	*142*	*1.21*	*2329*	*06*	*0.26*
ADEN/BLS	*18327*	*246*	*1.34*	*14343*	*22*	*0.15*
ADEN/TMZ	*16929*	*62*	*0.37*	*10894*	*36*	*0.33*
ADEN/Kharagpur	*10723*	*52*	*0.48*	*10083*	*57*	*0.57*
TOTAL	**76,071**	**671**	**0.88**	**62,803**	**203**	**0.32**
			SWR			
AEN - Bellary	7590	1679	*22.12*	222	02	*0.90*
AEN - Gadag	6619	1302	*19.67*	-	-	*0.00*
AEN - Central	6398	1586	*24.79*	-	-	*0.00*
AEN - Belagavi	9133	1801	*19.72*	523	04	*0.76*
AEN - Castlerock	4949	780	*15.76*	1441	14	*0.97*
TOTAL	**34,689**	**7,148**	**20.61**	**2,186**	**20**	**0.91**

- In NCR, Alumino Thermite welding was not initiated with single shot crucible**.** However, in some cases use of single shot crucible was noticed only after January 2017.
- In SER, Alumino Thermite welding with single shot crucible was started after April 2017 instead of April 2015 i.e. after a lapse of two years by SSE/Rourkela and SSE/Kolaghat under Jharsuguda – Rourkela and Mecheda – Panskura sections respectively.

- In SWR, Alumino Thermite welding was done with single shot crucible with effect from 1 April 2015.

- In ECR, Alumino Thermite welding with single shot crucible was started in non-HDN route with effect from October 2016 after delay of 18 month and in HDN route with effect from June 2016 after delay of 14 month. The reason was attributed to delay in supply of material.

- In SR, Alumino Thermite welding was not being done with single shot crucible and instead done by auto thimble (pre-fabricated piece). During March 2017, a contract has been awarded for Alumino Thermite welding with single shot crucible in the Chennai Central-Arrakonam section.

- In NCR and ECR, initial testing of one new weld executed in presence of CTEs was not done**.**

- In NCR, welding work was carried out departmentally and by the staff of contractor**.** No case of contractors' failure and imposition of penalty as per contract *ibid* were noticed in NCR, ECR and SWR.

During Exit Conference (30 August 2017), Railway Board stated that they use Alumino Thermite welds only for repair work. It was also stated that while flash butt welding is better methodology for welding of rails, it is techno-economically not feasible for welding in all cases. As such, flash butt welding is being used in joining rails in depots and Alumino Thermite weld judiciously used for repair work only. At present there are seven flash butt welding plants in Indian Railways, renewal of which has been planned. However, Audit observed that railways have taken a policy view for gradually reducing the population of Alumino Thermite Welds and replace them by Flash Butt (FB) welds with the help of mobile flash butt welding plants. Railway Board has also issued various instructions over the years for reducing the number of AT welds and using mobile flash butt welding plants instead to enhance the quality of welds and safety of tracks. However, progress made in this regard was not satisfactory.

Railway Board further stated that 70 *per cent* of rails procured from SAIL are 13/26 m and 30 *per cent* rails are 130 m which are joined to make LWR. It was added that it is planned to have 70 *per cent* rails of 130 m which will need lesser number of field welds.

Railway Board also stated that availability of block of minimum 75 minutes is essential for good quality Alumino Thermite welding, which is usually not made

available. Audit is of the view that Railways need to ensure availability of required block time for ensuring quality of Alumino Thermite welds.

To improve the quality of welds and enhancing safety, the population of Alumino Thermite Welds was to be gradually reduced and replaced by Flash Butt welds with the help of mobile flash butt welding plants. Railways need to take action and enhance the use of mobile flash butt welding plants.

2.2.3.2 Monitoring of track where enhanced loading (CC+8+2t /25 t axle load) is permitted

(a) Conditions to be followed where operation of wagons with enhanced loading was permitted

Anticipating that enhanced axle load will have more adverse effect on track, the operation of CC+8+2t wagons with load in excess of carrying capacity by eight tonnes with tolerance of two tonnes was permitted with a set of strict conditions. Instructions were issued from the apex level on 10 August 2006. The salient points are given below:

- Wheel impact load detectors (WILD) were to be installed at all selected locations within one year
- Weighbridges were to be installed and it was to be ensured that all weighbridges were maintained and functional. No overloading was to be permitted. Drastic penal action was to be taken against defaulters.
- Wagons were to be well maintained and additional springs were to be provided during Routine Overhauling/Periodical Overhauling.

RDSO further prescribed requirements for operation of CC+8+2t /25 t axle load that *inter alia* included:

1. The track was to be of a minimum standard of 60 kg rail (90UTS), with 1660 sleeper density and minimum depth of ballast cushion of 300 mm below sleeper. Maximum permissible speed was to be restricted to 70 kmph in loaded condition and 100 kmph in empty condition. For track with a minimum standard of 52 kg rail (90UTS), sleeper with M+7 density and minimum depth of ballast cushion of 250mm below sleeper, the maximum permissible speed was to be restricted to 50 kmph in loaded condition and 100 kmph in empty condition.

2. The welds were to be protected by joggled fish plates as per laid down provisions[60]and maintenance of Rails and Rail joints was to be ensured[61]. In

[60] Para 6.4 and Para 8.14 of Ultrasonic Flaw Detection Manual and Para 6.3 of AT welding manual and other policy instruction of Railway Board.
[61] Para 250 and 251 of Indian Railway P-way Manual

addition, wherever condition warranted on account of corrosion on rail/weld collar, wear on rail, cupping of welds, etc., necessary precautions were to be taken for fish plating/joggled fish plating.

3. USFD testing was to be carried out at a frequency, one grade higher than the specified frequency in the USFD manual. On section with GMT more than 60, the existing stipulated frequency of once in one and a half month as per USFD Manual was to be continued.

4. Only weighed raked were to be moved on the section after unloading/ correction of over loaded wagons. In case unloading/correction is not possible then speed of rakes was to be restricted as applicable for CC+8+2 tonne loaded rakes as mentioned in unified JPO issued by Railway Board[62].

5. Zonal Railway were to set up a regular rail grinding regime which is considered necessary, to check development of rolling contact fatigue defects in rail due to 25T axle load operations.

(b) Adherence to Railway Board guidelines regarding checks and controls before running heavier loads on sections

In NCR, operation of 22.9t BOXNHL wagon was introduced through Railway Board sanction in December 2009. In the selected sections of NCR, no assurance could be derived about compliance to these conditions with regards to weighment and availability of minimum depth of ballast cushion for running of 25t axle load. In ECR CC+8+2 loading was introduced in Patna-Mughalsarai-Gomoh sections in 2008 and in SER, out of six selected HDN sections, four sections were identified for CC+8+2/25 ton Axle load. No assurance could be derived in ECR and SER about availability of minimum depth of cushion for running of 25t axle load due to non-maintenance of records in the selected sections. In SWR ballast cushion of 300 mm was seen maintained over the selected sections. In SR sleeper density of M+8 and ballast cushion of 300 mm was maintained in the selected sections.

Railway Board/RDSO issued a number of control and monitoring measures to be strictly followed in the sections where enhanced loading was permitted. This included rehabilitation of distressed bridges and installation of Bridge Load Monitoring System, installation of weighbridges and ensuring weighment, use of USFD testing for monitoring track, replacement of rails by 90R rail in the whole section, monitoring rail and weld defects, etc. The compliance of these instructions was checked in the selected sections, where enhanced loading of CC+8+2/CC+6+2/CC+4+2 was permitted.

[62] Railway Board letter no. 2007/CE/II/TS/8 dated 2.4.2009

(i) In NCR, it was observed that all the nine sections (Allahabad division) were notified for running of CC+8+2 rakes. However,

- Damages were reported in 14 bridges in Ghaziabad-Mughalsarai section , but yet to be rectified (March 2017),
- Location-wise stock of USFD tested rails was not made in selected sections for use,
- New welds were not tested by USFD within 30 days of welding,
- 52 kg rails still existed on few portions of these sections (67.754 kms) where enhanced loading was permitted, due to which speed restrictions had been imposed; and
- Only one weighbridge at GMC was available in Allahabad Division, which was installed in December 2011.

(ii) In ECR, Patna-Mugalsarai and Mugalsarai-Gomoh sections were notified for running CC+8+2 rakes. However, Bridge load monitoring system was not installed and USFD testing was not being done as per prescribed frequency. In Patna-Mughalsarai section, no weighbridge was installed to check overloading of rakes.

(iii) In SER, out of six selected HDN sections, four sections (Jharsuguda – Rourkela, Rourkela – Bondamunda, Tata-Kharagpur and Mecheda - Panskura) were identified for CC+8+2/25t Axle load. Bridge Load Monitoring System had not been installed in these sections.

(iv) In SR, three sections have been notified for running of CC+8+2 rakes. New welds were tested by USFD within 60 days instead of 30 days due to busy schedule of deployment of USFD machine over the division.

(v) In SWR, there is one section notified for running of CC+8+2 rakes. New welds were USFD tested after delay of one to six months. Though scanned images/peak pattern were saved for the test conducted by the private agencies, for departmental USFD team, these were saved only for welds and rails which required immediate removal/replacement.

Annexure 2

In this regard, review of report of RDSO regarding 'Effect on track due to operation of CC+8+2t/ 25t axle load' revealed an increasing trend of rail/weld defects in Mughalsarai-Ghaziabad section on quarter-to-quarter basis as detailed below:

Table 13- Rail / Weld failure and USFD testing details of Mughalsarai – Ghaziabad section (60 kg rail, PSC – 1660/kms)								
Quarter	Track length (Km)	Rail Defects (OBS + IMR)	Weld Defects (OBS+IMR)	Rail Failure	Weld Failure	No of welds tested	DFW	DFW per 100 weld
Oct 2015 to Dec 2015	1502.4	92	345	5	18	11682	889	7.6
Oct 2016 to Dec 2016	1502.4	141	304	5	19	9806	757	7.7
Jan 2016 to Mar 2016	1502.4	96	322	4	11	14570	706	4.8
Jan 2017 to Mar 2017	1502.4	189	341	10	19	7425	977	13.2
April 2016 to June 2016	1502.4	56	206	0	2	10910	849	7.8
July 2016 to Sep 2016	1502.4	74	168	3	5	8177	815	10

(OBS – observation of weld, DFW – Defective weld, IMR – Immediate rail removal)

A comparison of number of defective welds per 100 weld tested of various quarters during October to March, with the figures of the previous year's respective quarters, showed an increasing trend in Mughalsarai – Ghaziabad section. The actual rail and weld failures were also showing an increasing trend. The report of RDSO highlighted that

- Increased axle load wagons have adverse effect on rail and old Alumino Thermite weld.
- Defect generation in rail and welds is increasing due to heavy load on the track.
- Actual failures in rails and welds are also increasing.
- Rate of breakage of PSC sleepers, glued joints and fish plates and wear of switches & crossing were increasing.
- The implementation of Railway Board instructions regarding monitoring and detachment of defective wagons as per WILD alarms was severely lacking.
- Weighment of each rake and control on overloading is also not being monitored by NCR.
- At present in sections where 22.9 t /25t axle loads are running there is no rail grinding regime in operation to take the advantage of the technology.

(c) Non installation of Wheel Impact Load Detector (WILD) System

WILD (Wheel Impact Load Detector), is an unmanned intelligent trackside data acquisition system that measures the dynamic impact load of wheels on the track. It is a useful 'wayside detection system' for safety and asset reliability in train operations.

WILD system helps reduce the railway maintenance cost significantly by identifying the damage causing wheels for quick removal. Out of round wheels produce very high impact loads which result in normally imperceptible damage.

Such impact loads sustained over long term leads to premature failure of rails, wheels, bearings, etc. With rising axle-loads the severity of this type of damage increases.

Thus, WILD helps in reducing service failures and unplanned maintenance cost of rolling stock and tracks and catching the defects at an early stage and thereby instrumental in protecting rail infrastructure, avoid derailment and accidents. It replaces subjective human judgment, increases reliability of identification of defective wheel, has in-built automatic communication for prompt corrective action, detects overloaded wagons and helps in improvement in safety of vehicle and track.

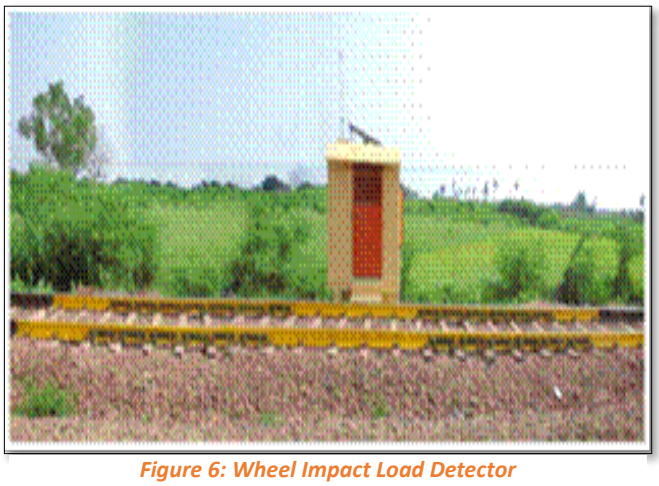

Figure 6: Wheel Impact Load Detector

Minister of Railways in August 2006 pointed out that WILD must be installed at all the selected locations (270 locations were identified over all Zonal Railways) within one year. Further, Railway Board in 2008-09 decided for procurement of WILD through development cell at Railway Board. In December 2015, RDSO advised all Zonal Railways to ensure installation and maintenance of adequate number of WILD instruments to record the impact of loading spectrum actually passing over the track. As against 270 locations identified, WILD had been installed at Mughalsarai (ECR), Bina and Itarsi (WCR) and Dongargarh (SECR). Audit observed that no WILD system had been installed in NCR, SER and SR. In SWR, WILD was installed in Hitnal station in August 2010, but not working since February 2017 due to ongoing doubling work in the section. It was further seen that the global tender for installation of WILD was yet to be finalised (March 2017).

RDSO in its report (11 May 2017) on 'Effect on track due to operation of CC+8+2t/25t axle load' stated that implementation status of Railway Board's instruction regarding weighment of each rake and control on overloading is not being monitored by Zonal Railways. The Report highlighted the following deficiencies:

1. In NCR, not even one *per cent* of the rakes running on the system were being passed through weighbridge installed at Jhansi and Kanpur Goods Marshalling

Yard (GMC). Between January 2016 and March 2017, of 7207 rakes of 22.9t axle load which passed through Allahabad- Kanpur Goods Marshalling Yard, only 20 rakes were weighed of which five were found overloaded and corrected.

2. Operation of 22.9t BOXNHL wagon was introduced in NCR through Railway Board sanction in 2009. Ghaziabad-Mughalsarai route (Track length 1502.4 Km) was under CC+8+2 routes and line capacity utilisation was more than 100 *per cent.* However, WILD instrument has still not been installed over NCR. Hence, impact of heavy loading, flat wheel and overloading on track could not be ascertained for quick remedial action.
3. Analysis of the RDSO report for the WILD at Mugalsarai showed that during January 2016 to March 2017, of the 7857516 wheel passed through WILD, 27183 maintenance alarms were generated, of which 221 were critical. However, only seven wagons were detached. Even the wagons producing alarm up to 51t were allowed to run.
4. The Report also showed an increasing trend of rail and weld defects in most of the sections operating 22.9t/25t axle load.

During Exit Conference (30 August 2017), Railway Board stated that at present out of 270 locations identified, WILD has been installed in 15 locations, of which, two are no longer functional. It was stated that a JPO has been issued at Railway Board level to follow laid down procedures for monitoring through WILD, which needs to be followed properly. It was also stated that the impact load and sometimes due to overloading on already stressed rails also cause sudden rail failures.

Railway Board further stated that all critical alarms generated are crucial and action need to be taken on each and every critical alarm. Not taking action and detaching wagons where critical alarms are generated leads to severe damage to tracks/rails and entail high risk of accident/derailment.

Thus, necessary measures such as installing weighbridges to ensure weighment and control overloading, laying of higher strength rails, were also not implemented. Running goods trains with enhanced load without ensuring the check and control mechanism in place could lead to poor track condition, which could impact the safety of running trains. Eleven years after the issue of instructions, WILD system was not installed at most of the identified locations. In a few locations like Mughalsarai where WILD was installed, corrective action was not being taken on the basis of the information/data generated from WILD as Railway Administration ignored most of the critical alarms.

2.2.3.3 Monitoring through Track Management System (TMS)

With a view to maximize the benefits of material, equipment and manpower inputs made to track and to optimize the life and utilisation of assets, Track Management System (TMS) application software has been developed.

TMS provides benefits in the form of prioritization of works, need based deployment of Gang and Machine, overall economy in Track Maintenance, monitoring of overdue inspections, listing of features needing attention, optimization of maintenance inputs, easy management of entire infrastructure with centralized option, reduced IT maintenance and personnel costs and seamless transfer of data for users moving from one location to other by virtue of centralized database. TMS has various modules, viz. Asset, Inspection, Planning, Work, Stores, Report, Innovations, Miscellaneous, Rail and weld fracture, Track monitoring by machines, Monitoring by machines & USFD testing, Engineering control-caution orders and traffic blocks, Track renewal and deep screening, Ballast supply and insertion, Patrolling and accidents reporting.

Audit examined the implementation of TMS over the selected Zonal Railways. In this regard, read only access of TMS was not provided by Railway authorities to Audit at Divisional and Zonal level. Thus, details of functioning of TMS application and its optimum utilization in decision making by divisional and Zonal offices could not be ascertained in Audit. Limited access to the TMS reports was given to audit at sectional level. Audit observations on the basis of analysis of these reports are detailed below:

- TMS was working over Allahabad Division since 2014-15. 115 TMS connections were provided to ADEN and SSE (P-Way) over Allahabad Division. Check of reports generated through TMS revealed that
    - Asset, store, caution orders, traffic block, ballast supply and insertion and accident reporting modules were not working in TMS.
    - Monitoring of TMS at ADEN & SSE level is a regular activity and must be done on day to day basis . However, compliance of inspections was not entered in TMS. Consequently backlog of compliance was being reflected on TMS .
    - Data of bridge inspection, training of staff, periodical medical examination and refresher courses was not updated in TMS.
    - Check of reports of Track Machine module of TMS revealed that details of track machine deployed in different sections were updated in TMS regularly.

- In SER, updation of data in TMS was not regular as internet connection was poor. However, manual records viz. Gap register, Points & Crossings Register, Curve Register, etc. were being maintained side by side along with TMS.
- In ECR, information/data in respect of track maintenance viz. inspection programme of SSE/ P. Way, AEN of the concerned section, Inspection details asset register of LWR, detail of machine maintenance were fed in the TMS from the year 2015-16 onwards. It was further noticed that ECR was not uploading the reports of inspection done at SSE/P-way level and compliance thereof at all the levels in the system in all the cases rather uploading was done selectively.

  Scrutiny of inspection reports of SSE/P. Way, AEN & DEN generated from TMS of both selected HDN and Non-HDN routes revealed that action taken and compliance of general remarks/findings of inspection conducted by concerned officers/officials were not incorporated in the TMS. In absence of action taken and compliance of Inspection Reports, it could not be assessed whether timely action was taken.
- In SWR, implementation of TMS in eight selected SSE (P-way) and five AEN Offices was checked.
  - There were delays in feeding data in TMS by P-way officials.
  - Alerts issued by TMS were not attended to/taken care of.
  - In SSE (P-way), Hubli (East), though inspections - LWR, points & crossings, curves, Level Crossings, etc., were conducted, details of the same were not fed in TMS from April to September 2016.
- In SR, in regard to track maintenance part of TMS, except Stores Module, all other Modules relating to track maintenance have been implemented. Track Machines programme is uploaded in the TMS for monitoring by officials, of adhering to the planned maintenance schedule using track machines, TMS is used by the concerned officials.
- Store module viz. receipt, issue and balance of material and excess/shortage of material, etc. were not maintained in the TMS of both selected HDN and non- HDN routes in all Zonal Railways - NCR, SER, ECR, SWR and SR.

During Exit Conference (30 August 2017), Railway Board stated that at present module for bridge inspection is not inbuilt in the TMS and is being prepared separately. Only master data of bridges has been uploaded in TMS. During discussions Audit suggested providing access of TMS to all departments for better coordination of maintenance activities, to which Railway Board responded that

access to TMS was on a 'need to know' and 'need to use' basis. However, reports could be made available as and when required to officials of other departments.

Thus, TMS was not being used effectively in monitoring track maintenance activities. There is a need for complete development of bridge inspection module in TMS, implementation of all modules of TMS in all Zonal Railway formations, completeness of data entry, real time updation of data into TMS and utilization of information in TMS for monitoring, decision making and undertaking track maintenance activities.

2.3 Impact due to deficiencies in track maintenance

Deficiencies in maintenance of track result in imposition of speed restriction on various sections, and can also lead to derailments/ accidents.

2.3.1 Speed restrictions

The impact of running trains causes heavy wear and tear of the track. It becomes necessary to rehabilitate or renew the track periodically to ensure that it continues to be safe and efficient. Retaining the over aged tracks in operation not only leads to an increased cost of maintenance but also affects the safety and fluidity of the movement of traffic. Due to delays in track maintenance, incidents of rail fractures may increase.

Zonal Railways impose speed restrictions on various sections due to poor track structure. Each speed restriction has a cost attached to it and prolonged imposition would also have a financial impact in addition to the operational impact. It is therefore necessary to ensure completion of works within a set time frame so that speed restrictions are removed at the earliest.

Audit revealed that

- In NCR, 34 PSRs which had been continuing since 2007 in the selected sections. The reasons for imposing PSRs included defects in track structure, less transition curve in the track, inadequate transition length between points & crossings, weak bridge structure, bad drainage system, poor visibility, large number points and crossings in track, unusual vibration sound during oscillation trail, etc.
- In SER, a total of 159 PSRs were imposed (Kharagpur - 102 and Chakradharpur - 57), out of which 28 PSRs (Kharagpur - 18 and Chakradharpur-10) were removed during the last three years in HDN routes.

- In ECR, scrutiny of working time table of Mughalsarai Division (for HDN Route) and Danapur Division (for Non- HDN routes) revealed that, there was no PSR on account of poor track structure.
- In SWR, a total of 119 PSRs were imposed from November 1993 to December 2008 on account of bad sub-soil and bunching of ballast, kinking welds on track, non-interlocked point, less lateral distance on bridges, points & crossings taking off on curves, insufficient super elevation of curve, yielding formation, vulnerable bridges, poor visibility of level crossings and steep degree of curve, etc.
- In SR, 15 PSRs were in place due to poor track structure like diamond crossing on wooden layouts and existence of Girder Bridge with wooden sleepers. Five PSRs were relaxed during 2016-17.

Thus, 294 speed restrictions had to be imposed in these five Zonal Railways because of track vulnerability.

2.3.2 Train Accidents

Audit reviewed the records of train accidents over the last three years over the selected five zones. The details of accidents occurred during the last three years (2014-15 to 2016-17) are mentioned below:

Table 14– Trains accidents during 2014-15 to 2016-17 in selected Zonal Railways

S. no	Date of accident	Train no. and Location	Brief description	Cause	Impact of the accidents
NCR					
1	25.05.2015	18101 Tata-Jammu Tawi Express (km-887/21 of Sirathu-Athsarai section	11 coaches derailed	Buckling of track	Damage assessment at ₹1.64 crore, causalities of three passengers, one passenger sustained grievous injury and six passenger suffered minor injuries.
2	07.12.2015	AMG special (Loop line point No.202B)	Three wagons derailed	Non-negotiation of curve of the point and center pivot defects in wagon	Damage assessment at ₹11 lakh, no casualties / no injury.
3	31.03.2016	ICDD special (km 1496/16 of Ootward-Ramgarh section)	Four wagons derailed	Track buckled in 'S' form with onset of temperature	Damage assessment at ₹10.10 lakh, no casualties / no injury.
4	30.09.2016	Goods KN-25 (Between DN Home and DN Starter of Barhan station)	Five wagons and 1 break van derailed	Track reading and wagon reading on higher side	Damage assessment at ₹23.10 lakh, no casualties / no injury.
SER					

Table 14– Trains accidents during 2014-15 to 2016-17 in selected Zonal Railways					
S. no	Date of accident	Train no. and Location	Brief description	Cause	Impact of the accidents
5	22.06.2014	53342 DN Muri-Dhanbad Passenger (Muri-Bokaro Steel City Section)	Train engine and five coaches derailed	Rail fracture of RHS tongue rail (5.09 m from toe)	There were no casualties. Though Engineering Department was held responsible, no individual Railway staff was held responsible.
6	03.12.2014	UP NBox E Spl (Ranchi-Muri section)	21 Nbox derailed	Rail facture under load	There was no casualty. Responsibility was fixed on one SSE/P-Way and one JE/P-Way and censure issued.
ECR					
7	20.12.2015	At Pasarha station of Kathiar – Barauni section, seven coaches of Train number 15707 Katihar – Amritsar Express derailed	7 coaches derailed	Breakage of RH tongue rail of RH switch of point	No impact quantified either in terms of loss due to accident or for casualties / injuries.
8	07.06.2015	UP Dadri Goods (coal) (Barkakana-Barwadih section) between Richughutu and Demu stations	Train engine and 19 wagons derailed	Rail Broken	Both up and down main line blocked
9	14.02.2017	53349 UP Barwadih Jn. to Dehri On Son Passenger (Dehri-on-son station in Garwa Road Jn.-Dehri-on-son section)	Train engine derailed	Defects in point	No impact quantified either in terms of loss due to accident or for casualties / injuries.
10	17.11.2016	53371 Koderma to Barka Kana Passenger (Mid-section/Koderma-Hazaribagh and Kurhagada)	Train engine derailed	Weld fracture	No impact quantified either in terms of loss due to accident or for casualties / injuries.
11	11.10.2016	18698 Patna Jn.-Saharsa Jn. Koshi Exp (Bakhtiyarpur – Danapur section)	Derailed at PF No. 10 at Patna Jn.	Rail Fracture	No impact quantified either in terms of loss due to accident or for casualties / injuries.
12	25.07.2016	13006, Amritsar Jn - Howrah Mail (Mid-section/DNR-BXR & BXR-BUE)	Train derailed	Defects in point	No impact quantified either in terms of loss due to accident or for casualties / injuries.
SWR					
13	13.02.2015	12677 UP Bengaluru-Ernakulam Jn. Express (Anekal Road-Hosur section)	Train engine and coaches (except 2nd coach and trailing loco) derailed.	Rail Fracture, under category Failure of Equipment- Rail Failure	No casualties/no injuries to Passengers reported. Damaged track material was replaced. Cost of damages was assessed at ₹ 1.11 crore.

Table 14– Trains accidents during 2014-15 to 2016-17 in selected Zonal Railways					
S. no	Date of accident	Train no. and Location	Brief description	Cause	Impact of the accidents
14	28.08.2015	18463 Bhubaneswar-Bengaluru Prashanti Express (OHE mast No SBC 1043 & 1048)	Train engine and two coaches derailed.	Track defect	No casualties/no injuries to passengers reported.
15	21.12.2015	11006 Puduchery to Dadar Express (Unakal station)	Train engine and two coaches derailed.	Failure of Equipment(P-way)	No casualties reported, 11 passengers injured. Cost of damages to track material was assessed at ` 35.62 lakh.
SR					
16	17.06.2015	12658 Bengaluru to Chennai, Chennai Mail (Basin Bridge Chennai-Arakkonam section)	While the train was passing through Basin Bridge station wheels of two coaches derailed	Deep flange in R-1 wheel of coach and track instability at diamond crossing on wooden layout.	No impact quantified either in terms of loss due to accident or for casualties / injuries.

In the selected five Zonal Railways, during 2014-15 to 2016-17, sixteen accidents/derailments took place due to deficient track maintenance. The reasons were rail fracture, weld fracture, track defects, defects in points, track buckling, etc.

Figure 7: Train no. 12987, Ajmer-Sealdah Express derailed in Kanpur on 28.12.16

This included the following three train accidents that occurred during 2016-17 over NCR for which causes of accidents were under investigation.

Table 15 – Accidents where final investigation report is awaited				
S. no	Date of accident	Location	Train no.	Brief description
1	20.11.2016	Pokhrayan – Malasa(PHN-MLS) section in Kanpur	19321 Indore - Rajendra Nagar Patna Express	14 coaches derailed. 150 passengers died and more than 200 injured
2	28.12.2016	Kanpur Central – Rura Section	12987 Sealdah – Ajmer Express	15 coach derailed and 50 passengers were injured
3	30.03.2017	Kulpahar- Mahoba	12189 Jabalpur – H. Nizamuddin-Mahakaushal Express	Eight coaches derailed

Audit carried out detailed analysis of position of track maintenance in the sections, where the major accidents took place. Some important findings in respect of four accidents are tabulated below:

Table 16 – Important findings of four major accidents	
1. Accident of Train no. 19321, Indore - Rajendra Nagar Patna Express on 20 November 2016	
Spot of Accident	Between Pokhrayan - Malasa station section, Pole no. 1290/2 – 1290/16, SSE/Juhi, Jhansi Division, NCR, Section Ait – Bhimsen
Loss of life/ railway property	Death of 150 passengers Estimated loss of C&W – ₹ 6 crore
Cause of accident as per supervisor's joint note	Rail failure due to old flaw in rail
Report of the Commissioner of Railway Safety (CRS)	Preliminary Report of CRS which should be given within one month of the accident and Final report of CRS enquiry which is due within six months of the accident is awaited.
Audit findings regarding track maintenance activities of the section	
• USFD was done on 18 October 2016 i.e. about one month before the accident. At that time, no major deficiencies were reported. • 13 rail/weld failures took place between May 2016 and March 2017. Spot of failures were not inspected by ADEN, Kanpur. • Track recording by TRC was to be done in six month. Last TRC was done on 5 March 2016. No TRC carried out in 2016-17. • Deep screening was overdue in main line section at 10 locations for length of 16264 meter from one to 19 years. • Out of 196 staff on roll, 32 staff were absent from the duty without any intimation to office establishment between 01 April 2016 to 31 March 2017 for more than 15 days. 15 Track maintainers were posted in the section of SSE, Juhi without imparting initial training of track maintenance.	
2. Accident of Train no. 12987, Ajmer Sealdah Express on 28 December 2016	
Spot of Accident	Near KM-1061/26 UP Line of Maitha-Rura under jurisdiction of SSE – II, Kanpur, Allahabad Division, NCR
Loss of life/ railway property	16 coaches derailed, 50 persons were injured and estimated loss of ₹ 4.67 crore occurred due to damages to assets
Cause of accident as per supervisor's joint note	Rail fracture
Report of the Commissioner of Railway Safety (CRS)	Preliminary Report of CRS which should be given within one month of the accident and Final report of CRS enquiry which is due within six months of the accident is awaited.
Audit findings regarding track maintenance activities of the section	
• Four rail/weld failure took place during 2016-17. Spot of failures were not inspected by ADEN, Kanpur. • TRC was to be done in six month. During 2016-17, only TRC was done in December 2016 • Deep screening was overdue in main line section at 41 locations for length of 34.46 km due from three to four years. • As of April 2017, against the sanctioned strength of 488 track maintainers only 288 were on roll of which, 14 were deployed in other than track maintenance work.	
3. Accident of Train no. 12189,Jablapur – Nizamuddin Mahakaushal Express on 30 March 2017	

Table 16 – Important findings of four major accidents	
Spot of Accident	Between Mahoba and Kulpahar Stations under Manikpur- Jhansi Section, jurisdiction of SSE/Mahoba
Loss of life/ railway property	Estimated loss of ₹ 25.6 lakh on account of damaged track. Eight rearmost Coaches of the Train derailed and 10 passengers injured.
Cause of accident as per supervisors joint note	Fracture near rail joints.
Report of the Commissioner of Railway Safety (CRS)	Not made available to Audit.
Audit findings regarding track maintenance activities of the section	
• As per USFD test, 276 defective welds and 76 defective rails existed at different locations. Welding of most of defective welds was done in 2002 and 2003 i.e. welds are old and prone to frequent weld failures. • TRC was not done as per frequency prescribed. During 2016-17, only TRC was done in July 2016. • Out of 127 track maintainers on roll, 20 track maintainers were deployed in other than track maintenance work.	
4. Derailment of Train no. 18101, Tata-Jammu Tawi Express on 25 March 2015	
Spot of Accident	Near KM-887/21 in Sirathu- Athsarai Section (Main Section Allahabad-Kanpur) under jurisdiction of SSE, Khaga
Loss of life/ railway property	11 coaches derailed, cost of damage ₹1.64 crore Death of 10 passengers
Cause of accident	Buckling of Track
Report of the Commissioner of Railway Safety (CRS)	Report of CRS finalised on 26.05.2015 and as per enquiry report of CRS derailment of Train caused by buckling of track. Responsibility fixed against three railway staffs.
Audit findings regarding track maintenance activities of the section	
• Under-utilisation of track maintenance machines in Allahabad Division was 23.40 to 81.61 *per cent*. • TRC was to be done once in three months. During 2016-17, only two TRC done in July 2016 and December 2016. • Deep screening was overdue at seven location for length of 25 km between two to five years. De-stressing was required to be done on seven locations. However, due to non-maintenance of record and not providing the access to TMS report to Audit, could not be ascertained whether de-stressing was done or not. • Out of 242 track maintainers on roll, 41 track maintainers were absent between May 2014 to May 2015.	

Detailed observations in respect of five major accidents are given in **Appendix II.**

Chapter 3 - Utilisation of resources and infrastructure for track maintenance

Audit Objective 2: Whether the resources/infrastructure required for maintenance of tracks were available and used efficiently and effectively?

For effective and efficient day to day maintenance of tracks, resources and infrastructure in the form of necessary machines/equipment, blocks, budget, trained manpower and a mechanism to monitor and control various track parameters is the basic requirement. The availability and adequacy of such infrastructure was reviewed in audit of the selected sections. Audit findings are discussed in the paragraphs that follow:

3.1 Development of infrastructure for track maintenance as envisaged in Vision 2020

As per Indian Railway Vision 2020 Document of Ministry of Railways tabled in Parliament (December 2009), the following actions were proposed to be taken with regard to track maintenance**:**

(i) Para 8 (a) of the Vision 2020 document stated that 'Track structure will be standardized with 60 kg, 90 Ultimate Tensile Strength (UTS) rails and concrete sleepers with elastic fastenings. Improvements in specifications of materials, new types of elastic fastenings, economical designs of concrete sleepers and modern mechanized methods of track-laying and maintenance will be progressively adopted.'

The issue was examined in the selected five Zonal Railways (NCR, ECR, SER, SR and SWR) and it was observed that in all the selected zones, concrete sleepers with elastic fastenings were being used. Track structure was yet to be standardized. Over NCR rails were changed manually and track laying activities were still not mechanized. Track maintenance activities such as deep screening and de-stressing were carried out both manually and with machines. However, modern mechanized methods for track maintenance are being used in heavy traffic sections of all the other selected zones.

(ii) Para 8 (b) of Vision 2020 document states that 'Tracks on identified, segregated routes would be made fit for running passenger trains at speeds up to 160- 200 kmph and freight trains at speeds up to 100 kmph.'

During examination of the records of the selected five Zonal Railways (NCR, ECR, SER, SR and SWR), it was noticed that

- Tracks were identified and segregated route-wise over Allahabad Division. However, maximum speed of passenger trains was up to 130 kmph and goods trains with load at speeds up to 80 kmph and empty up to 100 kmph only.
- In selected sections of ECR, SWR, SR and SER, no tracks were identified and route-wise segregation was not made for running of passenger trains and freight trains speed wise. However, in SER, planning for increase in speed to 130/ 160 kmph on A and B routes was under process.

(iii) Para 8 (c) of Vision 2020 Document envisages that 'Rails will be procured in long panels of 120 metres and would be welded in flash-butt plants and laid with lengths ranging from 250 meters to 500 meters. Such continuously welded rails would eliminate a large number of rail joints and, in turn, would improve rail metallurgy i.e. minimal residual stress, higher wear resistance, higher elongation and better fracture toughness and maintenance and riding comfort. Joints will be welded *in situ* by portable flash butt welding plants and in exceptional circumstances by Alumino-Thermite (AT) welding. Rail life will be extended by rail grinding and rail lubrication. Improved types of switch expansion joints (SEJ) would be used in place of the conventional switch expansion joints.'

Further, Corporate Safety Plan (2003-13) stipulates that as the Alumino Thermite weld are weak links in track, its population need to be gradually reduced and replaced by Flash Butt welds to be executed with the help of Mobile flash butt welding plants. Railway also stated (December 2015) that Tender for Mobile Flash Butt Welding Plant should be called for improvement of quality of welding.

Rails are procured from Steel Authority of India Ltd., Bhilai (SAIL) on the basis of requisitions placed by the Zonal Railways on Railway Board. Railways send their yearly requirement in metric tonne to Railway Board. The length of rails to be supplied to respective Railways is decided by Railway Board on the basis of Rolling Stock Programme of the SAIL. During the examination of records of the selected sections of five Zonal Railways, it was noticed that

- Over NCR, Rails of 13m long panels were procured. Long welded rails panel up to 260 meter length (20 rails x 13 meter) were used in LWR section. Mobile Flash Butt Welding Plant was not introduced in open line and in general maintenance welding was carried out using AT welding technology.
- In ECR, SER and SWR, rails were not being procured in long panels of 120 metres. In ECR and SER, rails were being procured in 13/26 metre length and welded by Flash Butt to make the rail panels and supplied to the fields for laying. However, in ECR, rails were not being welded in Flash Butt welding

plants for being laid with lengths ranging from 250 metres to 500 metres. In SWR, 260 m long rail panels are being used.

- In SR, rails were being laid as per the prescribed procedure.
- Though use of improved types of switch expansion joints was initiated over selected sections of NCR, proper monitoring/supervision of assembling activities was not carried out and concerned supervisors were not conversant with improved SEJ assembling and its maintenance. In ECR, improved types of switch expansion joints were not used. However, in SR, SER and SWR, improved types of switch expansion joints were being used.

(iv) Para 8(d) of Vision 2020 Document envisaged that 'Cost effective options for mechanized track maintenance, including through remote satellite control, shall be explored. There will be complete mechanization of track maintenance activities. A decision support system such as TMS will be in place to optimize material, machine and equipment and manpower inputs for track recording-cum-monitoring on the entire IR network (including USFD cars capable of recording precisely the location of track irregularities). P-way engineers shall also be provided with personal digital assistance (PDAs) for recording inspection inputs. All the maintenance and construction activities related to track shall be mechanized. Trackmen will be equipped with small track machines also. Human dependence in the form of push trolley inspection, foot-plating, patrolling, etc. for detection of flaws and deficiencies in track parameters will be eliminated. It is envisaged that by 2020, the health monitoring of assets should be completely mechanized. Vehicle mounted USFD would be stabilized by 2020 to achieve a sharp reduction in the number of rail fractures and increased reliability of assets.'

During examination of records of selected sections of five Zonal Railways, it was seen that

- In NCR, ECR, SER, track maintenance activities in selected sections were not completely mechanised. Deep screening of ballast, rail change, and de-stressing of track was carried out manually. However, in SWR, track maintenance activities were completely mechanised. In SR, track maintenance activities were mechanised in selected sections except that deep screening in platform stretches of track and de-stressing of rails were being done manually.
- In ECR, SER and SR, Personal Digital Assistants (PDAs) were provided to Permanent Way Engineer's for recording inspection inputs. However, during examination it was found that none of the PDAs were in proper working condition. In NCR and SWR, PDAs were not provided but computer note book/ laptops were provided to Permanent Way Engineer's.

- Track maintainers were equipped with small track machines available in the gang, but no communication equipment was provided to trackmen to report any failure, fracture or damage immediately from the section where short comings/defects in track were observed. In ECR, Trackmen were not equipped with small track machines. However, in SWR and SR, small track machines were available with all SSEs (P-way).
- Human dependence in the form of push trolley inspection, foot-plating, patrolling, etc. for detection of flaws and deficiencies in track parameters were not eliminated/reduced in NCR, ECR, SWR, SER and SR due to absence of mechanisation of maintenance activities and absence of utilisation of advance monitoring tools viz., Wheel Impact Load Detector (WILD), Geo Positioning System (GPS) – based Foot plate inspection device.
- One of the objectives of installation of TMS was to maximise the benefit of material, equipment and utilisation of assets without impairing the safety. However, Asset module of TMS was not functioning over selected sections of NCR and ECR, and hence health monitoring of assets remained to be mechanised. In SWR, efforts/steps/initiatives were taken for progressive and complete mechanized health monitoring of assets. Track parameters were measured and corrective action was taken. In SR and SER, the assets module over TMS was functional over the selected sections.

Thus, infrastructure and other arrangements, as envisioned in 2020 document with respect to track maintenance, are yet to be put in place. Further, manual dependence in the form of push trolley inspection, foot plating, patrolling etc. continued for detection of flaws and deficiencies in the tracks.

3.2 Budget Allotment and Expenditure on Path way maintenance

Details of Budget Grant (BG), Final Grant (FG) and Actual Expenditure (AE) for the year 2015-16 and 2016-17 under Demand No 4 Abstract 'B': Repairs & Maintenance of Permanent Way & works and Minor Head 200- Maintenance of Permanent way are as under:

Table 17– Budget Allotment and Expenditure (₹ in crore)

Zonal Railway	BG	FG	AE	Savings (BG- AE)
2015-16				
NCR	489.4	483.33	474.87	-14.53
SER	411.43	454.39	454.56	43.13
ECR	203.58	225.01	220.66	17.08
SWR	268.99	260.73	251.69	-17.3
SR	461.54	478.7	484.13	22.59
2016-17				
NCR	633.99	578.44	527.34	-106.65
SER	552.91	559.09	570.38	17.47

Table 17– Budget Allotment and Expenditure (₹ in crore)				
Zonal Railway	BG	FG	AE	Savings (BG- AE)
ECR	570.55	559.02	563.32	-7.23
SWR	328.53	319.48	307.68	-20.85
SR	581.51	592.23	584.5	2.99

It is seen that from 2015-16 to 2016-17 the Budget grant had increased from 22.13 *per cent* to 180.26 *per cent* for the selected Zonal Railways with mean increase of 45.37 *per cent*. The actual expenditure has also increased during the period by 11 *per cent* to 155.32 *per cent* with mean increase of 35.38 *per cent* in these selected Zonal Railways. The savings were significant at 16.82 *per cent* in 2016-17 for NCR and 6.43 *per cent* in 2015-16 and 6.35 *per cent* in 2016-17 for SWR. The maintenance activities need to be accelerated to ensure utilisation of budgetary allocations.

3.3 Availability of manpower for track maintenance and their training

3.3.1 Sanctioned Strength and Men on Roll of track maintainers

A maintenance gang consist of 10-15 track maintainers[63]who are responsible for protecting the line in an emergency and during work affecting the track. Patrolling of track is also carried out by the track maintainers. As per Rules[64], the strength of each maintenance gang shall be decided by the Chief Engineer. A register should be maintained by each SSE and in office of ADEN with details of sanctioned strengths of gangs, Gatemen, Watchmen, Lookout men, Trolley men and other staff. No deviation from the sanctioned strength of gangs and other staff shall be permitted without the approval of the Chief Engineer.

In this regard, Audit reviewed the data regarding the length of jurisdiction of various SSEs, sanctioned strength of track maintainers and the track maintainers available in the selected sections of five Zonal Railways. Audit also reviewed the data on total manpower available for track maintenance in the selected five Zonal Railways. The audit observations are discussed below:

(i) The line capacity utilisation of the selected sections is more than 100 per cent (except four sections, where it is between 90 *per cent* and 100 *per cent*). As such, there should not be wide variations in length of the jurisdiction of SSEs in these sections, mainly because the line capacity utilisation in a section would be same for all the SSEs under the section. It was however seen that the jurisdiction of SSEs varied from 16.65 kms (Santragachi) to 149 kms (Tamluk) in various selected sections. It was further seen that the sanctioned strength of track

[63]including Gangmate (Head of the group), Keymen, Gangmen and Blacksmith.
[64]Para 213 of Indian Railway p-way manual

maintainers per km also had wide variations. The same ranged from 2.01 per km (Tamluk) to 18.56 kms (Gaya). This indicated that that the criteria on the basis of which the sanctioned strength had been assessed was not objective and scientific. As mechanised means of track maintenance are being used gradually and increasingly, there is an urgent need to re-assess the requirement of manpower in respect of track maintainers.

Review of men-in-position under the jurisdiction of various SSEs in the selected sections further showed that the men-in-position per km was significantly high as compared to the other parts of the sections in places like Allahabad, Washermanpet (very close to Chennai), Santragachi (very close to Howrah) and Gaya among others. Thus, more track maintainers have been posted to bigger cities than remote locations though the requirement for the whole section may be uniform.

Annexure 3

In 2006, Railway Board approved a report of the Committee on 'Manpower and Cost Norms for Track Maintenance' (MCNTM), which laid down a formula for calculation of strength of track maintainers/ gang strength on the basis of manual and mechanised track maintenance activities being undertaken by the railways in 2000[65].

In December 2013, Railway Board directed ZRs to undertake regular exercise for working out the required strength of trackmen as per MCNTM formula for maintenance of all running section of the railway. The exercise was to be carried out jointly by PCE, FA&CAO and CPO every year on 1 April to work out surrender/creation/ re-distribution of post of trackmen every year. This was to ensure zero based review, as per actual traffic and other related conditions every year. The resultant status with w.r.t total requirement of Trackman on Zonal Railways as a whole (for surrender or creation or re-distribution) was to be worked out every year in a systematic manner. This exercise was to serve following purposes.

- Possible redistribution on Zonal Railways.
- Managing gap between actual Trackman on Roll and requirement of total trackman by a rational deployment of contractual agencies till requisite posts as needed were created and vacancies filled up.
- Identify and account for loss of actual man-days beyond what is provided (accounted) for.

[65] The Committee Report was finalized in May 2000

- The identified resources for deployment of contractual agencies was to be utilised to provide sufficient funds for the purpose.

The matter was reviewed in five selected Zonal Railways and the following was observed:

- In NCR, the exercise was undertaken only in two years, (April 2014 and 2015) but no action was taken on the re-assessed requirements. No re-assessment was done thereafter.
- In SER and SR, the assessment of sanctioned strength of trackmen was undertaken every year in April (2014, 2015 and 2016) as per MCNTM formula and forwarded to Railway Board. However, the gaps between actual trackmen on rill and requirement of total trackmen were not being filled by outsourcing.
- In ECR and SWR, no such annual assessment was done. However, in ECR recently (in September 2017), sanctioned strength was assessed as per MCNTM formula and information sent to Railway Board.

It was also seen that the criteria on the basis of which the formula was prepared included mix of activities (manual and mechanised) as of 2000. The same may not be relevant after 17 years due to significant changes in methods of track maintenance and introduction of mechanised means in a larger number of activities.

Thus, there was an urgent need to re-work the formula and re-assess the requirement of manpower for undertaking the work of track maintenance in view of the changed scenario, wherein, more and more mechanised means are going to be used for track maintenance. In addition, equitable distribution of manpower in accordance with workload was also needed to be carried out.

(ii) Review of total manpower available for track maintenance works in selected five Zonal Railways showed that there were shortages of staff in different safety categories in selected Zonal Railways viz. NCR, SER, ECR, SWR and SR ranging from nine to 22 *per cent* as given below:

Table 18 – Manpower availability for track maintenance

Zonal Railway	Sanctioned Strength	Men on Roll	Vacancy	Percentage of Vacancy	No. of staff deputed in other works (viz. other official Est., officers residence, etc.)
NCR	2972	2325	645	22	90
SER	3390	2884	506	16	381
ECR	3449	2762	687	20	0
SWR	1698	1553	145	9	70
SR	782	659	123	16	0
Total	**12291**	**10183**	**2106**	**17**	**541**

Though no deviation from the sanctioned strength of gangs and other staff is permitted without the approval of the Chief Engineer, 541 (five *per cent*) staff was deputed for other duties.

During Exit Conference (30 August 2017), Railway Board stated that there were acute shortages in the safety category staff relating to track maintenance. It was also stated that staff recruited as track maintainers are over-qualified and do not want to do physical work on tracks. It was further stated that due to very lenient eligibility criteria for Physical Efficiency Test for women, a large number of women with inadequate physical ability are also recruited, many of whom do not want to work as track maintainers in the field. Railway Board however, did not provide any reasons for wide variations in the sanctioned strength of track maintainers under the jurisdiction of various SSEs.

Annexure 4

Thus, despite a shortage in manpower position vis-à-vis sanctioned strength, the situation was made worse by diverting available track maintainers to works other than track maintenance. Due to shortage of track maintainers, the length covered by them had increased which can impact the quality of maintenance. Recruitment of overqualified staff who are not willing to undertake physical work at tracks indicated that the selection criteria for track maintainers is not aligned with their job requirement. This issue needs to be resolved.

(iii) The minimum educational qualification prescribed for recruitment of Track Maintainers is 10th pass or ITI or equivalent[66]. Check of records of attendance of Track Maintainers in selected sections of NCR, SER, SWR and ECR revealed that Track Maintainers and other safety category staff of the Gang, were not signing the Attendance Register in token of their presence at the work location. Only P'' for present and A'' for absent were being marked by the supervisors **.**The attendance of staff deputed to other locations was also marked as 'P' and 'A' in the Gang Attendance Register. Non-signing in the Attendance Register by the Track Maintainers facilitated such incorrect marking of attendance.

An effective system of marking attendance is needed to be put in place in order to ensure optimum utilisation of available manpower. Railways need to streamline the system of attendance marking of track maintainers on priority.

[66] As per Railway Board Railway Board letter no. E(NG)-II/2009/RR-1/10 pt. dated 09 December 2010 minimum educational qualification prescribed for recruitment in Pay Band – 1 of Rs.5200 -20,200 grade pay of ₹1800/- was 10th pass or ITI or equivalent

3.3.2 Training for permanent way staff

Rules[67] require that P-way staff should be imparted training at regular interval. The following four types of training courses should be organized in the Training Institutes run by the Railway Administration :

- Initial/Induction Courses
- Promotional Courses
- Refresher Courses
- Special Courses

Arrangements for training of all Permanent Way staff working on LWR /CWR sections shall be made by Chief Engineer by holding special /regular courses in Zonal Training centres and by Sr.DEN/DEN in Divisional Training Center[68]. Further, only staff trained in laying and maintenance of LWR /CWR shall be posted on LWR /CWR sections[69]. In case of Keyman, Gangmate & PWM, only such staff, who possess valid competency certificate issued by Zonal /Divisional training centre shall be posted on LWR /CWR section. The competency certificates shall be valid for five years from the date of issue[70]. Check of competency certificate in selected sections of NCR, SER, ECR and SWR revealed that no system existed to ensure that only trained staffs were posted in LWR / CWR section. The position of trained staff posted in these sections is mentioned below:

Table 19 - Number of Staff working in LWR/CWR sections without training

Zonal Railway	Number of staff posted in LWR/CWR section	Number of staff not trained (percentage)
NCR	1728	638 (37)
SER	2865	450 (15.7)
ECR	1993	0
SWR	1452	67 (4.6)
SR	659	0
TOTAL	**8697**	**1155**

It was seen that 37 *per cent*, 15.7 *per cent* and 4.6 *per cent* of the total staff of NCR, SER and SWR respectively, deployed in LWR/CWR section had not been imparted training. Deployment of staff for laying and maintenance of LWR without training/ competency certificate has a bearing on the safety. It was, however seen that in ECR and SR, 100 *per cent* of staff deployed in LWR/CWR sections had been trained. Competency certificate for working on LWR/ CWR section was also not obtained for Keyman, Gangmate.TMS report of training of staff was also not updated and consequently monitoring of training programme at higher level was not carried out. ***Annexure 5***

[67] Para 1501 to 1505 of IRWPM
[68] Para 9.2.1 of Manual of instructions on Long Welded Rails
[69] Para 9.2.2 of Manual of instructions on Long Welded Rails
[70] Para 9.2.3 of Manual of instructions on Long Welded Rails

Thus, untrained staff handling track maintenance could compromise the quality of track maintenance. There was no mechanism to ensure that trained staff was posted to LWR/CWR sections.

3.3.3 Training for Operating and Maintenance of Small Track Machine

Rules[71] provide that Sr. Divisional Engineer (Co-ord) shall organize training of staff for operation and maintenance of Small Track Machines /tools through the machines /tools manufactures. It shall also be ensured that adequate training facilities are made available in Divisional Training School at Divisional Level and Zonal Training Schools at Zonal Level.

Further, centralized training for operation, maintenance and repair of small track machines /tools shall be organized at Zonal Railway Training Centre / Divisional Training Centre[72].

Review of records of training for staff deployed on working of small track machines over the selected zones revealed that about 60 *per cent* staff were not trained. The position is given as under:

Table 20 - Number of staff deployed in operation of Small Track Machines during 2016-17

Zonal Railway	Number of staff deployed in STMs	Number of staff trained	Number of staff not trained
NCR	294	139	155
SER	57	38	19
ECR	Need Based	Trained/certified track maintainers are utilized for operation of small track machine.	
SWR	164	0	164
SR	28	22	6
TOTAL	**543**	**215**	**328**

In SWR, no separate Training Centre was established for imparting training to staff attending to Small Track Machines/Tools. The Training Schedule of Civil Engineering Training Centre, Hubli Division, was analyzed for the three years from 2014-15 to 2016-17. No separate training slots were provided for operation and maintenance of Small Track Machines. Thus, Track Maintainers were not trained in operation and maintenance of small Track Machines.

Thus, 60 per cent of the staff deployed in working of STMs was not trained. Deployment of untrained staff for operation of STMs undermines the quality of maintenance.

Annexure 6

[71] Para 1.6 of Indian Railway Small Track Machine Manual
[72] Para 1.6.1 of Indian Railway Small Track Machine Manual

3.4 Utilisation of track machines including small track machines

SSE in-charge of a section is responsible to undertake and assist in maintenance activities which include Alumino Thermite welding of rails, spot attention in yards, distressing and fracture repair. This is carried out by the section in-charge through use of small track machines such as abrasive disc cutter, rail drilling machine, rail profile grinder, weld trimmer, hydraulic jacks, etc. Besides, the officer section in-charge is required to assist in work of mechanized maintenance carried out through track machines. These activities are required to be carried out in a well-planned and scientific manner.

(a) Utilisation of track machines

The utilisation of track machines over the selected sections of these five Zonal Railways was reviewed and noticed that

- Out of 6878 machine days, 2341 machine days were not utilised by Allahabad Division. The major reasons were non-availability of block, machines under repair/breakdown/shifting, staff rest, site not ready, etc. The target fixed in the annual plan for various track machines for the year 2016-17 was not achieved and maintenance of track was hampered. During the year, as against the target of 11717 km, only 5041 km (43 *per cent*) was achieved. Comparison of block time made available for track maintenance and networking time of track machines revealed that the track machines could not be utilized effectively due to time loss in travelling, setting, windings of machines, OHE failure, non-availability of P-way staff at site, failure of assets, etc. The detailed review of availability of block time and its utilisation by 25 track machines during 2016-17 revealed that on an average 33 *per cent* time of block could not utilised by these track machines. Audit also noticed that 46 *per cent* loss of block time of the track machine was attributable to travelling time i.e. shifting of track machines.

- In selected non-HDN sections of Danapur Division of ECR, during the year 2016-17 as against the target of 6856.25 kms, only 2824.86 kms was achieved resulting in shortfall of 58.79 *per cent*. In selected HDN section of Mughalsarai Division, the achievement was 29826 kms against the target of 43886 kms, leaving short fall of 32 *per cent*. The reasons for shortfall was attributed to shortfall in granting of block by operating department, base shifting of machine and idling of machines on account of maintenance .

- In SER, Track Management System (TMS) data revealed that against 19276 machine days of the availability of track machines, the machines worked for 10031 days in 2016-17 and remaining idle for 9245 machine days. The reason for non-utilization was stated as non-availability of block, under repair/breakdown/ maintenance, no fuel, machine under shifting, etc.
- In SWR, no instances were noticed in short achievement of targets of available track machines in the selected sections.

(b) Utilisation of small track machines

As per the Integrated Railway Modernization Plan 2005-2010, issued in November 2004, Indian Railways had planned to achieve complete mechanization of track maintenance and relaying by 2012. Due to growing traffic and introduction of heavier track structure, faster and more efficient methods of maintenance are needed to be evolved[73]. Thus, the role of small track machines has increased for quality maintenance of track. Different types of small machines such as Abrasive Rail cutter, Rail Drilling machine, Rail Creep Adjuster, Hydraulic Track Jack, Rail Profile Weld Grinder, etc. have been developed for various activities on track. These small track machines are to be used for day-to-day maintenance, laying and casual repair of track.

Figure 8: Abrasive Rail cutter

Figure 9: Hydraulic Track Jack

Figure 10: Rail Creep Adjuster

During the check of records of SSEs of selected sections over the five Zonal Railways it was seen that

- Adequate numbers of essential small track machines were not available with each SSE offices in all the selected sections of NCR, SER, ECR, SWR and SR. 33 *per cent* of the available small track machines were found out of order during Audit.

[73]Para 1.1 of Indian Railway Small Track Machine Manual

- In NCR, it was seen that various track repairing activities such as drilling of rails, chamfering of holes[74], cutting of rails, maintaining proper gap for welding (using tensors), welding, chipping of extra metal after de-molding, grinding of weld, painting of weld, etc. are being done both manually as well as using small track machines. The small track machines were not used optimally due to sub-optimal maintenance practices. There were operational constraints in movement of these machines to work site as these machines weighed 20 to 375 kgs and could not be carried without the help of a utility vehicles. In selected sections, 62 out of 110 Abrasive rail cutters and 10 out of 52 rail drilling machines were out of order. Besides, there was shortfall of 186 hydraulic track jacks against prescribed norms. This hampered maintenance work in these sections. Non-availability of spares locally, absence of workshops at decentralized locations (only one centralized workshop over Allahabad Division at Allahabad is present for repair and maintenance of Small Track Machines) and absence of imprest for repair and maintenance were the main reasons for such a large number of machines remaining out of order.
- In SER, one PWI/STM was posted in non-HDN route dealing with an average 12 Express trains per day where an imprest of ₹ 3500/- pm was sanctioned to meet the emergency repair of faulty STMs. In contrast to this, neither any PWI/STM nor imprest was sanctioned in HDN route handling an average of 150 Express trains per day indicating misplaced priority. Non-availability of imprest and shortfall of machines impacted various aspects of track maintenance like de-stressing, squaring, reconditioning, toe load measuring, lifting & packing, trolling work, packing and screening work.
- All small track machines and tools shall be purchased under at least two years manufacturer's warranty and negotiations for AMCs after warranty period shall be held & finalised at the time of initial purchase[75]. AEN shall carry out inspection of all the small track machines once in six months, while the SSE shall inspect all his machines/tools once in a fortnight. This was not being done in SR.

Annexure 7

Track maintenance work were also hampered due to non-availability of material. Audit noticed the following cases over selected section of five Zonal Railways during 2016-17.

[74] Chamfering means cut way (right-angled edge or corner) to make a symmetrical sloping edge. Chamfering of rail holes gives substantial increase in fatigue life of rail at the hole (an increase of three to four times). Chamfering of bolt holes also delays the formation of cracks.
[75] Para 1.4(h) and 1.5 of IRSTMM

- In SER, track maintenance works was hampered in all selected sections due to non-availability of materials like SEJ Bolt, crossing Bolt, Point Crossing Rubber Pad, Plate screw, SEJ sole pad, SEJ sleeper, Cast Manganese Steel (CMS) crossing, Grooved Rubber (GR) Pad, SEJ GR Pad, Glass Filled Nylon (GFN) Liner, Turn out GR pads, check rail bolt, GFN liner 3706, etc. in all PWI offices in the selected HDN and Non-HDN sections.
- In SWR, non-availability of Hacksaw Blades, Simplex Jacks, Insulated Gauge-cum-Level, Banner Flag Red, etc., impacted track maintenance works.
- Due to shortage of material the PWI offices had to manage the maintenance work by taking recourse to material from other PWIs or use second hand material which had been retrieved during track renewal works.
- In other three Zonal Railways (NCR, ECR and SR) no instance of hampering of maintenance work due to non-availability of materials was noticed.

There was sub-optimal utilisation of track machines due to reasons such as non-availability of block, under repair/breakdown/ maintenance, no fuel, machine under shifting, etc. Further, the small machines were not available in the selected sections as per requirements. Where available, these could not be used optimally due to various constraints such as frequent breakdowns, non-availability of blocks, non-availability of utility vehicles for transportation of these machines at work sites, non-availability of spares, non-availability of imprest to handle repair and maintenance of these machines etc.

3.5 Allotment of blocks for track maintenance

Track maintenance by machines requires line occupation and availability of blocks for their working[76]. It is desirable for these machines to be given a single block of at least four hours per day or two separate blocks of 2½ hours each, for better working. It is necessary to have longer blocks, so that the net available time for working on the line is as high as possible. On the double line section, temporary single line working may be introduced whenever possible. Diversion of some trains along alternative routes may also be resorted to, wherever possible. An ideal situation would be to provide for time allowance for working the machines in the Working time table. The block time should be interpolated in the master chart for passenger and goods trains that is prepared with every change in time table. It is as much the responsibility of the Operating Department as that of the Engineering Department to ensure provision of adequate time for economical

[76]Para 226 of Indian Railway P-way Manual

working of machines. For this purpose it is desirable to frame a programme of working the machines in consultation with the Operating Department.

Maintenance of track is done after availability of blocks as demanded by the Engineering department since it is a safety item. Passenger train and target for loading of goods for the last three years shows an increasing trend. But the scope of maintenance work is less due to non-availability of required block (as demanded by Engineering department), though increase in operation of traffic requires more maintenance.

The availability of block against demand for the selected five Zonal Railways was as follows:

Table 21– Availability of blocks against demand for track maintenance

Zonal Railways	Division	Block demanded (in hours)	Block made available (in hours)	Shortage (%)
NCR	Allahabad	27648.00	10921.00	60.50
ECR	Danapur	4538.65	1767.80	61.05
	Mughalsarai	5553.60	3689.78	33.56
SWR	Hubli	13591.00	9942.00	26.85
SR	Chennai	1326.15	1102.19	16.89
SER	Kharagpur	1042.75	566.50	45.67
	Chakradharpur	4147.50	1176.00	71.65
	Ranchi	487.33	238.00	51.16
TOTAL		**58342.00**	**29411.00**	**49.60**

Zonal Railways wise audit findings are discussed below:

In NCR, line capacity utilisation of the selected sections was more than 100 *per cent***.** It was observed that there was huge gap between the blocks demanded and blocks made available by the railway administration**.** Audit further noticed that

- Only 40 *per cent* block of the block demanded were given by operating department for maintenance of track**.** Less availability of block in heavy traffic section may lead to poor maintenance of track**.**
- Review of corridor block provision made in working time table of Allahabad division for the selected sections revealed that corridor block was provided in the range of 90 minutes to 120 minutes for maintenance work, which was less than 2.5 hours as per the norms.
- Check of block register maintained in engineering control offices revealed that block was not provided as per provision made in Working Time Table. The prime reasons of deviation from corridor block was late running of train, introduction of new/special train and running of all goods trains without any scheduled timing.

- During the time of provision of corridor block for maintenance (which was less than the required time), some scheduled trains time falls under the corridor block. This further hampered the maintenance work, as corridor block could not be utilised due to running of these trains during the time of availability of corridor block.

In SWR, Working Time Table of Hubli Division provided for blocks to facilitate maintenance works. It was further observed that

- During 2016-17, in Hubli Division as against 13591 hours of line blocks demanded by the Engineering Department, only 9942 hours were provided by the Operating Department (73 *per cent*).
- Due to non-availability of blocks, SSEs (P-way) reduced the target of inspections of tracks.
- In respect of 14 Track Machines, out of the available net block hours of 8021 hrs and 15 min, only 5359 hrs and 40 min were utilized (66.82 *per cent*) for maintenance works.

In SR, it was seen that though the Working Time Table had tentative provision for maintenance blocks, actual provision of line block icould only be decided by the Operations department on a day to day basis based on the prevailing position of movement of traffic. It was seen that

- In the three selected sections in Chennai Division, as against the total 1326.15 hours of line block sought for maintenance during 2016-17, 1102.19 hours of line block was provided.
- In the sections checked, there was no instance of non-utilisation of line block provided.

In ECR, it was observed that

- Maintenance block was provided by the operating department (provision in Working Time Table was 7331 hrs in Mughalsarai Division and 7400 hrs in Danapur Division) during the review period. The main reason for not providing corridor block was late running of trains, lack in co-ordination between operation and engineering departments, etc. Therefore, all the track maintenance work was conducted during maintenance block granted by the operating department.
- In Mughalsarai Division (selected HDN Route), there was a shortfall of 33.56 *per cent* in grant of block for maintenance of track (3689.78 hour granted against demand of 5553.60 Hrs). In Danapur Division (selected non-HDN section), there was a shortfall of 61.05 *per cent* in grant of block for maintenance work.

In SER, it was seen that despite a provision in the Working Time Table to provide minimum hours of block per day, the same was not being followed. Adequate number of blocks was not provided to ensure economical and gainful working of machines. It was further seen that

- In Kharagpur Division (Rajgangpur-Tatanagar, Mecheda-Panskura, Howrah-Tikiapara-Santraganchi sections), the block made available was about 54 *per cent* by operating department.
- In the selected sections of Chakradharpur and Ranchi Division, the shortage of block made available by the operating department against the block demanded during 2016-17 was 72 *per cent* and 51 *per cent* respectively.

During Exit Conference (30 August 2017), Railway Board stated that availability of assured maintenance block need to be ensured by operating department for undertaking timely track maintenance works. It was further stated that as per the practice being followed in foreign railways, adequately long hours of blocks are dedicated for track maintenance. Audit is of the view that Railways need to ensure provision for corridor block in the Working Time Tables and to ensure its availability and proper utilisation.

As line capacity utilisation of these sections on an average of 2013-14 to 2015-16 was more than 100 per cent, less availability of block in heavy traffic section may lead to poor maintenance of track. Hence, these sections needs more block hours along with mechanised maintenance for proper maintenance of track. The assessment of requirement of blocks may be arrived at in consultation with all the concerned departments, so that a realistic assessment of requirement is done and blocks are provided and utilised optimally. Divisional Railway Managers who head the Divisions, could play an important role in coordinating efforts regarding block availability and utilisation.

Chapter 4 - Conclusion and Recommendations

4.1 Conclusion

Audit of 37 selected sections (29 high density routes (HDN) and eight non-HDN routes) of the Indian Railways showed that track maintenance activities needed to be strengthened and undertaken following the laid down instructions and guidelines. Planning for track maintenance needed to be done comprehensively with a view to completely shift towards mechanised maintenance. Inspections were not being done as per laid down frequency by railway officials at various levels including Sr. Section Engineer and Assistant Divisional Engineer in the selected sections. There were deficiencies in conducting Inspections and all prescribed activities of inspection were not being undertaken. In many cases, notes of inspections were not being prepared for further follow up. Timely supervision through (USFD) testing could help detect the vulnerable points and accidents can be avoided. It was seen that USFD testing was not being done as per laid down provisions and thus not used effectively for monitoring track parameters. Though four Track Recording Cars (TRCs) were available, these were not used optimally due to frequent breakdowns and repairs. Non-deployment of TRCs as per laid down frequency over the planned sections also led to non-assessment of track parameters viz., position, curvature, alignment of track, smoothness, rail profile, etc. There were significant arrears in deep screening work, which could impact the resiliency and elasticity of the ballast bed with consequent impact on running quality of tracks. Further, there were delays in de-stressing in selected sections after special maintenance work. This may have a bearing on the safety as thermal stress gets locked up in the LWR/CWR, which may result in buckling or fractures in rails. In respect of track maintenance works undertaken through contractors, there was no clause in the contract for ensuring deployment of only skilled labours under the supervision of trained personnel.

Various activities of track maintenance were guided, driven and undertaken by different formations. While utilisation and allotment of track machines was managed by Chief Track Engineer in Zonal Headquarters, Sr. Divisional Engineer (Coordination) was monitoring allotment and use of USFD machines and Track Recording Cars were under the control of Research, Design and Standard Organisation (RDSO). Thus, there was lack of comprehensive integrated track maintenance plan which could address and take care of all aspects of track maintenance.

To improve the quality of welds and enhancing safety, the population of Alumino Thermite Welds was to be gradually reduced and replaced by Flash Butt welds with the help of mobile flash butt welding plants. Railways however, need to take action and enhance the use of mobile flash butt welding plants.

Railway Board permitted enhanced loading at CC+8+2/CC+8+6/CC+4+2t on various selected sections on various Zonal Railways in 2006. While permitting higher loading, instructions were issued to put in place a mechanism to monitor track for adverse impact of enhanced loading on track and rolling stock and ensure timely corrective action. Zonal Railways were to install necessary machines/equipment /systems for the same. Eleven years after the issue of instructions, as against 270 locations identified, Wheel Impact Load Detector (WILD) system was yet to be installed at all identified locations. Where installed, corrective action was not being taken on the basis of the information/data generated from WILD as Railway Administration ignored most of the critical alarms generated through WILD in Mughalsarai (which feeds the traffic on Mughalsarai-Ghaziabad Section). Other necessary measures such as installing weighbridges to ensure weighment and control overloading, laying of higher strength rails, were also not implemented in all sections where it was required to be done. Running goods trains with enhanced load without ensuring the check and control mechanism in place could lead to poor track conditions and impact the safety of running trains. As such, all the sections notified for CC+8+2/25t axle load required continuous monitoring for track defects and suitable remedial actions. Speed restrictions were imposed due to poor track conditions at many locations.

Infrastructure and other arrangements for track maintenance, as envisaged in Vision 2020 document, were yet to be put in place. Further, manual dependence in the form of push trolley inspection, foot plating, patrolling, etc. continued for detection of flaws and deficiencies of the tracks. The philosophy of track maintenance was yet to shift from ‘find and fix’ to ‘measure and predict’.

Railways had prescribed a formula for calculation of strength of track maintainers/ gang strength on the basis of manual and mechanised track maintenance activities being undertaken by them in 2000. This criteria on the basis of which this formula was derived may not be relevant after 17 years due to significant changes in methods of track maintenance and introduction of mechanised means in a larger number of activities. This formula was also not used by the five selected Zonal Railways to assess the manpower requirement and fill the gap for track maintenance activities during the past three years. There was a

shortage in manpower vis-à-vis sanctioned strength and the situation was made worse by diverting available track maintainers to works other than track maintenance. Due to shortage of gangmen, the length covered by them was increased which can impact the quality of maintenance. Also, equitable distribution of manpower in accordance with workload was not carried out in selected sections of all five Zonal Railways. Adequate training was not provided to the track maintenance staff. 37 *per cent*, 15.7 *per cent* and 4.6 *per cent* of the total staff of NCR, SER and SWR respectively, deployed in LWR/CWR section had not been imparted training. 60 *per cent* of the staff deployed in working of Small Track Machines (STMs) were not trained. Deployment of untrained staff for operation of STMs and track maintenance could compromise the quality of track maintenance. There was no mechanism to ensure that trained staff was posted to Long Welded Rails/ Continuous Welded Rails (LWR/CWR) sections. The small machines were not available in the selected sections as per requirements. Where available, these could not be used optimally due to various constraints such as frequent breakdowns, non-availability of blocks, non-availability of utility vehicles for transportation of these machines at work sites, non-availability of spares, non-availability of imprest to handle repair and maintenance of these machines etc. In all these selected sections, line capacity utilisation of 2013-14 to 2015-16 ranged between 90 *per cent* and 168 *per cent.* As such, these sections required adequate blocks for proper track maintenance. However, blocks provided were much less than blocks demanded which impacted track maintenance.

4.2 Recommendations

Planning and monitoring

1. ***All Zonal Railways should prepare integrated track maintenance plans for day to day as well as periodical maintenance and condition monitoring using machines/ equipment such as USFD machine, Track Recording Cars, etc., duly incorporating timelines and resource requirement/ availability. The plan should include mechanised and non-mechanised components of track maintenance. It should also incorporate addressing arrears of deep screening of ballast, de-stressing and prescribed requirements for operations of CC+8+2 / 25t.***

2. ***The integrated annual maintenance plan for track maintenance of a Zonal Railway should be promptly communicated to the divisional and field formations for its effective implementation.***

3. ***Patrolling and inspections should be done as per norms and the teams should be equipped with GPS enabled devices. Output of patrolling, inspections should be incorporated into Track Maintenance System through GPS based devices, which can be used for monitoring of patrolling, inspections, etc.***

4. ***Monitoring of preparation and implementation of integrated annual maintenance plan for track maintenance over Zonal Railways should be treated as a key results area for Principal Chief Engineer and key performance area for the Chief Track Engineer for Zonal Railways. Co-ordination issues between departments related to monitoring of preparation and implementation of integrated track maintenance plan should be a key performance area for Divisional Railway Managers and key results area for the General Managers.***

<u>Strengthening the process of track maintenance</u>

5. ***RDSO prescribed guidelines regarding storage of USFD output and subsequent review / test check / post check should be implemented. Output of USFD should be uploaded to a centralised data base in real time and analysed for monitoring the conditions of the rails.***

6. ***Availability, maintenance and operations of Track Recording Cars should be ensured for checking track parameters at prescribed frequency.***

7. ***Dual detection has been provided to improve the reliability of signals and decrease the failure of signals. As a side effect, it allows the signals to remain green even when there is a rail fracture and the track circuit has dropped. In such a case when the signal would be green and the train would be moving at maximum permissible speed, there is a risk of accident. Track circuiting system has the potential for detecting rail fractures. Safety Committee had recommended that the signal should be put to yellow aspect as soon as track circuit drops in the dual detection territory so that the train speed is controlled to lower speed while passing the affected zone, which may have rail fracture. Railways may consider using this feature of track circuiting effectively to avert accidents. When a track circuit fails due to any reason, the signal could be put to yellow and the train could be passed only at***

cautious speed, till the track is certified fit by the P-Way Inspector and there is no rail fracture.

8. ***Application system like the TMS should be used efficiently to its full potentiality. Need based access to TMS should be provided to all related functional departments and units namely Operating, Safety, Accounts and Signal & Telecommunication, instead of restricting to the Engineering department only. This will enable effective planning by these departments and enable them to align their operations and maintenance activities to the integrated maintenance plans for the track maintenance. This will also enhance efficiency and effectiveness of block utilisation.***

<u>Adequate provision and effective utilisation of resources</u>

9. ***Railways may consider revising/re-working the formula for calculation of manpower requirement for track maintenance and re-assess the manpower requirement in view of the changed scenario, wherein, more and more mechanised means are going to be used for track maintenance. Diversion of man power provided for maintenance of track for other work should not be permitted. Selection criteria for track maintainers may be aligned with the requirement of their job which includes physical work as well and persons with defective attitude should be adequately sensitized. Deployment of man power should be monitored to ensure proper maintenance of the entire route length.***

10. ***To ensure effective co-ordination between various departments involved, it may be considered to entrust Divisional Railway Managers with the responsibility of monitoring block availability and utilization for regular and periodical maintenance activities.***

11. ***The routes, where enhanced loading over and above the carrying capacity has been permitted, should be equipped with necessary infrastructure. This would include installation of Wheel Impact Load detectors (WILD) to assess impact of enhanced loading on the track structure, installation and utilisation of weighbridges to detect and prevent overloading, up-gradation of track infrastructure, addressing concern of rail grinding, weld protection through joggled fish plates and USFD testing of rails at shorter intervals.***

12. ***Officials of the field formations engaged in track maintenance should be equipped with mechanised and digital equipment including Personnel Digital Assistants, GPS enabled communication devices and small track machines. Necessary skills and training should be imparted to the personnel engaged in track maintenance. Appropriate funds in the form of imprest should be provided to enable expeditious maintenance of these machines and equipment. Availability of spares for these machines should also be ensured.***

(NAND KISHORE)
Deputy Comptroller and Auditor General

New Delhi
Dated: 03 January 2018

Countersigned

(RAJIV MEHRISHI)
Comptroller and Auditor General of India

New Delhi
Dated: 05 January 2018

Appendix I (Para no. 1.2)

Track maintenance activities (preventive and others) along with the periodicity and responsibility centre

S.no.	Groups	Activities	Items	Periodicity / Frequency				Responsibility Centre
				Sectional JE/P. Way	*SSE/P. Way In-charge*	*Sectional ADEN/DEN*	*Sr. DEN*	
1	**Inspection of Track**	Patrolling by Track maintainers (Gang man, Track man, Key Man), Inspection by Junior Engineer, Inspection by Sectional Engineer, Inspection by Assistant Divisional Engineer, Inspection by Divisional Engineer	Gang Inspection	Once in a month (all gangs)	Once in a month one gang per JE/ P. way	Work of minimum one gang in each SSE's jurisdiction every quarter	Minimum one gang per SSE / P.Way Incharge three month	Divisional and Field formations of Zonal Railways
			Push Trolley Inspection	Once in a fortnight	Once in a month	Entire sub division once in two month	Once in three month	
			Footplate Inspection	Once in a month	Once in a month	Once in a month	Once in three month	
			Night Inspection	Once in a fortnight	Once in a month	Once in a month	Once in a month	
			On Foot Inspection	Once in Six months on pro-rata basis so as to cover entire section	Once a year on pro-rata basis so as to cover entire section	-	-	
			Curve	Once in Six months by rotation with SSE / Permanent Way In-charge	Once in Six month by rotation with sectional JE/P. Way	One curve every quarter under each SSE/ P. Way In-charge	Minimum one curve in each ADEN section in every three months.	

S.no.	Groups	Activities	Items	Periodicity / Frequency				Responsibility Centre
				Sectional JE/P. Way	*SSE/P. Way In-charge*	*Sectional ADEN/DEN*	*Sr. DEN*	
	Inspection of Track		Points and crossings of Pass. & running lines	Once in three months by rotation with SSE/P. Way Incharge	Once in three months by rotation with sectional JE/P. Way	Once in a year	As often as possible during trolley inspection at least one important points and crossing on Pass and running lines.	Divisional and Field formations of Zonal Railways
			Points and crossings of other lines & Yards	Once in 6 months by rotation with SSE/P. Way Incharge	Once in 6 months by rotation with JE/P. Way	I/10th of total T/outs every year on Programme basis	-	
			LWR/CWR & SE	Once in fortnight during two coldest and two hottest months min and max temperature, otherwise once in two months by rotation with SSE/P. Way Incharge	Once in fortnight during two coldest and two hottest months at min and max temperature, otherwise once in two months by rotation with sectional JE/P.Way	Once in every six months preferably hottest & coldest months	-	

S.no.	Groups	Activities	Items	Periodicity / Frequency				Responsibility Centre
				Sectional JE/P. Way	***SSE/P. Way In-charge***	***Sectional ADEN/DEN***	***Sr. DEN***	
	Inspection of Track		Level Crossing	Once in a month	Once in a month	Once in Six months	Minimum One LC per SSE/ P. Way In-charge in three months	Divisional and Field formations of Zonal Railways
			Small Track machines	-	Once a fortnight	Once in Six months	-	
			Patrolling (hot weather / cold weather / Monsoon)	Check the night patrolling once a fortnight	Arrange for patrolling of track by deputing suitably selected men, check the night patrolman once a month	Check the work of patrolman at night once in a month	-	
		Daily inspection	The key man shall inspect by foot his entire beat once a day, both the tracks and bridges, and return along the opposite rail to that taken on his outward journey in case of single line. On double line, key man will carry out one round of inspection in morning hours by going along, UP line and then returning along DN line or vice – versa. Key man looks for defects, broken rail, fittings, greasing, lubrication, buckling, unauthorized structures etc. in his beat.					Key man, SSE of Divisional and field formations of Zonal Railways

2	USFD testing	USFD testing of weld	Type of welds	Type of testing	Testing Schedule	Responsibility Centre
	USFD testing of welds	Type of Welds	Type of Testing	Testing Schedule		SSE / USFD team, ADEN and DEN, Track
		Conventional AT weld	Periodic Tests	Every 40 GMT or 5 year, whichever is earlier		
		SKV weld	Acceptance Test	Immediately after welding		
			First Periodic Test	1 year		
		Further tests based on route GMT		**Routes having GMT**	**Frequency**	
				>45	2 years	
				>30 ≤45	3 years	
				>15≤30	4 years	
				0-15	5 years	
	USFD testing of Rails (Rail head center and gauge face corner / non – gauge face corner / non – gauge face corner testing)	**Routes having GMT**		**Testing frequency Once in**		
		≤5		2 years		
		>5≤8		12 months		
		>8≤12		9 months		
		>12≤16		6 months		
		>16≤24		4 months		
		>24≤40		3 months		
		>40≤60		2 months		
		>60≤80		1 and 1/2 months		
		>80		1month		

3	**Track monitoring**	**Rail Profile Measurement by Track Recording Cars (TRC)**	**Types of Routes**	**Frequency**	**Responsibility Centre**
		Track Recording Cars (TRC)	Routes with existing speeds above 120 kmph	Once in 2 months	Track Machines and Monitoring Directorate of RDSO for deployment of TRC and AEN should accompany the TRC in his
			Routes with existing speeds above 110 Kmph and up to 130 kmph	Once in 3 months	
			Other Group 'A' and 'B' routes	Once in 4 months	

			Group 'C', D'D' and 'D Special' Routes	Once in 6 months	jurisdiction and take down notes regarding the spots needing attention
			Group 'E' and 'E Special' Routes	Once in 12 months	
4	**WILD**	Monitoring of impact load on track by 'Wayside detection system' through Wheel Impact Load Detector (WILD) system			Zonal Railway
5	**Preventive and periodic maintenance activities**	Deep Screening	**Deep screening should be carried out in the following situations by providing full ballast cushion:** 1. Prior to complete track renewal 2. Prior to through sleeper renewal 3. Where the caking of ballast has resulted in unsatisfactory riding 4. Before converting existing track into L.W.R. or C.W.R; or before introduction of machine maintenance, unless the ballast was screened in recent past. 5. The entire track must be deep screened at least once in ten years.		Divisional and Sub – divisional formations of Zonal Railways
		De-stressing	Abnormal behavior of LWR/CWR whenever gets manifested in one or more of the Following, de-stressing shall be undertaken i) When the gap observed at SEJ (a) differs beyond limits specified; (b) exceeds the maximum designed gag of SEJ; (c) When stock/tongue rail crosses the mean position. ii) After special maintenance operations iii) After restoration of track following an unusual occurrence iv) If number of locations where temporary repairs have been done exceed three per km.		Divisional and Sub – divisional formations of Zonal Railways
		Others	1. Overhauling of points and Crossing 2. Renewal of crossings 3. Changing of sleepers 4. Lubricating and adjusting switches 5. Tamping 6. Welding		SSE (in overall charge)

6	**Training**	Arrangements for training of all Permanent Way Staff working on LWR/CWR sections shall be made/by Chief Engineer by holding special/regular Courses in Zonal Training centers and Sr. DEN / DEN in Divisional Training Centers.	PCE and Sr. DEN
7	**Co-ordination with other Departments**	The Assistant Engineer should co-operate effectively with officers and staff of other departments in matters that warrant co-ordination	AEN
8	**Track on Bridges**	The track on Bridges should be inspected as a part of the annual Bridge inspection, besides normal track inspections.	AEN
9	**Ballast**	Measure and record the measurements of ballast or carry out 100 per cent check on quality and quantity of the ballast, if the measurements are recorded by SSE	AEN

Appendix II (Para no. 2.3.2)

On account of reasons attributed to track condition or deficient track maintenance such as rail fracture, weld fracture, track defects, defects in points, track buckling etc., 14 accidents occurred in the five selected Zonal Railways NCR, ECR, SER, SR and SWR, during the review period 2014-15 to 2016-17. Of these ten accidents were of trains carrying passengers and four accidents were that of goods trains. In addition, three accidents of passenger carrying trains occurred in NCR during 2016-17, for which causes of accidents were still under investigation.

In respect of the following five selected passenger train accidents out of the 17 accidents mentioned above, Audit checked the track maintenance practices and track conditions in the sections where these accidents took place:

1. Train no. 19321, Indore - Rajendra Nagar Patna Express on 20 November 2016
2. Train no. 12987, Ajmer Sealdah Express on 28 December 2016
3. Train no. 12189,Jablapur- NizamuddinMahakaushal Express on 30 March 2017
4. Train no. 18101, Tata-Jammu Tawi Express on 25 March 2015
5. Train no. 53342 DN, Muri-Dhanbad Passenger on 22 June 2014

The track maintenance practices in these sections were reviewed andAudit noticed deficiencies in inspections and maintenance of tracks against the norms/schedules. These are tabulated below:

Review of major passenger train accidents	
1. Accident of Train no. 19321, Indore - Rajendra Nagar Patna Express on 20 November 2016	
Train no. and name	Train no. 19321 - Indore - Rajendra Nagar Patna Express
Date of Accident	20 November 2016 at 3:03 hrs
Spot of Accident	Between Pokhrayan – Malasastation section, Pole no. 1290/2 – 1290/16
Zonal Railway	North Central Railway
Division	Jhansi
Name of the Section	Ait – Bhimsen
Jurisdiction of SSE	Sr. Section Engineer (SSE) /Juhi
Jurisdiction of ADEN	Assistant Divisional Engineer (ADEN), Kanpur, Jhansi Division
Loss of life/ railway property	Death of 150 passengers Estimated loss of C&W – ₹ 6 crore
Cause of accident as per supervisor's joint note	Rail failure due to old flaw in rail
Report of the Commissioner of Railway Safety (CRS)	Preliminary Report of CRS which should be given within one month of the accident and Final report of CRS enquiry which is due within six months of the accident are still awaited.
Audit findings regarding track maintenance activities of the section where an accident of passenger train took place on 20 November 2016	

<table>
<tr><td>Perspective Plan for manual track maintenance by the sectional officials</td><td>

Advance perspective maintenance plans were not prepared.
Advance planning for realignment of curves, deep screening, casual renewal of points and crossing, welding, de-stressing etc. were not planned.

</td></tr>
<tr><td>Plan for mechanised maintenance through Track Machines (Zonal Headquarters)</td><td>

Annual plan for deployment of various track machines was intimated to Sr. Divisional Engineer (Coordination), Allahabad on 29 April 2016, i.e. after 29 days from the start of the year.
Deployment plan of various track machines was not intimated to concerned ADEN and SSE of Juhi.

</td></tr>
<tr><td>TMS reports of Jhansi Division during 2016-17</td><td>

Advance planning for smooth shifting and functioning of machines was not made.
3246 machine days out of 7641 machine were not utilised / wasted over Jhansi Division on account of non-availability of block, deport work, repairs, shifting, staff rest, site not ready etc.

</td></tr>
<tr><td>Utilisation of track machines in Jhansi Division</td><td>

Average shortfall in achievement of target over Jhansi Division was 57 per cent with minimum value of 14 per cent and maximum value of 87.5 per cent.
Shortfall in targets of ballast cleaning machine (87 per cent) , ballast regulation machine (57 per cent), Tamping, lifting, slewing and deep screening of track (59per cent),Tamping, aligning and labelling of track (56 per cent) and Lining, labelling and tamping of track (68 per cent).

</td></tr>
<tr><td>Welding of rail joints</td><td>

Use of AT welds, due to which tracks are prone to frequent weld failures, still widespread. Comparison of defect reported in AT welt and Mobile flash butt weld revealed that defects in AT weld was 9.2per cent and FB weld is 0.58per cent i.e. failure in FB weld was negligible.

<table>
<tr><th>Name of the Section</th><th>AT weld population</th><th>Defects noticed in USFD testing</th><th>Percentage</th><th>Flash butt weld population</th><th>Defects noticed in USFD testing</th><th>Percentage</th></tr>
<tr><td>Ait-Bhimsen (up)</td><td>141</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Ait-Bhimsen (Dn.)</td><td>114</td><td>03</td><td>2.63</td><td>61</td><td>0</td><td>0</td></tr>
<tr><td>Ait-Bhimsen (SL)</td><td>4130</td><td>413</td><td>10</td><td>6633</td><td>45</td><td>0.68</td></tr>
<tr><td>Bhimsen - Govindpuri (up)</td><td>146</td><td>05</td><td>3.42</td><td>1088</td><td>04</td><td>0.37</td></tr>
<tr><td>Bhimsen - Govindpuri (Dn.)</td><td>152</td><td>10</td><td>6.58</td><td>777</td><td>01</td><td>0.13</td></tr>
<tr><td>Total</td><td>4683</td><td>431</td><td>9.2</td><td>8559</td><td>50</td><td>0.58</td></tr>
</table>

In SSE / Juhi, single shot crucible was not initiated in AT welding after 01 April 2015 due to non-supply of single shot crucible welding portion. In some cases single shot crucible was sued only after January 2017.

</td></tr>
<tr><td>USFD testing</td><td>

USFD was done by the Departmental Team 7 of Kanpur on 18 October 2016. No major deficiencies were reported in USFD testing.
Training and Workshop for training of ADEN and SSE to handle USFD machines independently was not conducted in Jhansi Division of North Central Railway. SSE, Juhi was not trained in USFD testing.
Test check of 5 per cent was not conducted by ADEN in the section where the USFD testing was actually carried out by the Contractor.
Scanned images / peak patterns was not saved by the USFD team. Thus in successive USFD test scrutiny / analysis by concerned supervisors / officers were not possible.

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- Due to irregularities in test check new flaw left out by the contractor / USFD team could not be detected. In reply to audit observation ADEN, Kanpur remarked that test check details were recorded by him on Measurement book. No record could be provided by ADEN, Kanpur, Jhansi Division to Audit in support of test check.

</td></tr>
<tr><td>Preparation of location wise stock of USFD tested rails</td><td>

- Instructions for preparation of location wise stock was issued by NCR. However, location wise stock of USFD tested rails was not made and certification from USFD operator before use in replacement / change of rail work was not ensured. No system existed to ensure that the only USFD tested rails was used for repair and casual renewal work.
- Check of rail / weld failure during 2016-17 in the jurisdiction of SSE / Juhi revealed that 13 number of failure took place but, in order to establish whether the fracture was detectable and missed by USFD machine spot of fracture/ was not inspected by ADEN, Kanpur, Jhansi Division. Details are as under:

<table>
<tr><th>S.no.</th><th>Location</th><th>Date of Failure</th><th>Type of failure</th><th>Date of USFD testing</th><th>Result of USFD test</th><th>Responsibility</th></tr>
<tr><td>1</td><td>1284/14-16</td><td>17.05.2016</td><td>Weld failure</td><td>20.01.2016</td><td>Good</td><td>M/s Khemchand</td></tr>
<tr><td>2</td><td>1299/30 to 1300/2</td><td>15.10.2016</td><td>Weld failure</td><td>18.03.2015</td><td>Good</td><td>Sudden failure responsibility not fixed.</td></tr>
<tr><td>3</td><td>1320/8-10</td><td>24.10.2016</td><td>Mid rail fracture</td><td>23.07.2016</td><td>Good</td><td>M/s Khemchand</td></tr>
<tr><td>4</td><td>1289/4-6</td><td>10.11.2016</td><td>Rail fracture</td><td>18.10.2016</td><td>OBS Rail</td><td>Sudden failure responsibility not fixed.</td></tr>
<tr><td>5</td><td>1310/14-16</td><td>18.12.2016</td><td>Rail fracture</td><td>15.12.2016</td><td>Good</td><td>Sudden failure responsibility not fixed.</td></tr>
<tr><td>6</td><td>1291/4-6</td><td>27.12.2016</td><td>Rail fracture</td><td>15.12.2016</td><td>No flaw</td><td>Avoidable, detected by patrolmen on duty.</td></tr>
<tr><td>7</td><td>1289/4-6</td><td>10.01.2017</td><td>Rail fracture</td><td>13.12.2016</td><td>Nil</td><td>Sudden failure responsibility not fixed.</td></tr>
<tr><td>8</td><td>1297/26-28</td><td>11.01.2017</td><td>Weld failure</td><td>12.02.2014</td><td>No flaw</td><td>Last USFD testing about 03 years ago.</td></tr>
<tr><td>9</td><td>1326/30-32</td><td>14.01.2017</td><td>Sudden failure</td><td>13.12.2016</td><td>Good</td><td>Nil</td></tr>
<tr><td>10</td><td>1305/18-20</td><td>12.02.2017</td><td>Weld failure</td><td>29.11.2016</td><td>DFWO</td><td>Nil</td></tr>
<tr><td>11</td><td>1314/12-14</td><td>25.02.2017</td><td>Rail failure</td><td>14.12.2016</td><td>OBS</td><td>NIL</td></tr>
<tr><td>12</td><td>1285/14-16</td><td>25.02.2017</td><td>Weld Failure</td><td>23.01.2016</td><td>Good</td><td>Nil</td></tr>
<tr><td>13</td><td>1310/12-14</td><td>12.03.2017</td><td>Weld failure</td><td>06.04.2015</td><td>Nil</td><td>Last USFD testing about 02 years ago.</td></tr>
</table>

- In two out of 13 cases last USFD test of weld was carried out 2 to 3 years ago.

</td></tr>
<tr><td>Track recording</td><td>

Check of register of TRC results of track in the office of SSE, Juhi revealed that:

- Jhansi – Kanpur route of Indian Railway comes under ‘D’ routes i.e. monitoring frequency of TRC was once in six months.
- Track recording was not conducted during 2016-17. Last track recording was carried in

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<table>
<tr><td></td><td>2015-16 on 05 March 2016.
• Track recording car did not have an uninterrupted run over Jhansi – Kanpursections of NCR and speed of TRC was also not uniform. Thus, comparable results between successive recordings were not produced by TRC unit.
• The prescribed recording speed range of a BroadGauge car is 70 - 80 kmph and the recording done below these speeds are taken as ‘Non-recorded’. Check of TGI of accident location showed that from km 1289-1291 TGI of the track was not recorded by TRC unit on 05 March 2016 due to running of TRC below the prescribed speed range of 70-80 kmph. Speed of TRC was also not recorded by the officer accompanying the Track Recording run.</td></tr>
<tr><td>Inspection</td><td>• GPS based foot plate inspection device was not procured by NCR and inspection of track was carried out traditionally.
• Track maintainers were not equipped with communication equipment to report any failure, fracture or damage immediately from the section where short comings / defects in track was observed.</td></tr>
<tr><td>Deep screening of ballast</td><td>In the jurisdiction of SSE, Juhi, Deep screening was overdue in main line section at 10 locations for length of 16264 meter between one to 19 years, as detailed below:
<table>
<tr><th>S.no.</th><th>Section</th><th>Line</th><th>Deep Screening month & year</th><th>Location from km/m to Km/m</th><th>Length</th></tr>
<tr><td>1</td><td>Ait-Bhimsen</td><td>Single Line</td><td>March 1999</td><td>1272/0 to 1274/300</td><td>2264 m</td></tr>
<tr><td>2</td><td>Ait - Bhimsen</td><td>Single Line</td><td>Jan. 1999</td><td>1275/275 to 1275/655</td><td>380 m</td></tr>
<tr><td>3</td><td>Ait - Bhimsen</td><td>Single Line</td><td>March 1998</td><td>1276/472 to 1280/285</td><td>3839 m</td></tr>
<tr><td>4</td><td>Ait - Bhimsen</td><td>Single Line</td><td>March 1998</td><td>1281/330 to 1281/375</td><td>45 m</td></tr>
<tr><td>5</td><td>Ait - Bhimsen</td><td>Single Line</td><td>April 2007</td><td>1315/0 to 1317/580</td><td>2582 m</td></tr>
<tr><td>6</td><td>Ait - Bhimsen</td><td>Single Line</td><td>March 2007</td><td>1318/775 to 1319/0</td><td>266 m</td></tr>
<tr><td>7</td><td>Ait - Bhimsen</td><td>Single Line</td><td>March 2007</td><td>1319/0 to 1324/0</td><td>4991 m</td></tr>
<tr><td>8</td><td>Ait - Bhimsen</td><td>Single Line</td><td>March 2007</td><td>1324/0 to 1325/0</td><td>997 m</td></tr>
<tr><td>9</td><td>Bhimsen-Govindpuri</td><td>Up Line</td><td>Jan. 2002</td><td>1332/850 to 1333/580</td><td>730 m</td></tr>
<tr><td>10</td><td>Bhimsen-Govindpuri</td><td>Up Line</td><td>Jan. 2002</td><td>1333/580 to 1333/750</td><td>170 m</td></tr>
<tr><td colspan="5"></td><td>16264 m</td></tr>
</table></td></tr>
<tr><td>De-stressing of LWR/CWR</td><td>In the sections of SSE, Juhi,during 2016-17,
1. De-stressing was done without rail tensors and done manually by contractual labours in
• 8175 meter out in LWR number 33 (1289 km 696m to 1297 km to 970 m)
• 800 meter in LWR number 34 (1298 km 115 m to 1298 km to 915 m)
• 796 meter was carried out in LWR number 32 (1288 km 776 m to 1289 km to 570 m)
2. De-stressing was done without rail tensors and done manually by departmental labours in</td></tr>
</table>

<table>
<tr><td></td><td>

- 834 meter in LWR number 30 (1280 km 375 m to 1281 km to 193 m)
- 7285 meter in LWR number 43 (1325 km 328 m to 1332 km to 613 m)

</td></tr>
<tr><td>Standardisation of Track structure</td><td>

Track structure was not standardised with 60 Kg, 90 UTS rails. As per rail change report during 2016-17, both 52 Kg and 60 Kg rails were still in use. During 2016-17 in 367 instances rail were replaced due to defects. Of these,

- 45 instances were caused by defects in welds at joints viz. defective weld, IMR weld (where immediate rail removal is required), weld failure.
- In 16 cases, premature renewal of rail was carried out due to SEJ failure.
- In 143 cases rails was changed due to pitted rail.

</td></tr>
<tr><td>Use of Small Track Machines for mechanized track maintenance</td><td>

In Jhansi – Kanpur section all maintenance activities are being done through manually as well as through machines. Track maintenance work such as de-stressing, reconditioning, toe load measuring, lifting, trolling and screening of ballast was impacted due to the following constraints:

- Number of small track machines was not adequate
- Arrangement for transport of these machines was not proper
- Spares for small track machines were not available in local market
- For emergency repairs of small track machines imprest was not sanctioned.
- Staff deputed on deployment / operation of small track machines were not trained.

Check of records of SSE, Juhi and ADEN, Kanpur revealed that there was huge shortage of small track machines. During January 2017,

- 17 out of 44 Abrasive rail cutters were out of order
- 12 out of 52 Rail drilling machines were out of order
- One out of four rail tensors were out of order
- Both the Rail profile weld grinders were out of order
- One out of 8 Double action trimmer for AT welding were not working
- Generator for running these machines was also not working

</td></tr>
<tr><td>Manpower for track maintenance</td><td>

As on 1 April 2016, the staff position in under the SSE/Juhi was as follows:

Category	Sanction	Actual Men on roll	Shortage
Blacksmith	02	01	-01
H/Man	0	01	+1
Welder	02	01	-01
MSN	2	0	-02
ART/Khalasi	02	01	-01
Non ART / Khalasi	01	0	-01
T.M - I	14	5	-9
T.M. II	27	8	-19
T.M. III	51	71	+20
T.M. IV	148	108	-40
Total	**249**	**196**	**-53**

Out of 196 staff on roll, 32 staff were absent from the duty without any intimation to office establishment between 01 April 2016 to 31 March 2017 for more than 15 days.Though shortages of staff was communicated by SSE in the monthly reports, no action was taken so far for filling of vacancies.

As such, actual man power of SSE's after rest, leave, sick, absent and training was being used in maintenance activities. Thus work of regular maintenance in jurisdiction of SSE, Juhi was hampered.

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</table>

Training for permanent way staff	In NCR, Check of competency certificate in selected sections showed that no system existed to ensure that only trained staffs were posted in LWR / CWR section. It was seen that • 15 Track maintainers were posted in the section of SSE, Juhi without imparting initial training of track maintenance. • Records of refresher courses were not maintained and Competency certificate for working on LWR section was also not obtained for Keyman, Gangmate. • TMS report of training of staff was also not updated as a result monitoring of training programme at higher level was not carried out.

2. Accident of Train no. 12987, Ajmer Sealdah Express on 28 December 2016	
Train no. and name	12987 (Sealdah Ajmer express)
Date of Accident	28 December 2016at 05:11
Spot of Accident	Near KM-1061/26 UP Line
Zonal Railway	North Central Railway
Division	Allahabad
Name of the Section	Maitha-Rura
Jurisdiction of SSE	SSE – II, Kanpur, Allahabad Division
Jurisdiction of ADEN	ADEN, Line Kanpur
Loss of life/ railway property	16 coaches derailed, 50 persons were injured and estimated loss of Rs. 4.67 crore occurred to Railways for damages to assets
Cause of accident as per supervisor's joint note	Rail fracture
Report of the Commissioner of Railway Safety (CRS)	Preliminary Report of CRS which should be given within one month of the accident and Final report of CRS enquiry which is due within six months of the accident are still awaited.
Audit findings regarding track maintenance activities of the section where an accident of passenger train took place on 28 December 2016	
Preparation of Perspective Plan for manual track maintenance by the sectional officials	• Advance perspective monthly planning for realignment of curves, deep screening, casual renewal of points and crossing, welding, de-stressing etc. were not made. • Activities of maintenance were not executed as per Annual plan of TMS.
Plan for mechanised maintenance through Track Machines (Zonal Headquarters)	• Annual plan for deployment of various track machines was intimated to Sr. Divisional Engineer (Coordination), Allahabad on 29 April 2016, i.e. after 29 days from the start of the year. • Deployment plan of various track machines was not intimated to concerned ADEN and SSE of Kanpur - II.

<table>
<tr><td>TMS reports of Allahabad Division during 2016-17</td><td>

Advance planning for smooth shifting and functioning of machines was not made.
Check of reports of TMS regarding working of Track machines over Allahabad Division revealed that during 2016-17 advance planning for smooth shifting and functioning of machines was not made and 2341 machine days out of 6878 machine days i.e. 34 per cent were not utilised / wasted over Allahabad Division on account of non-availability of block, deport work, repairs, shifting, staff rest, site not ready, bad weather, non-availability of fuel etc.

</td></tr>
<tr><td>Utilisation of track machines in Allahabad Division</td><td>

Average shortfall in achievement of target over Allahabad Division was 55 per cent with minimum value of 14 per cent and maximum value of 87.5 per cent.
Shortfall in targets of ballast cleaning machine (87 per cent), ballast regulation machine (57 per cent), Tamping, lifting, slewing and deep screening of track (59per cent),Tamping, aligning and labelling of track (56 per cent) and Lining, labelling and tamping of track (68 per cent).

</td></tr>
<tr><td>Welding of rail joints</td><td>

Use of AT welds, due to which tracks are prone to frequent weld failures, still widespread. Comparison of defect reported in AT welt and Mobile flash butt weld revealed that defects in AT weld was 33.6 per cent and FB weld is 0.92 per centi.e. failure in FB weld was negligible.

<table>
<tr><th>Name of the Section</th><th>AT weld population</th><th>Defects noticed in USFD testing</th><th>Percentage</th><th>Flash butt weld population</th><th>Defects noticed in USFD testing</th><th>Percentage</th></tr>
<tr><td>Govindpuri - Panki</td><td>1242</td><td>435</td><td>35.02</td><td>2622</td><td>15</td><td>0.57</td></tr>
<tr><td>Panki - Etawah</td><td>2653</td><td>874</td><td>32.94</td><td>8217</td><td>85</td><td>1.03</td></tr>
<tr><td>Total</td><td>3895</td><td>1309</td><td>33.60</td><td>10839</td><td>100</td><td>0.92</td></tr>
</table>

In SSE /Kanpur, single shot crucible was not initiated in AT welding.

</td></tr>
<tr><td>USFD testing</td><td>

USFD testing results of rail joints was not recorded in welding register.
USFD was done by the Departmental and Contractual Team. As per USFD test result in jurisdiction of SSE/ II, Kanpur 14734 defective welds and 61 defective rails existed at different locations.
SSE, Kanpur II was not trained in USFD testing.
Scanned images/peak pattern was not saved by the USFD team. Thus, in successive USFD test scrutiny/analysis by concerned supervisors/officers were not possible. Test check of 5 per cent was not conducted by ADEN in the section where the USFD testing was actually carried out by the Contractor.
Due to irregularities in test check new flaw left out by the contractor /USFD team could not be detected.

</td></tr>
<tr><td>Preparation of location wise stock of USFD tested rails</td><td>

Instructions for preparation of location wise stock were issued by NCR. However, location wise stock of USFD tested rails was not made and certification from USFD operator before use in replacement / change of rail work was not ensured. No system existed to ensure that the only USFD tested rails was used for repair and casual renewal work.
Check of rail / weld failure during 2016-17 in the jurisdiction of SSE /Kanpur II revealed that four weld failure took place but, in order to establish whether the fracture was detectable and missed by USFD machine spot of fracture/ was not inspected by ADEN, Kanpur, Allahabad Division.

</td></tr>
<tr><td>Date of previous TRC Run and TGI</td><td>Check of register of TRC results of track in the office of SSE, Kanpur II revealed that:</td></tr>
</table>

<table>
<tr><td></td><td>

Monitoring frequency of TRC was once in six months.
Track recording was not conducted as per prescribed frequency as during 2016-17 track recording was carried in only one times in December'2016
TGI of spot of the accident was 107 and no major irregularities were reported by TRC unit.

</td></tr>
<tr><td>Inspection</td><td>

GPS based foot plate inspection device was not procured by NCR and inspection of track was carried out traditionally.
Track maintainers were not equipped with communication equipment to report any failure, fracture or damage immediately from the section where short comings / defects in track was observed.

</td></tr>
<tr><td>Deep screening of ballast</td><td>In the jurisdiction of SSE, /II/Kanpur, Deep screening is overdue in main line section at 41 locations for length of 34.46 km, due from three to four years. Section and location wise details are as under:
<table>
<tr><th>S.no</th><th>Section</th><th>Line</th><th>Deep Screening month & year</th><th>Location from km/m to km/m</th><th>Length</th></tr>
<tr><td>1</td><td>Govindpuri-Panki</td><td>UP & DN</td><td>Dec2002</td><td>1022 to 1026</td><td>4.33 TKM</td></tr>
<tr><td>2</td><td>Panki-Etawah</td><td>UP & DN</td><td>July 2003</td><td>1027 to 1047</td><td>30.13 TKM</td></tr>
<tr><td colspan="5">TOTAL</td><td>34.46 TKM</td></tr>
</table>
</td></tr>
<tr><td>De-stressing of LWR/CWR</td><td>De-stressing of LWR/CWR under SSE/II/Kanpur was not entered in TMS. No records were produced to audit regarding due de-stressing and its method.</td></tr>
<tr><td>Use of Small Track Machines for mechanized track maintenance</td><td>Check of records of SSE/II/Kanpur revealed that:

Over Govindpuri - Etawah section all these maintenance activities are being done through dual maintenance. It not only takes longer time but also affects quality of work resulting in lesser life of the work done.
For emergency repairs of Small track machines imprest was not sanctioned.
Staff deputed on deployment / operation of small track machines was not trained.
Non-availability of imprest and shortfall of machines impacted various aspects of track maintenance like de – stressing, reconditioning, toe load measuring, lifting, trolling and screening of ballast.
During March 2017, out of 13Hydraulic track Jack 10were out of order, out of 13Abrasive rail cutters, 10 were out of order and three out of fiveRail drilling machineswere out of order.

</td></tr>
<tr><td>Manpower for track maintenance</td><td>

As on April 2017, against the sanction strength of 488 Track maintainers only 288 track maintainers were on roll.
Out of 288 track maintainers 14 track maintainers were deployed in other then track maintenance work.

</td></tr>
<tr><td>Training for permanent way staff</td><td>In NCR, checks of competency certificate in selected sections showed that no system existed to ensure that only trained staffs were posted in LWR /CWR section. It was seen that

44 Track maintainers were posted in the section of SSE /Kanpur-II without imparting initial training of track maintenance.
Records of refresher courses were not maintained and Competency certificate for working on LWR section was also not obtained for Key man, Gang mate.
TMS report of training of staff was also not updated as a result monitoring of training programme at higher level was not carried out.

</td></tr>
</table>

3. Accident of Train no. 12189,Jablapur - NizamuddinMahakaushal Express on 30 March 2017	
Train no. and name	*Train no. 12189 - Jablapur –NizamuddinMahakaushal Express*
Date of Accident	30 March 2017 at 2:30 hrs
Spot of Accident	Between Mahoba and Kulpahar Stations
Zonal Railway	North Central Railway
Division	Jhansi
Name of the Section	Manikpur – Jhansi Section
Jurisdiction of SSE	SSE/Mahoba
Jurisdiction of ADEN	ADEN, Mahoba, Jhansi Division
Loss of life / railway property	Estimated loss of ₹ 25.6 lakh on account of damaged track. Eight rearmost Coaches of the Train derailed 10 passengers injured.
Cause of accident as per supervisors joint note	Fracture near rail joints.
Report of the Commissioner of Railway Safety (CRS)	NAV 
Audit findings regarding track maintenance activities of the section where an accident of passenger train took place on 30 March 2017	
Preparation of Perspective Plan for manual track maintenance by the sectional officials	• Advance perspective monthlyplanning for realignment of curves, deep screening, casual renewal of points and crossing, welding, de-stressing etc. were not made. • Activities of maintenance were not executed as per Annual plan of TMS.
Plan for mechanised maintenance through Track Machines (Zonal Headquarters)	• Annual plan for deployment of various track machines was intimated to Sr. Divisional Engineer (Coordination), Jhansi on 29 April 2016, i.e. after 29 days from the start of the year. • Deployment plan of various track machines was not intimated to concerned ADEN and SSE of Mahoba.
TMS reports of Jhansi Division during 2016-17	• Advance planning for smooth shifting and functioning of machines was not made. • 3246 machine days out of 7641 were not utilised / wasted over Jhansi Division on account of non-availability of block, deport work, repairs, shifting, staff rest, site not ready etc.
Utilisation of track machines in Jhansi Division	• Average shortfall in achievement of target over Jhansi Division was 57 *per cent* with minimum value of 14 *per cent* and maximum value of 87.5 *per cent.* • Shortfall in targets of ballast cleaning machine *(*87 *per cent)*, ballast regulation machine *(*57 *per cent)*, Tamping, lifting, slewing and deep screening of track *(*59*per*

<table>
<tr><td></td><td>cent),Tamping, aligning and labelling of track (56 per cent) and Lining, labelling and tamping of track (68 per cent).</td></tr>
<tr><td>Welding of rail joints</td><td>
Use of AT welds, due to which tracks are prone to frequent weld failures, still widespread. Comparison of defect reported in AT welt and Mobile flash butt weld revealed that defects in AT weld was 3.36per cent and FB weld is 0.1per centi.e. failure in FB weld was negligible.
<table>
<tr><th>Name of the Section</th><th>AT weld population</th><th>Defects noticed in USFD testing</th><th>Percentage</th><th>Flash butt weld population</th><th>Defects noticed in USFD testing</th><th>Percentage</th></tr>
<tr><td>JHS-MBA</td><td>6956</td><td>270</td><td>3.88</td><td>2048</td><td>6</td><td>0.29</td></tr>
<tr><td>MBA KID</td><td>329</td><td>23</td><td>6.99</td><td>2412</td><td>8</td><td>0.33</td></tr>
<tr><td>MBA KURJ</td><td>1446</td><td>0</td><td>0</td><td>9022</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>8731</td><td>293</td><td>3.36</td><td>13482</td><td>14</td><td>0.1</td></tr>
</table>
In SSE / Mahoba, single shot crucible was not initiated in AT welding after 01 April 2015 due to non-supply of single shot crucible welding portion.
</td></tr>
<tr><td>USFD testing</td><td>

USFD testing results of rail joints was not recorded in welding register.
USFD was done by the Departmental and Contractual Team. As per USFD test result in Jhansi – Mahoba section 276 defective welds and 75 defective rails were exist at different locations. Year of welding in most of the defective welds was 2002 and 2003 i.e. these welds are old and prone to frequent weld failures.
Training and Workshop for training of ADEN and SSE to handle USFD machines independently was not conducted in Jhansi Division of North Central Railway. SSE, Mahobawas not trained in USFD testing.
Scanned images / peak patterns were not saved by the USFD team. Thus, in successive USFD test scrutiny / analysis by concerned supervisors / officers were not possible.Test check of 5 per cent was not conducted by ADEN in the section where the USFD testing was actually carried out by the Contractor.
Due to irregularities in test check new flaw left out by the contractor / USFD team could not be detected.

</td></tr>
<tr><td>Preparation of location wise stock of USFD tested rails</td><td>

Instructions for preparation of location wise stock was issued by NCR. However, location wise stock of USFD tested rails was not made and certification from USFD operator before use in replacement / change of rail work was not ensured. No system existed to ensure that the only USFD tested rails was used for repair and casual renewal work.
Check of rail / weld failure during 2016-17 in the jurisdiction of SSE / Mahoba
Oneweld failure took place but, in order to establish whether the fracture was detectable and missed by USFD machine spot of fracture/ was not inspected by ADEN, Mahoba, Jhansi Division.

</td></tr>
<tr><td>Date of previous TRC Run and TGI</td><td>Check of register of TRC results of track in the office of SSE, Mahoba revealed that:

In Jhansi – Mahoba sectionmonitoring frequency of TRC was once in six months.
Track recording was not conducted as per prescribed frequency as during 2016-17 track recording was carried in only one times on 24 July 2016. As per TRC register TGI of spot of the accident (Km 1291) was 110. i.e. no deficiencies were detected by TRC unit in track parameters.

</td></tr>
<tr><td>Inspection</td><td>

GPS based foot plate inspection device was not procured by NCR and inspection of track was carried out traditionally.
Track maintainers were not equipped with communication equipment to report any failure, fracture or damage immediately from the section where short comings /

</td></tr>
</table>

	defects in track was observed.
Deep screening of ballast	Records of deep screening in the Jhansi – Mahoba section was not available in office of SSE / Mahoba and SSE states that Deep screening is overdue in a large porting of Jhansi – Mahoba section.
De-stressing of LWR/CWR	Details of De – stressing of LWR / CWR was not made available to Audit.
Standardisation of Track structure	• Track structure was not standardised with 60 Kg, 90 UTS rails. As per rail change report during 2016-17, both 52 Kg rails were still in use. During 2016-17 in 84 instances rail were replaced due to defects. Out of these, • 41 instances were caused by defects in welds at joints viz. defective weld, IMR weld, weld failure. • In 23 cases rails was changed due to defects in rail viz pitted rail, scabbed rail, OBS rail.
Use of Small Track Machines for mechanized track maintenance	• In Jhansi – Mahoba section all maintenance activities are being done through manually as well as through machines. Track maintenance work such as de-stressing, reconditioning, toe load measuring, lifting, trolling and screening of ballast was impacted due to the following constraints: • Number of small track machines was not adequate • Arrangement for transport of these machines was not proper • Spares for small track machines were not available in local market • For emergency repairs of Small track machines imprest was not sanctioned. • Staff deputed on deployment / operation of small track machines were not trained. This impacted • Check of records of SSE, Mahoba revealed that there was huge shortage of small track machines. During June 2017, - 7 out of 11 Abrasive rail cutters were out of order - 13 out of 20 Rail drilling machines were out of order - 2 out of 3 Rail profile weld grinders were out of order
Manpower for track maintenance	Out of 127 track maintainers on roll 20 track maintainers were deployed in other then track maintenance work.
Training for permanent way staff	In NCR, checks of competency certificate in selected sections showed that no system existed to ensure that only trained staffs were posted in LWR / CWR section. It was seen that • 61 Track maintainers were posted in the section of SSE / Mahoba without imparting initial training of track maintenance. • Records of refresher courses were not maintained and Competency certificate for working on LWR section was also not obtained for Key man, Gang mate. • TMS report of training of staff was also not updated as a result monitoring of training programme at higher level was not carried out.

4. *Derailment of* Train no. 18101, Tata-Jammu Tawi Express on 25 March 2015	
Train no. and name	Train no. 18101 Tata Jammu Tawi Express
Date of Accident	25.05.2015, 13:45

Spot of Accident	Near KM-887/21 in Sirathu- Athsarai Section
Zonal Railway	North Central Railway
Division	Allahabad
Name of the Section	Allahabad - Kanpur
Jurisdiction of SSE	SSE/Khaga
Jurisdiction of ADEN	ADEN, Line, Allahabad Division
Loss of life/ railway property	11 coaches derailed, cost of damage Rs.1.64 crore Death of 10 passengers
Cause of accident	Buckling of Track
Report of the Commissioner of Railway Safety (CRS)	Report of CRS finalised on 26.05.2015 and as per enquiry report of CRS derailment of Train caused by buckling of track. Responsibility fixed against three railway staffs.
Audit findings regarding track maintenance activities of the section where an accident of passenger train took place on 25May 2015	
Preparation of Perspective Plan for manual track maintenance by the sectional officials	• Advance perspective maintenance plans for maintenance were not prepared by SSE, Khaga. • Advance planning for realignment of curves, deep screening, casual renewal of points and crossing, welding, de-stressing etc. were not made.
Plan for mechanised maintenance through Track Machines (Zonal Headquarters)	• Annual plan for deployment of various track machines was intimated to Sr. Divisional Engineer (Coordination), Allahabad on 29 April 2016, i.e. after 29 days from the start of the year. • Deployment plan of various track machines was not intimated to concerned ADEN and SSE.
TMS reports of Allahabad Division during 2016-17	• Advance planning for smooth shifting and functioning of machines was not made. • Advance planning for smooth shifting and functioning of machines was not made and 2341 machine daysout of 6878 machine daysi.e. 34 *per cent*were not utilised / wasted over Allahabad Division on account of non-availability of block, depot work, repair, shifting, Staff rest, site not ready, bad weather, non-availability of fuel etc.
Utilisation of track machines in Allahabad Division	• Average shortfall in achievement of target for 17 machines over Allahabad Division of NCR was 57 per cent with minimum value of 23.34 and maximum value of 81.61 percent. • Shortfall in targets of ballast cleaning machine (70.5 *per cent*), ballast regulation machine (68.5 *per cent),* Tamping, lifting, slewing and deep screening of track (39 *per cent),* Tamping, aligning and labelling of track (76.8*per cent*) and Lining, labelling and tamping of track (62.8*per cent*).
Welding of rail joints	• Use of AT welds, due to which tracks are prone to frequent weld failures, still widespread. • In jurisdiction of SSE / Khaga, single shot crucible was not initiated in AT welding after 01 April 2015 due to non-supply of single shot crucible welding portion. In some cases single shot crucible was sued only after January 2017.

<table>
<tr><td>USFD testing</td><td>

USFD was testing of the section was carried out by the Departmental Team and by the contractor M/s Khemchandra.
SSE, Khaga was not trained in USFD testing.
Test check of 5 per cent was not conducted by ADEN in the section where the USFD testing was actually carried out by the Contractor.
Scanned images / peak patterns were not saved by the USFD team. Thus, in successive USFD test scrutiny / analysis by concerned supervisors / officers were not possible.
Due to irregularities in test check new flaw left out by the contractor / USFD team could not be detected.

</td></tr>
<tr><td>Preparation of location wise stock of USFD tested rails</td><td>

Instructions for preparation of location wise stock were issued by NCR. However, location wise stock of USFD tested rails was not made and certification from USFD operator before use in replacement / change of rail work was not ensured. No system existed to ensure that the only USFD tested rails was used for repair and casual renewal work.
Check of rail / weld failure during 2016-17 in the jurisdiction of SSE / Khaga revealed that one number of weld failure took place but, in order to establish whether the fracture was detectable and missed by USFD machine spot of fracture/ was not inspected by ADEN, Line, Allahabad.

</td></tr>
<tr><td>Date of previous TRC Run and TGI</td><td>
Check of register of TRC results of track in the office of SSE, Khaga revealed that:

Allahabad – Kanpur route of Indian Railway comes under ‘A’ routes i.e. monitoring frequency of TRC was once in three months.
During 2016-17Track recording by TRC was conducted on 22.07.2016 and 26.12.2016 i.e. recording of track was not conducted as per prescribed frequency.
Track recording car did not have an uninterrupted run over Allahabad – Kanpursection of NCR and speed of TRC was also not uniform. Thus, comparable results between successive recordings were not produced by TRC unit.

</td></tr>
<tr><td>Inspection</td><td>

GPS based foot plate inspection device was not procured by NCR and inspection of track was carried out traditionally.
Track maintainers were not equipped with communication equipment to report any failure, fracture or damage immediately from the section where short comings / defects in track was observed.

</td></tr>
<tr><td>Deep screening of ballast</td><td>
In the jurisdiction of SSE, Khaga, Deep screening was overdue at 07 locations for length of 25 Kilo meter between twoto five years, as detailed below:
<table>
<tr><th>S.no.</th><th>Section</th><th>Line</th><th>Deep Screening month & year</th><th>Location from km/m to Km/m</th><th>Length</th></tr>
<tr><td>1</td><td>SRO - Yard</td><td>UP</td><td>2003</td><td>881.83 to 882.63</td><td>0.80 TKM</td></tr>
<tr><td>2</td><td>ASCE YARD</td><td>UP</td><td>2002</td><td>888.88 to 889.46</td><td>0.60 TKM</td></tr>
<tr><td>3</td><td>KUW YARD</td><td>UP</td><td>2002</td><td>894.00 to 895.24</td><td>1.24 TKM</td></tr>
<tr><td>4</td><td>KTCE YARD</td><td>UP</td><td>2002</td><td>899.85 to 901.14</td><td>1.29 TKM</td></tr>
<tr><td>5</td><td>SNIE YARD</td><td>UP</td><td>2005</td><td>914.22 to 915.40</td><td>1.18 TKM</td></tr>
<tr><td>6</td><td>SRO YARD</td><td>DN</td><td>2005</td><td>881.82 to 882.84</td><td>1.02 TKM</td></tr>
<tr><td>7</td><td>KUW - SNIE</td><td>DN</td><td>2003</td><td>895.27 to 914.22</td><td>18.95 TKM</td></tr>
<tr><td colspan="5">Total</td><td>25.08 TKM</td></tr>
</table>
</td></tr>
<tr><td>De-stressing of LWR/CWR</td><td>In the sections of SSE, Khaga,during 2016-17, de-stressing is required at 07 locations of main line. Details are as under:</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><th>Location from</th><th>Location To</th><th>Required de-stressing in kilo meter</th></tr>
<tr><td>895.34</td><td>899.85</td><td>4.51</td></tr>
<tr><td>894.33</td><td>895.24</td><td>0.91</td></tr>
<tr><td>900.16</td><td>900.92</td><td>0.76</td></tr>
<tr><td>900.14</td><td>900.92</td><td>0.78</td></tr>
<tr><td>901.13</td><td>906.80</td><td>5.67</td></tr>
<tr><td>914.42</td><td>915.10</td><td>0.68</td></tr>
<tr><td>915.30</td><td>921.0</td><td>5.70</td></tr>
<tr><td></td><td>Total</td><td>19.01</td></tr>
</table>
Records of de-stressing were not maintained and access to TMS reports were not provided to Audit. Thus could not be ascertained that the due de-stressing was carried out.
</td></tr>
<tr><td>Use of Small Track Machines for mechanized track maintenance</td><td>In Allahabad – Kanpur section all maintenance activities are being done through manually as well as through machines. Track maintenance work such as de-stressing, reconditioning, toe load measuring, lifting, trolling and screening of ballast was impacted due to the following constraints:

Number of small track machines was not adequate
Arrangement for transport of these machines was not proper
Spares for small track machines were not available in local market
For emergency repairs of Small track machines imprest was not sanctioned.
Staff deputed on deployment/ operation of small track machines was not trained.

</td></tr>
<tr><td>Manpower for track maintenance</td><td>As on 1 March 2015, the staff position in under the SSE/Khaga was as follows:
<table>
<tr><th>Category</th><th>Sanction</th><th>Actual Men on roll</th><th>Shortage</th></tr>
<tr><td>Blacksmith</td><td>08</td><td>06</td><td>-02</td></tr>
<tr><td>Welder</td><td>05</td><td>02</td><td>-03</td></tr>
<tr><td>Fitter</td><td>02</td><td>02</td><td>00</td></tr>
<tr><td>Car penter</td><td>01</td><td>01</td><td>00</td></tr>
<tr><td>Penter</td><td>01</td><td>01</td><td>00</td></tr>
<tr><td>Mate</td><td>08</td><td>07</td><td>-01</td></tr>
<tr><td>Key Man</td><td>13</td><td>8</td><td>-05</td></tr>
<tr><td>Track Maintainer</td><td>222</td><td>176</td><td>-46</td></tr>
<tr><td>Head Trolly Man</td><td>04</td><td>03</td><td>-01</td></tr>
<tr><td>Trolly Man</td><td>12</td><td>07</td><td>-05</td></tr>
<tr><td>Gate Man</td><td>28</td><td>28</td><td>00</td></tr>
<tr><td>Stock issuer</td><td>01</td><td>01</td><td>00</td></tr>
<tr><td>Total</td><td>305</td><td>242</td><td>-63</td></tr>
</table>
Out of 242 staff on roll, 41 staff were absent from the duty without any intimation to office establishment between 012.05.2014 to 30.05.2015. Though shortages of staff were communicated by SSE in the monthly reports, no action was taken so far for filling of vacancies.
As such, actual man power of SSE’s after rest, leave, sick, absent and training was being used in maintenance activities. Thus, work of regular maintenance in jurisdiction of SSE, Khaga was hampered.
</td></tr>
<tr><td>Training for permanent way staff</td><td>In NCR, Check of competency certificate in selected sections showed that no system existed to ensure that only trained staffs were posted in LWR / CWR section. It was seen that</td></tr>
</table>

	• 30 Track maintainer were posted in the section of SSE / Khaga without imparting initial training of track maintenance. • Records of refresher courses were not maintained and Competency certificate for working on LWR section was also not obtained for Keyman, Gangmate. • TMS report of training of staff was also not updated as a result monitoring of training programme at higher level was not carried out.
5. Accident of Train no. 53342 DN–Muri-Dhanbad Passenger on 22 June 2014	
Train no. and name	Train no. 53342 DN–Muri-Dhanbad Passenger
Date of Accident	22nd June 2014 at about 05.35 hours
Spot of Accident	In Muri – Bokaro Section at Bokaro 'A' cabin Km 402/06.
Zonal Railway	South Eastern Railway
Division	ADRA
Name of the Section	Muri – Bokaro
Jurisdiction of SSE	Sr. Section Engineer (SSE) /Bokaro
Jurisdiction of ADEN	Assistant Divisional Engineer (ADEN), Bokaro, AdraDivision
Loss of life/ railway property	No Casualty
Cause of accident as per supervisors joint note	Rail facture of RHS tongue Rail (5.09 mtrs. From toe)
Report of Chief Safety Officer(SER)	Enquiry Report has been submitted by CTE, CSE, CETE and CSO on 08.07.2014.
Audit findings regarding track maintenance activities of the section where an accident of passenger train took place on 22nd June 2014.	
Preparation of Perspective Plan for manual track maintenance by the sectional officials	• Advance perspective maintenance plans were not prepared. • Advance planning for realignment of curves, deep screening, casual renewal of points and crossing, welding, de-stressing etc. were not planned.
Plan for mechanised maintenance through Track Machines (Zonal Headquarters)	Deployment plan of various track machines was not intimated to concerned SSE of Bokaro.
TMS reports of Adra Division during 2014-15	Not applicable in respect of Tongue Rail
Utilisation of track machines in Adra Division	Not applicable in respect of Tongue Rail
Welding of rail joints	Welding of joints does not arise in Tongue Rail
USFD testing	• USFD of the Section in between Km400/500 Km to 402/500 kmswas done on 24 May 2014 by the PWI/USFD. No deficiencies were reported in USFD testing.

<table>
<tr><td></td><td>

It was revealed during inquiry that testing of this fractured location of Tongue rail is beyond the capacity of normal USFD rail testing process and there is no special technique of testing of Tongue rails as mentioned in USFD Manual 2012.
It was noted that this important aspect has not been taken care of till date as Railways have been spending lot of resources on USFD testing of track to detect flaws in the rails as well as welds.
Therefore, some system should be adopted for USFD checking as well as monitoring of health of Tongue Rail on regular basis.

</td></tr>
<tr><td>Preparation of location wise stock of USFD tested rails</td><td>Not applicable</td></tr>
<tr><td>Track recording</td><td>As per TMS record, TRC run prior to the date of accident in the section was done during July 2011 and thereafter in September 2014.</td></tr>
<tr><td>Inspection</td><td>Scheduled monthly inspections were being done by the Sectional PWI and there was no shortfall.</td></tr>
<tr><td>Deep screening of ballast</td><td>As per TMS record, In the jurisdiction of SSE, Bokaro, Deep screening in the section was last done during the year 2004-05 and then during February 2014. Therefore, Deep Screening was not overdue in the Section.</td></tr>
<tr><td>De-stressing of LWR/CWR</td><td>De-stressing of Tongue Railis not applicable.</td></tr>
<tr><td>Standardisation of Track structure</td><td>Tongue Rail of Bokaro – A Cabin is of 60 Kg rail</td></tr>
<tr><td>Use of Small Track Machines for mechanized track maintenance</td><td>InMuri - Bokaro section all maintenance activities were done manually as well as through machines. Track maintenance work such as de-stressing, reconditioning, toe load measuring, lifting, trolling and screening of ballast was impacted due to the following constraints:

Number of small track machines was not adequate
For emergency repairs of small track machines imprest was not sanctioned.

</td></tr>
<tr><td>Manpower for track maintenance</td><td>As on 1 April 2017, the Sanctioned Strength,actual men-in roll (Track Maintainers) under the SSE/Bokaro is as follows:
<table>
<tr><th>Sanctioned Strength</th><th>Men on Roll</th><th>Vacancy</th><th>Staff working in various Office Establishments</th></tr>
<tr><td>426</td><td>328</td><td>98</td><td>22</td></tr>
</table>
Though shortage of staff was communicated by SSE in the monthly reports, no action was taken so far for filling of vacancies. Further, 22 number of staff were engaged in various office establishments for which work of regular maintenance in jurisdiction of SSE, Bokaro was hampered.</td></tr>
<tr><td>Training for permanent way staff</td><td>Check of competency certificate in selected sections showed that no system existed to ensure that only trained staffs were posted in LWR/ CWR section. However, It was seen that85 Track maintainers were posted in the section of SSE, Bokaro without imparting initial training of track maintenance.</td></tr>
</table>

Annexure 1 (Para 2.2.2.1)

Statement showing sections where deep screening was overdue

ZR	Section	Total length of section in Km	Last Deep Screening	Next Deep Screening due	Location				Length (m)	Dealy in Month	Remarks
					From		To				
1	2	3	4	5	6	7	8	9	10	11	12
NCR	Dadri- Dankaur	17.4	Feb/98	2008	1405.68		1405.82		135	108	
	Dadri- Dankaur		Feb/98	2008	1405.1		1406.45		1350	108	
	Dadri- Dankaur		Feb/98	2008	1411.06		1411.7		645	108	
	Dadri- Dankaur		Jan/00	2010	1411.06		1411.6		545	106	
	Dadri- Dankaur		Feb/98	2008	1414.65		1414.85		200	108	
	Dadri- Dankaur		Mar/98	2008	1415.05		1415.2		150	108	
	Shikohabad-Tundla	183.4	Jan-2004	2014	1213	917	1213	1032	115	36	
	Shikohabad-Tundla		Jun-2005	2015	1213	825	1213	849	24	24	
	Shikohabad-Tundla		Oct-2004	2014	1214	868	1214	873	5	36	
	Shikohabad-Tundla		Oct-2004	2014	1218	115	1218	118	3	36	
	Shikohabad-Tundla		Oct-2004	2014	1221	137	1221	138	1	36	
	Shikohabad-Tundla		Oct-2004	2014	1221	338	1221	340	2	36	
	Shikohabad-Tundla		Jul-2004	2014	1221	349	1221	477	128	36	
	Shikohabad-Tundla		Jul-2004	2014	1221	477	1222	224	749	36	
	Shikohabad-Tundla		Jul-2004	2014	1222	224	1222	634	410	36	
	Shikohabad-Tundla		Dec-2005	2015	1225	245	1225	247	2	24	
	Shikohabad-Tundla		Dec-2005	2015	1226	84	1226	270	186	24	
	Shikohabad-Tundla		Dec-2005	2015	1227	169	1227	170	1	24	
	Shikohabad-Tundla		Dec-2005	2015	1230	905	1230	916	11	24	
	Shikohabad-Tundla		Dec-2005	2015	1230	916	1231	512	600	24	
	Shikohabad-Tundla		Dec-2005	2015	1230	916	1231	512	600	24	
	Shikohabad-Tundla		Dec-2005	2015	1231	512	1231	515	3	24	
	Shikohabad-Tundla		Jan-2006	2016	1231	512	1232	317	818	12	
	Shikohabad-Tundla		Feb-2006	2016	1232	317	1232	715	398	12	
	Shikohabad-Tundla		Sep-2004	2014	1233	162	1233	164	2	36	
	Shikohabad-Tundla		Sep-2004	2014	1234	964	1234	965	1	36	
	Shikohabad-Tundla		Sep-2004	2014	1235	864	1235	877	13	36	
	Shikohabad-Tundla		Sep-2004	2014	1237	648	1237	802	154	36	
	Shikohabad-Tundla		Sep-2004	2014	1239	125	1239	160	35	36	
	Shikohabad-Tundla		May-2005	2015	1239	167	1239	316	149	24	
	Shikohabad-Tundla		May-2005	2015	1239	316	1240	42	726	24	
	Shikohabad-Tundla		May-2005	2015	1240	42	1240	364	322	24	
	Shikohabad-Tundla		Sep-2004	2014	1241	5	1241	85	80	36	
	Shikohabad-Tundla		Sep-2004	2014	1242	140	1242	145	5	36	
	Shikohabad-Tundla		Sep-2004	2014	1242	605	1242	635	30	36	
	Shikohabad-Tundla		Sep-2004	2014	1244	190	1244	195	5	36	
	Shikohabad-Tundla		Dec-2005	2015	1218	22	1218	25	3	24	
	Shikohabad-Tundla		Dec-2005	2015	1218	675	1218	906	231	24	
	Shikohabad-Tundla		Dec-2005	2015	1221	104	1221	105	1	24	
	Shikohabad-Tundla		Nov-2004	2014	1221	302	1221	488	186	36	
	Shikohabad-Tundla		Nov-2004	2014	1221	488	1222	222	736	36	
	Shikohabad-Tundla		Nov-2004	2014	1222	222	1222	571	349	36	
	Shikohabad-Tundla		Jan-2006	2016	1224	950	1225	180	232	12	
	Shikohabad-Tundla		Jan-2006	2016	1226	54	1226	60	6	12	
	Shikohabad-Tundla		Jan-2006	2016	1227	39	1227	40	1	12	
	Shikohabad-Tundla		Jan-2006	2016	1230	823	1230	860	37	12	
	Shikohabad-Tundla		Apr-2001	2011	1230	867	1230	925	58	72	
	Shikohabad-Tundla		Apr-2001	2011	1230	925	1231	241	320	72	
	Shikohabad-Tundla		Jan-2001	2011	1231	241	1231	547	306	72	
	Shikohabad-Tundla		Jul-2001	2011	1231	547	1232	325	791	72	
	Shikohabad-Tundla		Jan-1985	1995	1232	325	1232	711	386	264	
	Shikohabad-Tundla		Feb-2006	2016	1234	906	1234	907	1	12	
	Shikohabad-Tundla		Feb-2006	2016	1235	791	1235	796	5	12	
	Shikohabad-Tundla		Feb-2006	2016	1237	109	1237	111	2	12	
	Shikohabad-Tundla		Feb-2006	2016	1238	881	1238	908	27	12	
	Shikohabad-Tundla		Feb-2005	2015	1239	83	1239	266	183	24	
	Shikohabad-Tundla		Feb-2005	2015	1239	266	1240	5	739	24	
	Shikohabad-Tundla		Feb-2005	2015	1240	5	1240	400	395	24	
	Shikohabad-Tundla		Mar-2006	2016	1242	145	1242	150	5	12	
	Shikohabad-Tundla		Mar-2006	2016	1243	29	1243	30	1	12	
	Shikohabad-Tundla		Mar-2006	2016	1244	175	1244	180	5	12	
	Shikohabad-Tundla		Mar-2006	2016	1246	69	1246	70	1	12	
	Etawah-Shikohabad		Sep-2004	2014	1167	890	1167	892	2	36	
	Etawah-Shikohabad		Sep-2004	2014	1168	890	1168	913	23	36	
	Etawah-Shikohabad		Sep-2004	2014	1169	940	1169	990	50	36	
	Etawah-Shikohabad		Jan-2004	2014	1197	926	1197	930	4	36	
	Etawah-Shikohabad		Jan-2004	2014	1199	716	1199	724	8	36	
	Etawah-Shikohabad		Jan-2004	2014	1204	899	1204	965	66	36	
	Etawah-Shikohabad		Jan-2004	2014	1207	34	1207	99	65	36	
	Etawah-Shikohabad		Jan-2004	2014	1210	140	1210	150	10	36	
	Etawah-Shikohabad		Jan-2005	2015	1197	935	1197	939	4	24	
	Etawah-Shikohabad		Jan-2005	2015	1200	157	1200	165	8	24	
	Etawah-Shikohabad		Jan-2005	2015	1200	705	1200	782	77	24	
	Etawah-Shikohabad		Jan-2005	2015	1200	847	1200	920	73	24	
	Etawah-Shikohabad		Jan-2005	2015	1200	970	1201	11	42	24	
	Etawah-Shikohabad		Jan-2005	2015	1201	99	1201	186	87	24	
	Etawah-Shikohabad		Jan-2005	2015	1204	1040	1205	0	17	24	
	Etawah-Shikohabad		Jan-2005	2015	1206	90	1206	130	40	24	
	Etawah-Shikohabad		Jan-2005	2015	1207	145	1207	200	55	24	
	Etawah-Shikohabad		Jan-2005	2015	1209	40	1209	50	10	24	
	Etawah-Shikohabad		Jan-2005	2015	1210	210	1210	220	10	24	
	Etawah-Shikohabad		Jun-1996	2006	1211	315	1211	365	50	132	
	Etawah-Shikohabad		Jun-1996	2006	1211	365	1211	802	437	132	
	Panki-Etawah		Jan-1987	1997	1028	550	1029	30	471	240	
	Panki-Etawah		Jun-2004	2014	1031	40	1031	230	190	36	
	Panki-Etawah		Jun-2004	2014	1033	1000	1034	0	11	36	

Annexure 1 (Para 2.2.2.1)

Statement showing sections where deep screening was overdue

ZR	Section	Total length of section in Km	Last Deep Screening	Next Deep Screening due	Location				Length (m)	Dealy in Month	Remarks
					From		To				
1	2	3	4	5	6	7	8	9	10	11	12
	Panki-Etawah		Jun-2004	2014	1034	900	1034	904	4	36	
	Panki-Etawah		Jun-2004	2014	1036	99	1036	100	1	36	
	Panki-Etawah		Jun-2004	2014	1037	805	1037	815	10	36	
	Panki-Etawah		Jun-2004	2014	1038	490	1038	520	30	36	
	Panki-Etawah		Jun-2004	2014	1039	158	1039	160	2	36	
	Panki-Etawah		Nov-2003	2013	1045	60	1045	70	10	48	
	Panki-Etawah		Nov-2003	2013	1048	173	1048	195	22	48	
	Panki-Etawah		Apr-2006	2016	1049	570	1049	910	340	12	
	Panki-Etawah		Jan-1997	2007	1049	570	1049	920	350	120	
	Panki-Etawah		Sep-2003	2013	1054	835	1054	864	29	48	
	Panki-Etawah		Sep-2003	2013	1057	275	1057	475	200	48	
	Panki-Etawah		Sep-2003	2013	1058	408	1058	505	97	48	
	Panki-Etawah		Sep-2003	2013	1059	630	1059	853	223	48	
	Panki-Etawah		Sep-2003	2013	1060	710	1060	980	270	48	
	Panki-Etawah		Jul-2003	2013	1064	935	1064	944	9	48	
	Panki-Etawah		Jul-2003	2013	1065	770	1065	785	15	48	
	Panki-Etawah		Jul-2003	2013	1065	920	1065	934	14	48	
	Panki-Etawah		Jan-2004	2014	1030	42	1030	48	6	36	
	Panki-Etawah		Jan-2004	2014	1033	818	1033	829	11	36	
	Panki-Etawah		Jan-2004	2014	1034	538	1034	638	100	36	
	Panki-Etawah		Jan-2004	2014	1034	908	1034	912	4	36	
	Panki-Etawah		Jan-2004	2014	1036	347	1036	348	1	36	
	Panki-Etawah		Jan-2004	2014	1037	733	1037	963	230	36	
	Panki-Etawah		Jan-2004	2014	1038	183	1038	208	25	36	
	Panki-Etawah		Sep-2003	2013	1040	785	1040	796	11	48	
	Panki-Etawah		Sep-2003	2013	1047	875	1047	897	22	48	
	Panki-Etawah		Dec-2002	2012	1127	470	1127	490	20	60	
	Panki-Etawah		Dec-2002	2012	1127	700	1127	770	70	60	
	Panki-Etawah		Dec-2002	2012	1128	440	1128	470	30	60	
	Panki-Etawah		Dec-2002	2012	1130	601	1130	880	279	60	
	Panki-Etawah		Dec-2002	2012	1132	0	1132	192	192	60	
	Panki-Etawah		Dec-2002	2012	1133	130	1133	252	122	60	
	Panki-Etawah		Dec-2002	2012	1133	362	1133	502	140	60	
	Panki-Etawah		Dec-2002	2012	1134	150	1134	250	100	60	
	Panki-Etawah		Dec-2002	2012	1135	67	1135	167	100	60	
	Panki-Etawah		Dec-2002	2012	1135	575	1135	642	67	60	
	Panki-Etawah		Jan-2001	2011	1140	869	1140	876	7	72	
	Panki-Etawah		Jan-2001	2011	1143	366	1143	438	72	72	
	Panki-Etawah		Jan-2001	2011	1144	108	1144	128	20	72	
	Panki-Etawah		Jan-2001	2011	1144	718	1144	818	100	72	
	Panki-Etawah		Jan-2001	2011	1146	38	1146	70	32	72	
	Panki-Etawah		Feb-2002	2012	1149	160	1149	363	203	60	
	Panki-Etawah		Feb-2002	2012	1149	573	1149	593	20	60	
	Panki-Etawah		Mar-2002	2012	1154	660	1154	668	8	60	
	Panki-Etawah		Mar-2002	2012	1155	88	1155	298	210	60	
	Panki-Etawah		Aug-2005	2015	1136	412	1137	520	1103	24	
	Panki-Etawah		Jul-2001	2011	1144	470	1144	534	64	72	
	Panki-Etawah		Jul-2001	2011	1146	70	1146	80	10	72	
	Panki-Etawah		Jun-2004	2014	1146	80	1147	200	1125	36	
	Panki-Etawah		Mar-2002	2012	1087	336	1087	380	44	60	
	Panki-Etawah		Mar-2002	2012	1087	805	1088	25	195	60	
	Panki-Etawah		Mar-2002	2012	1088	865	1088	880	15	60	
	Panki-Etawah		Mar-2002	2012	1089	155	1089	180	25	60	
	Panki-Etawah		Mar-2002	2012	1089	580	1089	590	10	60	
	Panki-Etawah		Mar-2002	2012	1091	305	1092	225	911	60	
	Panki-Etawah		Mar-2002	2012	1093	270	1093	370	100	60	
	Panki-Etawah		Mar-2002	2012	1095	470	1095	548	78	60	
	Panki-Etawah		Mar-2002	2012	1096	685	1096	710	25	60	
	Panki-Etawah		Mar-2002	2012	1097	140	1097	180	40	60	
	Panki-Etawah		Mar-2002	2012	1097	630	1097	670	40	60	
	Panki-Etawah		Nov-2006	2016	1099	950	1100	953	964	12	
	Panki-Etawah		Mar-2002	2012	1102	832	1102	886	54	60	
	Panki-Etawah		Mar-2002	2012	1107	118	1107	122	4	60	
	Panki-Etawah		Mar-2002	2012	1108	174	1108	200	26	60	
	Panki-Etawah		Aug-1998	2008	1109	380	1109	600	220	108	
	Panki-Etawah		Aug-1998	2008	1109	600	1109	690	90	108	
	Panki-Etawah		Aug-1998	2008	1110	81	1110	145	64	108	
	Panki-Etawah		Aug-1998	2008	1110	998	1110	1000	2	108	
	Panki-Etawah		Aug-1998	2008	1111	239	1111	240	1	108	
	Panki-Etawah		Aug-1998	2008	1113	7	1113	40	33	108	
	Panki-Etawah		Aug-1998	2008	1115	107	1115	300	193	108	
	Panki-Etawah		Aug-1998	2008	1116	390	1116	477	87	108	
	Panki-Etawah		Apr-1994	2004	1099	580	1100	910	1291	36	
	Panki-Etawah		Aug-1998	2008	1109	847	1109	911	64	108	
	Panki-Etawah		Aug-1998	2008	1111	31	1111	66	35	108	
	Panki-Etawah		Aug-1998	2008	1111	919	1111	950	31	108	
	Panki-Etawah		Aug-1998	2008	1111	950	1116	800	4789	108	
	Govindpuri-Panki	7.4	Jun-2004	2014	1021	850	1021	855	5	36	
	Govindpuri-Panki		Jun-2004	2014	1022	785	1022	793	8	36	
	Govindpuri-Panki		Jun-2004	2014	1022	785	1023	55	133	36	
	Govindpuri-Panki		Jul-2004	2014	1023	785	1023	811	26	36	
	Govindpuri-Panki		Jan-1996	2006	1027	840	1028	450	612	132	
	Govindpuri-Panki		Jan-1987	1997	1028	450	1028	550	100	240	
	Govindpuri-Panki		Dec-2002	2012	1021	791	1021	836	45	60	
	Govindpuri-Panki		Dec-2002	2012	1022	251	1022	261	10	60	
	Govindpuri-Panki		Dec-2002	2012	1022	901	1023	90	52	60	

Annexure 1 (Para 2.2.2.1)

Statement showing sections where deep screening was overdue

ZR	Section	Total length of section in Km	Last Deep Screening	Next Deep Screening due	Location				Length (m)	Dealy in Month	Remarks
					From		To				
1	2	3	4	5	6	7	8	9	10	11	12
	Govindpuri-Panki		May-2004	2014	1025	650	1025	660	10	36	
	Govindpuri-Panki		May-2004	2014	1026	830	1026	839	9	36	
	Govindpuri-Panki		May-2004	2014	1027	0	1027	100	100	36	
	Kanpur-Govindpuri	1.4	Sep-2006	2016	1021	280	1021	646	366	12	
	Kanpur-Govindpuri		Jan-1987	1997	1021	150	1021	540	390	240	
	Kanpur-Govindpuri		May-2006	2016	0	960	2	0	1111	12	
	Kanpur-Govindpuri		Jan-1998	2008	1019	144	1021	150	3544	108	
	Kanpur-Govindpuri		Jan-1995	2005	1017	969	1018	46	77	144	
	Kanpur-Govindpuri		Jan-1991	2001	1017	969	1018	60	103	192	
	Kanpur Central-Chandari	2	Feb-2006	2016	1019	0	1019	480	480	12	
	Allahabad-Naini	7.48	2005	2015	820		821		1000	24	
	Allahabad-Naini		2005	2015	821		825		4000	24	
	Allahabad-Naini		2005	2015	821		823		2000	24	
	Allahabad-Naini		2005	2015	823		824		1000	24	
	Naini-Cheoki	1.4	2005	2015	824		825		1000	24	
	Naini-Cheoki		1996	2006	815.55		815.984		434	132	
	Naini-Cheoki		1996	2006	816.604		816.672		68	132	
	Naini-Cheoki		1996	2006	816.672		816.72		48	132	
	Naini-Cheoki		1996	2006	816.72		816.806		86	132	
	Naini-Cheoki		1993	2003	816.806		817.484		678	168	
	Naini-Cheoki		1997	2007	817.484		817.86		376	120	
	Naini-Cheoki		2006	2016	817.86		818.243		383	12	
	Naini-Cheoki		1995	2005	818.243		818.5		257	144	
	Naini-Cheoki		1995	2005	819.452		819.51		58	144	
	Naini-Cheoki		2006	2016	809		809.572		572	12	
	Naini-Cheoki		2006	2016	809.572		814.672		5100	12	
	Naini-Cheoki		2006	2016	814.762		816.36		1598	12	
	Naini-Cheoki		2006	2016	815.514		815.88		366	12	
	Naini-Cheoki		2005	2016	815.88		816.358		478	12	
	Naini-Cheoki		2005	2016	816.358		816.51		152	12	
	Naini-Cheoki		2005	2016	816.51		816.756		246	12	
	Naini-Cheoki		2005	2016	818.314		820		1686	12	
	Mughalsarai-Chunar	7.8	Jan/06	2016	677	280	677	429	149	12	
	Mughalsarai-Chunar		Jan/06	2016	677	719	678	0	1	12	
	Mughalsarai-Chunar		Jan/06	2016	678	0	678	208	208	12	
	Mughalsarai-Chunar		Jan/06	2016	678	668	678	735	67	12	
	Mughalsarai-Chunar		Jan/02	2012	679	850	681	0	1227	60	
	Mughalsarai-Chunar		Jan/06	2016	677	280	678	0	440	12	
	Mughalsarai-Chunar		Jan/06	2016	678	0	679	0	927	12	
	Mughalsarai-Chunar		Jan/06	2016	679	0	680	0	1077	12	
	Mughalsarai-Chunar		Jan/06	2016	679	915	680	0	162	12	
	Mughalsarai-Chunar		Jan/02	2012	680	0	681	0	1000	60	
ECR	Mughalsarai-Manpur	210	2001-2002	2011-12	473.00	-	476.62	-	3620	72	
	Mughalsarai-Manpur				476.87	-	477.65	-	780	72	
	Mughalsarai-Manpur				639.78	-	640.65	-	870	72	
	Mughalsarai-Manpur				668.00	-	673.00	-	5000	72	
	Mughalsarai-Manpur				676.00	-	677.24	-	1240	72	
	Mughalsarai-Manpur				632.65	-	634.30	-	1650	72	
	Mughalsarai-Manpur		2002-03	2012-13	463.95	-	465.20	-	1250	60	
	Mughalsarai-Manpur				479.56	-	480.00	-	440	60	
	Mughalsarai-Manpur				628.91	-	634.40	-	5490	60	
	Mughalsarai-Manpur				644.02	-	645.00	-	980	60	
	Mughalsarai-Manpur				479.00	-	480.00	-	1000	60	
	Mughalsarai-Manpur				641.52	-	642.39	-	870	60	
	Mughalsarai-Manpur				642.46	-	643.31	-	850	60	
	Mughalsarai-Manpur				643.66	-	643.75	-	90	60	
	Mughalsarai-Manpur		2003-04	2013-14	599.75	-	601.00	-	1250	48	
	Mughalsarai-Manpur				605.00	-	606.30	-	1300	48	
	Mughalsarai-Manpur				611.50	-	619.00	-	7500	48	
	Mughalsarai-Manpur				635.00	-	638.00	-	3000	48	
	Mughalsarai-Manpur				643.75	-	647.92	-	4170	48	
	Mughalsarai-Manpur				656.00	-	658.00	-	2000	48	
	Mughalsarai-Manpur				480.00	-	484.47	-	4470	48	
	Mughalsarai-Manpur				579.20	-	580.00	-	800	48	
	Mughalsarai-Manpur				608.00	-	614.00	-	6000	48	
	Mughalsarai-Manpur				620.75	-	628.81	-	8060	48	
	Mughalsarai-Manpur		2005-06	2015-16	634.40	-	635.00	-	600	24	
	Mughalsarai-Manpur				748.00	-	753.00	-	5000	24	
	Mughalsarai-Manpur				753.00	-	756.00	-	3000	24	
	Mughalsarai-Manpur				756.00	-	757.60	-	1600	24	
	Mughalsarai-Manpur				548.55	-	549.00	-	450	24	
	Mughalsarai-Manpur				554.00	-	555.00	-	1000	24	
	Mughalsarai-Manpur				556.00	-	564.00	-	8000	24	
	Mughalsarai-Manpur				568.00	-	569.80	-	1800	24	
	Mughalsarai-Manpur				574.00	-	585.00	-	11000	24	
	Mughalsarai-Manpur				585.00	-	587.00	-	2000	24	
	Mughalsarai-Manpur				594.00	-	597.00	-	3000	24	
	Mughalsarai-Manpur				621.00	-	629.00	-	8000	24	
	Mughalsarai-Manpur				748.00	-	750.00	-	2000	24	
	Mughalsarai-Manpur				756.00	-	757.60	-	1600	24	
	Mughalsarai-Manpur		2006-07	2016-17	493.00	-	506.00	-	13000	12	
	Mughalsarai-Manpur				635.00	-	641.00	-	6000	12	

Annexure 1 (Para 2.2.2.1)

Statement showing sections where deep screening was overdue

ZR	Section	Total length of section in Km	Last Deep Screening	Next Deep Screening due	Location				Length (m)	Dealy in Month	Remarks
					From		To				
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
	Mughalsarai-Manpur				649.00	-	654.00	-	5000	12	
	Mughalsarai-Manpur		2004	2014	506	-	516	-	10000.00	36	
	Mughalsarai-Manpur		2004	2014	498	-	516	-	18000	36	
	Mughalsarai-Manpur		1998	2008	517.1	-	517.9	-	800	108	
	Mughalsarai-Manpur		1998	2008	517.2	-	517.8	-	600	108	
	Mughalsarai-Manpur		1998	2008	518	-	518.5	-	500	108	
	Mughalsarai-Manpur		2000	2010	519.1	-	519.9	-	800	84	
	Mughalsarai-Manpur		2000	2010	524	-	525.8	-	1800	84	
	Mughalsarai-Manpur		2000	2010	528	-	529.1	-	1100	84	
	Mughalsarai-Manpur		1999	2009	528.2	-	529.1	-	900	96	
	Mughalsarai-Manpur		2002	2012	537.5	-	538.9	-	1400	60	
	Mughalsarai-Manpur		2000	2010	537.1	-	538.9	-	1800	84	
	Mughalsarai-Manpur		1998	2008	543	-	543.9	-	900	108	
	Mughalsarai-Manpur		2000	2010	543.2	-	543.9	-	700	84	
	Mughalsarai-Manpur		2002	2012	546	-	548.5	-	2500	60	
	Mughalsarai-Manpur		1994	2004	548.5	-	550	-	1500	156	
	Mughalsarai-Manpur		2002	2012	555	-	556	-	1000	60	
	Mughalsarai-Manpur		2002	2012	564	-	566	-	2000	60	
	Mughalsarai-Manpur		2004	2014	564	-	566.9	-	2900	36	
	Mughalsarai-Manpur		2004	2014	570.8	-	572.8	-	2000	36	
	Mughalsarai-Manpur		2004	2014	573.8	-	587	-	13200	36	
	Mughalsarai-Manpur		2001	2011	574	-	579.5	-	5500	72	
	Mughalsarai-Manpur		2002	2012	582	-	585.9	-	3900	60	
	Mughalsarai-Manpur		2002	2012	588	-	594	-	6000	60	
	Mughalsarai-Manpur		2002	2012	597	-	599.75	-	2750	60	
	Mughalsarai-Manpur		2000	2010	597	-	598.5	-	1500	84	
	Mughalsarai-Manpur		2000	2010	606.8	-	607.8	-	1000	84	
	Mughalsarai-Manpur		2003	2013	606.5	-	607.5	-	1000	48	
	Mughalsarai-Manpur		2003	2013	619	-	621	-	2000	48	
	Mughalsarai-Manpur		2002	2012	619	-	628	-	9000	60	
	Mughalsarai-Manpur		2003	2013	645.5	-	648.5	-	3000	48	
	Mughalsarai-Manpur		2004	2014	654	-	656.9	-	2900	36	
	Patna-Mughalsarai	211	1999-2000	2009-10	543.85	-	545	-	1150		
	Patna-Mughalsarai				543.55	-	544.5	-	950		
	Patna-Mughalsarai		2002-03	2012-13	564	-	572	-	8000		
	Patna-Mughalsarai				575	-	576.9	-	1900		
	Patna-Mughalsarai				689.3	-	689.7	-	400		
	Patna-Mughalsarai		2003-04	2013-14	633	-	633.5	-	500		
	Patna-Mughalsarai				677	-	677.3	-	300		
	Patna-Mughalsarai				569.86	-	571	-	1140		
	Patna-Mughalsarai				575.75	-	576.75	-	1000		
	Patna-Mughalsarai				577.75	-	579.1	-	1350		
	Patna-Mughalsarai				660.3	-	662.5	-	2200		
	Patna-Mughalsarai		2005-06	2015-16	591.7	-	593	-	1300		
	Patna-Mughalsarai				576.9	-	582.1	-	5200		
	Patna-Mughalsarai				615.13	-	627	-	11870		
	Patna-Mughalsarai		2006-07	2016-17	583.1	-	591.7	-	8600		
SWR	Hospet-Bellary	0.2	Jul-06	Jul-16	Not readily available		Not readily available		0.200	8	Not Included in Annual Plan
	Hospet-Bellary	0.1	Jul-06	Jul-16					0.100	8	Not Included in Annual Plan
	Hospet-Bellary	0.28	Jul-06	Jul-16					0.280	8	Not Included in Annual Plan
	Hospet-Bellary	14.055	Jul-06	Jul-16					14.055	8	Not Included in Annual Plan
	Hospet-Bellary	0.2	Jul-06	Jul-16					3.500	7	Not Included in Annual Plan
	Hospet-Bellary	0.1	Jul-06	Jul-16					22.000	21	Not Included in Annual Plan
	Hospet-Bellary	0.28	Jul-06	Jul-16					3.000	13	Not Included in Annual Plan
	Hospet-Bellary	14.055	Jul-06	Jul-16					70	14	Deep screening completed with delay
	Hospet-Bellary	3.5	Aug-06	Aug-16	202.5		206		10	14	Deep screening completed with delay
	Hospet-Bellary	22	Jun-05	Jun-15	187		209		10	14	Not Included in Annual Plan
	Hospet-Bellary	3	Feb-06	Feb-16	209		212		30	14	Not Included in Annual Plan
	Hospet-Bellary	0.21	Jan-06	Jan-16	167.79		168		210	14	Not Included in Annual Plan
	Hospet-Bellary	0.01	Jan-06	Jan-16	176.9		176.91		10	14	Not Included in Annual Plan
	Hospet-Bellary	11.58	Dec-06	Dec-16	161.5		173.08		11580	3	Not Included in Annual Plan
	Hospet-Bellary	0.1	Dec-06	Dec-16	173.3		173.4		100	3	Not Included in Annual Plan
	Hospet-Bellary	1.47	Dec-06	Dec-16	173.6		175.07		1470	3	Deep screening completed with delay
	Hospet-Bellary	9.115	Jun-04	Jun-14	177.885		187		9115	31	Not done due to TFR work sanctioned
	Gadag-Hospet	4	Dec-01	Dec-11	79		83		4.000	63	Not Included in Annual Plan
	Gadag-Hospet	2	Nov-01	Nov-11	83		85		2.000	64	Not Included in Annual Plan
	Gadag-Hospet	2	Oct-01	Oct-11	85		87		2.000	65	Not Included in Annual Plan
	Gadag-Hospet	1	Sep-01	Sep-11	87		88		1.000	66	Not Included in Annual Plan
	Gadag-Hospet	2	Nov-03	Nov-13	88		90		2.000	40	Not Included in Annual Plan
	Gadag-Hospet	1	Nov-03	Nov-13	94		95		1.000	40	Not Included in Annual Plan
	Gadag-Hospet	6	Dec-03	Dec-13	95		101		6.000	39	Not Included in Annual Plan
	Gadag-Hospet	1	Jan-04	Jan-14	101		102		1.000	38	Not Included in Annual Plan
	Gadag-Hospet	0.6	Jan-02	Jan-12	102		102.6		0.600	62	Not Included in Annual Plan
	Gadag-Hospet	0.5	Jan-02	Jan-12	102.7		103.2		0.500	62	Not Included in Annual Plan
	Gadag-Hospet	0.1	Jan-02	Jan-12	103.4		103.5		0.100	62	Not Included in Annual Plan
	Gadag-Hospet	0.1	Jan-02	Jan-12	103.6		103.7		0.100	62	Not Included in Annual Plan
	Gadag-Hospet	0.41	Sep-03	Sep-13	63.35		63.76		0.410	42	Not Included in Annual Plan
	Gadag-Hospet	0.22	Sep-03	Sep-13	63.3		65.52		0.220	42	Not Included in Annual Plan
	Gadag-Hospet	0.34	Sep-03	Sep-13	65.82		66.16		0.340	42	Not Included in Annual Plan
	Gadag-Hospet	0.17	Oct-03	Oct-13	66.83		67		0.170	41	Not Included in Annual Plan
	Gadag-Hospet	3	Feb-02	Feb-12	67		70		3.000	61	Not Included in Annual Plan
	Gadag-Hospet	33	Feb-02	Feb-12	70		103		33.000	61	Not done due to TFR work sanctioned
	Gadag-Hospet	0.2	Jan-02	Jan-12	104.53		104.73		0.200	62	Not Included in Annual Plan

Annexure 1 (Para 2.2.2.1)

Statement showing sections where deep screening was overdue

ZR	Section	Total length of section in Km	Last Deep Screening	Next Deep Screening due	Location				Length (m)	Dealy in Month	Remarks
					From		To				
1	2	3	4	5	6	7	8	9	10	11	12
	Gadag-Hospet	0.325	Sep-01	Sep-11	114		114.325		0.325	66	Not Included in Annual Plan
	Gadag-Hospet	0.23	Sep-01	Sep-11	114.84		115.07		0.230	66	Not Included in Annual Plan
	Gadag-Hospet	0.15	Sep-01	Sep-11	115.22		118.37		0.150	66	Not Included in Annual Plan
	Gadag-Hospet	0.41	Sep-01	Sep-11	115.49		115.9		0.410	66	Not Included in Annual Plan
	Gadag-Hospet	0.1	Aug-03	Aug-13	115.9		116		0.100	43	Not Included in Annual Plan
	Gadag-Hospet	0.56	Jul-03	Jul-13	125.765		126.335		0.560	44	Not Included in Annual Plan
	Gadag-Hospet	0.7	Jun-03	Jun-13	130.95		131.65		0.700	45	Not Included in Annual Plan
	Gadag-Hospet	0.1	May-03	May-13	135.07		135.17		0.100	46	Not Included in Annual Plan
	Gadag-Hospet	0	Jun-02	Jun-12	136.53		137.075		0.545	57	Not Included in Annual Plan
	Gadag-Hospet	545	Mar-02	Mar-12	138.505		139.385		0.880	60	Not Included in Annual Plan
	Gadag-Hospet	0.095	Feb-02	Feb-12	141.425		141.52		0.095	61	Not Included in Annual Plan
	Gadag-Hospet	3.513	Mar-02	Mar-12	75.487		79		3.513	60	Not Included in Annual Plan
	Gadag-Hospet	2.085	Nov-03	Nov-13	90		92.085		2.085	40	Not Included in Annual Plan
	Gadag-Hospet	1.5	Nov-03	Nov-13	92.5		94		1.500	40	Not Included in Annual Plan
	Hubballi-Gadag	0.8	Jan-03	Jan-13	2.2		3		800	50	Not Included in Annual Plan
	Hubballi-Gadag	5.92	Aug-02	Aug-12	3.26		9.18		5920	55	Not Due
	Hubballi-Gadag	1.46	May-02	May-12	9.18		10.64		1460	58	Not Due
	Hubballi-Gadag	3.166	May-02	May-12	16.7		19.866		3166	58	Deep screening completed with delay
	Hubballi-Gadag	0.5	Mar-03	Mar-13	20		20.5		500	48	Not Included in Annual Plan
	Hubballi-Gadag	0.5	Feb-03	Feb-13	34		34.5		500	49	Not Due
	Hubballi-Gadag	1.06	Feb-04	Feb-14	35		36.06		1060	37	Not Included in Annual Plan
	Hubballi-Gadag	0.14	Feb-04	Feb-14	40.32		40.46		140	37	Not Included in Annual Plan
	Hubballi-Gadag	0.195	Feb-04	Feb-14	40.815		41.01		195	37	Not Included in Annual Plan
	Hubballi-Gadag	11.99	Mar-04	Mar-14	41.01		53		11990	36	Not Included in Annual Plan
	Hubballi-Gadag	3	Mar-03	Mar-13	53		56		3000	48	Not Included in Annual Plan
	Hubballi-Dharawad	0.28	Jan-01	Jan-11	480.72		481		0.280	74	Not Included in Annual Plan
	Hubballi-Dharawad	3.7	Oct-01	Oct-11	481		484.7		3.700	65	Not Included in Annual Plan
	Dharawad-Alnavar	12.9	Sep-01	Sep-11	488.5		501.4		12.900	66	Not Included in Annual Plan
	Dharawad-Alnavar	1.02	Mar-03	Mar-13	516.19		517.21		1.020	48	Not done due to TFR work sanctioned
	Dharawad-Alnavar	0.84	Jun-00	Jun-10	5243.16		525		0.840	81	Not done due to TFR work sanctioned
	Dharawad-Alnavar	1.6	Jun-01	Jun-11	525		526.6		1.600	69	Not done due to TFR work sanctioned
	Alnavar-Londa	0.35	Sep-94	Sep-04	526.65		527		0.350	150	Obstruction to Bridge No 148
	Alnavar-Londa	3	May-94	May-04	527		530		3.000	154	Not Included in Annual Plan
	Alnavar-Londa	4	Apr-94	Apr-04	531		535		4.000	155	Not Included in Annual Plan
	Alnavar-Londa	1	Sep-94	Sep-04	535		536		1.000	150	Not Included in Annual Plan
	Alnavar-Londa	2	May-94	May-04	536		538		2.000	154	Not Included in Annual Plan
	Alnavar-Londa	3	May-00	May-10	538		541		3.000	82	Not Included in Annual Plan
	Londa-Castle Rock	3.4	Feb-03	Feb-13	12.5		15.9		3.400	47	Not Included in Annual Plan
	Londa-Castle Rock	1.4	Apr-04	Apr-14	20.5		21.9		1.400	35	Not Included in Annual Plan
	Londa-Castle Rock	1.6	Jun-04	Jun-14	21.9		23.5		1.600	33	Not Included in Annual Plan
	Londa-Castle Rock	3.5	May-05	May-15	25.5		29		3.500	22	Not Included in Annual Plan
	Londa-Castle Rock	3	Nov-05	Nov-15	29		32		3.000	16	Not Included in Annual Plan
	Londa-Castle Rock	4	Dec-05	Dec-15	32		36		4.000	15	Not Included in Annual Plan
	Londa-Castle Rock	5	Jan-06	Jan-16	36		41		5.000	14	Not Included in Annual Plan
	Londa-Castle Rock	1	Dec-05	Dec-15	41		42		1.000	15	Not Included in Annual Plan
	Londa-Castle Rock	1	Jan-06	Jan-16	42		43		1.000	14	Not Included in Annual Plan
	Londa-Castle Rock	3	Apr-05	Apr-15	43		46		1.000	23	Not Included in Annual Plan
	Londa-Castle Rock	3	Feb-05	Feb-15	46		49		3.000	25	Not Included in Annual Plan
	Londa-Castle Rock	0.5	Dec-04	Dec-14	49		49.5		0.500	27	Not Included in Annual Plan
	Londa-Castle Rock	0.635	Apr-02	Apr-12	49.5		50.135		0.635	59	Not Included in Annual Plan
SR	Avadi-Villivakkam	53.48	2000-01	2010-11	Not readily available		Not readily available		4100	72	Site condition
	Arakkonam-Tiruvallur	46.947	2001-02	2011-12					1082	60	Site condition
	Vyasarpadi-Villivakkam	24.16	Sep.2010	Sep.2020					0	0	Not due
SER	Tikiapara-Howrah	2	May-06	May-16	Not readily available				750	10	TSR work along with deep screening was sanctioned in 2015-16, the same could not be taken up due to non-availability of sleepers. It is proposed to be taken up in 2017-18
			May-01	May-11					750	70	
			May-02	May-12					450	58	
	Santragachi-Tikiapara	5.6	Jun-06	Jun-16	Not readily available				701	9	
			Apr-01	Apr-11					3660	71	
			Apr-02	Apr-12					520	59	
			Mar-02	Mar-12					452	60	
			Jul-07	Jul-17					11460	0	
	Panskura-Mechada	14	2017	2027	Not readily available				11500	0	Prior to 2017 deep screening was last done in 2005
			2003-04	2013-14					12500	36	As stated by the SSE, the major problem for DSR by BCM was that the cess could not be thrown off as it would block both the Up & Dn line.
			2011	2021					10000	0	
			2001	2011					8000	72	Non availibility of BCM
SER	Kharagpur-TATA	134	2008-09	2018-19	Not readily available				36250	0	
			2011	2021					60750	0	
			2015	2025					192000	0	
	Rourkela-Jharsuguda	101	6.5 Kms in 2015 2.5 Kms in 2004-05	6.5 km in 2025 2.5 km in 2014-15	Not readily available				9000	24	Out of 9 Kms in Up line, 6.5 kms of Deep Screening has been done in the year 2015. Deep Screeing for the remaining 2.5 kms was last done in 2004-05. Delay of 24 months was in respect of 2.5 Km. only.

Annexure 1 (Para 2.2.2.1)

Statement showing sections where deep screening was overdue

ZR	Section	Total length of section in Km	Last Deep Screening	Next Deep Screening due	Location				Length (m)	Dealy in Month	Remarks
					From		To				
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
			May - 16	0.5 Km in 2026, 8.5 Km in 2014-15					9000	24	Out of 9 Kms in Dn line, 0.5 kms of Deep Screening has been done in the year May 2016. Deep Screeing for the remaining 8.5 kms was last done in 2004-05
SER	Burnpur-Asansol	5.6	Nov-2012 & Apr-2016	Nov-2022 & Apr-2026	Not readily available				5600	0	
	Nimpura-Gokulpur	6	2001	2011	Not readily available				2800	72	Work sanctioned in 2013-14 but tender not yet called.
			2006	2016					2240	12	
			2006-07 & 2008-09	2016-17 & 2018-19					17700	0	
			2003	2013					4650	48	Not done before. CTR done in 2000 then also deep screening not done. The section includs yard, loop line and sidings.
	Muri-Barkakhana	58	2012-13 & 2014-15	2022-23 & 2024-25	Not readily available				58000	0	
	Panskura-Haldia	70	Apr-04	Apr-14	Not readily available				15700	46	
			Aug-05	Aug-15					7700	31	
			Mar-12	Mar-22					117000	0	

Annexure 2 (Para 2.2.3.2 (b))

Statement showing implementation of measures for monitoring of CC+8+2 selected sections in five Zonal Railways

Zonal Railway	Name of the selected section	Whether selected section is notified for running of CC+8+2 /CC+6+2 /CC+4+2	Whether WILD installed, if yes, location of WILD	Whether any distressed bridges on the route. If yes, whether rehabilitation done and Bridge load monitoring system installed	Number of major bridges in which damages reported by Sr.DEN. Co. In his monthly report of 'impact of CC+8+2 on bridges' in the month of March 2017	Whether location wise stock of USFD tested rail was made in selected sections	Whether new welds were tested by USFD within 30 days of welding	Whether USFD testing done as per prescribed frequency	Whether scanned images / peak pattern of USFD testing was saved for comparision in successive check.	Number of rail failure / weld failure during 2016-17 within 01 month of USFD testing (Master register of Rail failure / weld failure)	Whether rails were replaced by 90R rail in the whole section	Whether rail replaced prematurely	No of weighbridges and location in the selected section	Whether track recording done as per prescribed frequency by Track recording cars	No of rail fractures 2016-17	Number of weld ailures during 2016-17	Number of rail and Weld failures within month in which USFD test results were good
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
NCR	Dadri - Dankaur	CC+8+2	No	No	Damages reported in 14 Bridges in GZB - MGS Section of Allahabad Division (Allahabad - Mugalsari SectionBridge No. 494, 498, 503, Kanpur Tundla Section - Bridge No. 285, 286, 11, 13, 48, 55 Tundla - Gaziabad section - Bridge No. 123, 126, 127 Allahabad - Kanpur section Bridge No. 205-206).	No	No	No	No	50	No. Because as per Working time table of Allahabad Division reason of Speed restriction at 08 location was existance of 52 Kg rails. Further rail change report of 2016-17 for the selected section shows that 52Kg UTS rails still exist on the track.	Yes	No	No	19	46	21
	Tundla- Shikohabad	CC+8+2	No	No		No	No	No	No			Yes	No	No			
	Shikohabad - Panki	CC+8+2	No	No		No	No	No	No			Yes	No	No			
	Panki - Juhi	CC+8+2	No	No		No	No	No	No			Yes	No	No			
	Juhi - Kanpur	CC+8+2	No	No		No	No	No	No			Yes	Goods marshalling yard (GMC) Kanpur	No			
	Juhi - Chandari	CC+8+2	No	No		No	No	No	No			Yes	No	No			
	Allahabad - Naini	CC+8+2	No	No		No	No	No	No			Yes	No	No			
	Naini - Cheoki	CC+8+2	No	No		No	No	No	No			Yes	No	No			
	Jeonathpur - MGS	CC+8+2	No	No		No	No	No	No			Yes	No	No			
SR	Vyasarpadi - Villivakkam	CC+8+2	No**	No	0	Yes	No *	Yes	Yes	0	No	No	No	No	3	0	0
	Villivakkam- Avadi	CC+8+2	No**	No	0	Yes	No *	Yes	Yes	0	No	No	Ambattur	No	3	0	0
	Tiruvallur - Arakkonam	CC+8+2	No**	No	0	Yes	No *	Yes	Yes	1	No	No	Thiruvalangadu	No	6	5	0
SWR	Bellari - Castlerock	CC+8+2	Yes WILD installed at Hitnal station in August 2010. However, due to doubling work by RVNL which is in progress, WILD was not working since Feb 2017.	No	0	No	Yes#	Yes	Yes##	NIL	Yes	No	Weigh Bridges provided by **SWR:** Bannihatti-01, Daroji-01, Dharwad-01 & Sanvordem-01 Weigh Bridges Provided by **Private Parties**: Jindal Steel Works (South Yard) Siding-02, Jindal Steel Works (North Yard) Siding-04, BMM Ispat Siding-01, Adani Siding-02 & SWPL at MPT Siding-01	No	90	232	10
SER	Tikiapara-Howrah	CC+6+2	No	No	Nil	Yes	No	Yes	Yes	Nil	Nil	No	Nil	No	0	0	Nil
	Santragachi-Tikiapara	CC+6+2	No	No	Nil	Yes	No	Yes	Yes	Nil	Nil	No	Nil	No	0	0	Nil
	Panskura-Mechada	CC+8+2	No	No	Nil	Yes	39 Nos were not tested.	Yes	Yes	Nil	Nil	No	Nil	4 against 12	0	1	Nil

Annexure 2 (Para 2.2.3.2 (b))

Statement showing implementation of measures for monitoring of CC+8+2 selected sections in five Zonal Railways

Zonal Railway	Name of the selected section	Whether selected section is notified for running of CC+8+2 /CC+6+2 /CC+4+2	Whether WILD installed, if yes, location of WILD	Whether any distressed bridges on the route. If yes, whether rehabilitation done and Bridge load monitoring system installed	Number of major bridges in which damages reported by Sr.DEN. Co. In his monthly report of 'impact of CC+8+2 on bridges' in the month of March 2017	Whether location wise stock of USFD tested rail was made in selected sections	Whether new welds were tested by USFD within 30 days of welding	Whether USFD testing done as per prescribed frequency	Whether scanned images / peak pattern of USFD testing was saved for comparision in successive check.	Number of rail failure / weld failure during 2016-17 within 01 month of USFD testing (Master register of Rail failure / weld failure)	Whether rails were replaced by 90R rail in the whole section	Whether rail replaced prematurely	No of weighbridges and location in the selected section	Whether track recording done as per prescribed frequency by Track recording cars	No of rail fractures dures 2016-17	Number of weld ailures during 2016-17	Number of rail and Weld failures within month in which USFD test results were good
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Kharagpur-Tata	CC+8+2	No	No	Nil	Yes	455Nos were not tested.	Yes	Yes	3	Nil	No	1 No at Dhalbhumgarh	1 against 8	3	1	Nil
	Rourkela-Jharsuguda	CC+8+2	No	No	Nil	Yes	Yes	Last testing was done in the month	Yes	Nil	No 90R rails in this section	No	Nil	2 against 8	6	0	Nil
	Barnpur-Asansol	Record under collection												Nil against 1	0	0	
	Nimpura-Gokulpur	CC+6+2	No	No	Nil	Yes	12 Nos were not tested.	Yes	Yes	Nil	Nil	No	Nil	1 against 1	0	1	Nil
	Muri-Barkakhana	Record under collection												Nil against 1	0	0	
	Panskura-Haldia	CC+8+2	No	No	Nil	Yes	20 Nos were not tested.	Yes	Yes	Nil	Nil	No	1 No at Durgachalk	Nil against 4	0	0	Nil

* Due to busy schedule of deployment of USFD over the division, this test is stated to be carried out within 60 days instead of 30 days.

** WILD installed in between Arakkonam and Renigunta section near Tirutani which falls under HDN 7. However, this is not in the selected section.

*** In this regard it is stated that as per RB's directives, 52 Kg or 60 Kg rails are to be laid in CC+8+2 route and not 90R rails. This column requires revision and comments to be modified accordingly.

In some cases new welds were not tested by USFD within 30 days of welding. Delay ranged from 1 month to 6 months.

Scanned images/peak pattern of USFD testing was saved for the test conducted by Agencies. In respect of Departmental USFD team, scaneed images/peak pattern saved only in IMR/Weld & IMR/Rail cases

Annexure 3 (Para 3.3.1)

Statement showing the staff position (Track maintenaners) over selected sections

Zonal Railway	Name of Division	Name of PWI/SSE Office	Track lengh covered by PWI/SSE (in kms)	Sanction strength	Men in position	Vacancy	Sanctioned strengh per kilometer	Men in position per kilometer
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
NCR	Allahabad	Kanpur II	102	397	295	102	3.89	2.89
		Kanpur (West)	80	284	205	79	3.55	2.56
		Kanpur (East)	62	242	242	242	3.90	3.90
		Etawah	103	240	190	50	2.33	1.84
		Phaphund	116	248	177	71	2.14	1.53
		Sikhohabad	102	271	204	67	2.66	2.00
		Dadri	104	232	189	41	2.23	1.82
		Allahabad	55.16	349	321	28	6.33	5.82
NCR	Allahabad	Naini	25	164	151	13	6.56	6.04
		Firozabad	71	212	159	53	2.99	2.24
		Chunar	98	333	253	80	3.40	2.58
			820.16	**2639**	**2133**	**746**	**3.22**	**2.60**
SWR	Hubballi	Bellary	50	277	234	43	5.54	4.68
		Hospet/ML	87.44	331	274	57	3.79	3.13
		Gadag/ML	109.75	196	180	16	1.79	1.64
		Hubballi (East)	66.39	292	269	23	4.40	4.05
		Dharwar	57.56	236	222	14	4.10	3.86
		Londa	28.8	183	190	-7	6.35	6.60
		Castle Rock	49.53	183	184	3	3.69	3.71
			449.47	**1698**	**1553**	**149**	**3.78**	**3.46**
SR	Chennai	Avadi	53.48	230	218	12	4.30	4.08
		Tiruvallur	46.95	228	225	3	4.86	4.79
		Washermanpet	24.16	324	216	108	13.41	8.94
			124.59	**782**	**659**	**123**	**6.28**	**5.29**
SER	Kharagpur	Santraganchi	16.65	281	243	38	16.88	14.59
		Kolaghat	49.5	171	164	7	3.45	3.31
		Panskura	79.5	209	201	8	2.63	2.53
		Jhargarm	80	226	188	38	2.83	2.35
		Gidhni	77.4	183	169	14	2.36	2.18
		Kharida	57	252	227	25	4.42	3.98
		Tamluk	149.4	300	214	86	2.01	1.43
	Chakradharpur	Galudih	54.28	151	131	20	2.78	2.41
		Rourkela	37.04	303	228	75	8.18	6.16
		Rajganpur	110.8	338	261	77	3.05	2.36
		Jharsuguda	88.09	345	279	66	3.92	3.17
	Adra	Damodar Jn.	77	268	266	2	3.48	3.45
	Ranchi	Muri-II	50	363	313	50	7.26	6.26
			926.66	**3390**	**2884**	**506**	**3.66**	**3.11**
ECR	Danapur	Danapur	45	389	319	70	8.64	7.09
		Ara	53	328	269	59	6.19	5.08
		Buxar	52	347	267	80	6.67	5.13
		Dildarnagar	53	381	284	97	7.19	5.36
ECR	Mughalsarai	Chandauli Majhwar	39.9	353	311	42	8.85	7.79
		Bhabua Road	40.1	332	248	84	8.28	6.18
		Dehri-on-sone	38	368	273	95	9.68	7.18
		Aurangabad	34	324	250	74	9.53	7.35
		Rafiganj	36	293	251	42	8.14	6.97
		Gaya	18	334	290	44	18.56	16.11
			409	**3449**	**2762**	**687**	**8.43**	**6.75**

Annexure 4 (Para 3.3.1)

Staff Position

Name of Zonal Railway	Name of Division	Name of PWI Office	Category of staff	Grade Pay (Rs.)	Sanction strength	Men in position	No. of vacancy	Whether action taken to fill up the vacancy (Y/N)	Whether maintenance work was hampered due to shortage of staff (Y/N)	No. of staff deputed in other works viz. other official establishments, Officers residence, offices of different departments etc.	Remarks
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
NCR	Allahabad	Kanpur II	Track Maintainer, Gr.-I	2800	1	1	0	Y	Y	14	
			Track Maintainer, Gr.-II	2400	19	19	0				
			Track Maintainer, Gr.-III	1900	73	71	2				
			Track Maintainer, Gr.-IV	1800	304	204	100				
		Kanpur West	Track Maintainer, Gr.-I	2800	17	1	16	Y	Y	6	
			Track Maintainer, Gr.-II	2400	34	19	15				
			Track Maintainer, Gr.-III	1900	63	42	21				
			Track Maintainer, Gr.-IV	1800	170	143	27				
		Kanpur East	Track Maintainer, Gr.-I	2800	8	5	3	Y	Y	8	
			Track Maintainer, Gr.-II	2400	7	7	0				
			Track Maintainer, Gr.-III	1900	49	47	2				
			Track Maintainer, Gr.-IV	1800	178	122	56				
		Etawa	Track Maintainer, Gr.-I	2800	4	2	2	Y	Y	4	
			Track Maintainer, Gr.-II	2400	9	5	4				
			Track Maintainer, Gr.-III	1900	12	8	4				
			Track Maintainer, Gr.-IV	1800	215	175	40				
		Phaphund	Track Maintainer, Gr.-I	2800	8	2	6	Y	Y	11	
			Track Maintainer, Gr.-II	2400	15	7	8				
			Track Maintainer, Gr.-III	1900	35	12	23				
			Track Maintainer, Gr.-IV	1800	190	156	34				
		Sikhohabad	Track Maintainer, Gr.-I	2800	16	4	12	Y	Y	10	
			Track Maintainer, Gr.-II	2400	32	22	10				
			Track Maintainer, Gr.-III	1900	60	60	NIL				
			Track Maintainer, Gr.-IV	1800	163	118	45				
		Dadri	Track Maintainer, Gr.-I	2800	14	0	14	Y	Y	5	
			Track Maintainer, Gr.-II	2400	28	6	22				
			Track Maintainer, Gr.-III	1900	51	20	31				
			Track Maintainer, Gr.-IV	1800	139	163	-26				
		Allahabad	Track Maintainer, Gr.-I	2800	21	9	12	Y	Y	11	
			Track Maintainer, Gr.-II	2400	42	30	12				
			Track Maintainer, Gr.-III	1900	77	109	-32				
			Track Maintainer, Gr.-IV	1800	209	173	36				
NCR	Allahabad	Naini	Track Maintainer, Gr.-I	2800	0	0	0	Y	Y	10	
			Track Maintainer, Gr.-II	2400	9	9	0				
			Track Maintainer, Gr.-III	1900	57	57	0				
			Track Maintainer, Gr.-IV	1800	98	85	13				
		Firozabad	Track Maintainer, Gr.-I	2800	0	0	0	Y	Y	5	
			Track Maintainer, Gr.-II	2400	2	2	0				
			Track Maintainer, Gr.-III	1900	22	22	0				
			Track Maintainer, Gr.-IV	1800	188	135	53				
		Chunar	Track Maintainer, Gr.-I	2800	4	0	4	Y	Y	6	
			Track Maintainer, Gr.-II	2400	16	8	8				
			Track Maintainer, Gr.-III	1900	38	27	11				
			Track Maintainer, Gr.-IV	1800	275	218	57				
			TOTAL		**2972**	**2325**	**645**			**90**	

Annexure 4 (Para 3.3.1)

Staff Position

Name of Zonal Railway	Name of Division	Name of PWI Office	Category of staff	Grade Pay (Rs.)	Sanction strength	Men in position	No. of vacancy	Whether action taken to fill up the vacancy (Y/N)	Whether maintenance work was hampered due to shortage of staff (Y/N)	No. of staff deputed in other works viz. other official establishments, Officers residence, offices of different departments etc.	Remarks
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
ECR	Danapur	Danapur	Track Maintainer, Gr.-I	2800	23	4	19	Y	Y	0	
			Track Maintainer, Gr.-II	2400	47	45	2			0	
			Track Maintainer, Gr.-III	1900	86	84	2			0	
			Track Maintainer, Gr.-IV	1800	233	186	47			0	
		Ara	Track Maintainer, Gr.-I	2800	20	2	18	Y	Y	0	
			Track Maintainer, Gr.-II	2400	39	33	6			0	
			Track Maintainer, Gr.-III	1900	72	68	4			0	
			Track Maintainer, Gr.-IV	1800	197	166	31			0	
		Buxar	Track Maintainer, Gr.-I	2800	21	3	18	Y	Y	0	
			Track Maintainer, Gr.-II	2400	42	26	16			0	
			Track Maintainer, Gr.-III	1900	76	76	0			0	
			Track Maintainer, Gr.-IV	1800	208	162	46			0	
		Dildarnagar	Track Maintainer, Gr.-I	2800	23	4	19	Y	Y	0	
			Track Maintainer, Gr.-II	2400	46	22	24			0	
			Track Maintainer, Gr.-III	1900	84	92	-8			0	
			Track Maintainer, Gr.-IV	1800	228	166	62			0	
ECR	Mughalsarai	Chandauli Mjhwar	Track Maintainer, Gr.-I	2800	18	5	13	Y	Y	0	
			Track Maintainer, Gr.-II	2400	44	61	-17			0	
			Track Maintainer, Gr.-III	1900	77	65	12			0	
			Track Maintainer, Gr.-IV	1800	214	180	34			0	
		Bhabhua Road	Track Maintainer, Gr.-I	2800	19	6	13	Y	Y	0	
			Track Maintainer, Gr.-II	2400	42	34	8			0	
			Track Maintainer, Gr.-III	1900	72	68	4			0	
			Track Maintainer, Gr.-IV	1800	199	140	59			0	
		Dehri-on-son	Track Maintainer, Gr.-I	2800	21	7	14	Y	Y	0	
			Track Maintainer, Gr.-II	2400	46	51	-5			0	
			Track Maintainer, Gr.-III	1900	80	73	7			0	
			Track Maintainer, Gr.-IV	1800	221	142	79			0	
		Anugrah N Road	Track Maintainer, Gr.-I	2800	19	9	10	Y	Y	0	
			Track Maintainer, Gr.-II	2400	39	32	7			0	
			Track Maintainer, Gr.-III	1900	72	61	11			0	
			Track Maintainer, Gr.-IV	1800	194	148	46			0	
		Rafiganj	Track Maintainer, Gr.-I	2800	18	7	11	Y	Y	0	
			Track Maintainer, Gr.-II	2400	32	73	-41			0	
			Track Maintainer, Gr.-III	1900	66	59	7			0	
			Track Maintainer, Gr.-IV	1800	177	112	65			0	
		Gaya	Track Maintainer, Gr.-I	2800	21	5	16	Y	Y	0	
			Track Maintainer, Gr.-II	2400	34	50	-16			0	
			Track Maintainer, Gr.-III	1900	75	66	9			0	
			Track Maintainer, Gr.-IV	1800	204	169	35			0	
			TOTAL		**3449**	**2762**	**687**			**0**	
		Bellary	Track Maintainer, Gr.-I	2800	17	8	9	Y	Y	0	
			Track Maintainer, Gr.-II	2400	34	40	-6	---	---	0	
			Track Maintainer, Gr.-III	1900	63	59	4	Y	Y	0	
			Track Maintainer, Gr.-IV	1800	163	127	36	Y	Y	0	1 long absent
		Hospet/ML	Track Maintainer, Gr.-I	2800	21	1	20	Y	Y	0	
			Track Maintainer, Gr.-II	2400	41	26	15			0	
			Track Maintainer, Gr.-III	1900	79	73	6			0	
			Track Maintainer, Gr.-IV	1800	190	174	16			1	5 Medical decateorised

Annexure 4 (Para 3.3.1)

Staff Position

Name of Zonal Railway	Name of Division	Name of PWI Office	Category of staff	Grade Pay (Rs.)	Sanction strength	Men in position	No. of vacancy	Whether action taken to fill up the vacancy (Y/N)	Whether maintenance work was hampered due to shortage of staff (Y/N)	No. of staff deputed in other works viz. other official establishments, Officers residence, offices of different departments etc.	Remarks
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
SWR	Hubballi	Gadag/ML	Track Maintainer, Gr.-I	2800	12	1	11	Y	Y	0	
			Track Maintainer, Gr.-II	2400	24	25	-1	---	---	---	
			Track Maintainer, Gr.-III	1900	43	39	4	Y	Y	0	
			Track Maintainer, Gr.-IV	1800	117	115	2	Y	Y	4	4 long sick/absent
		Hubali/ East	Track Maintainer, Gr.-I	2800	17	2	15	Y	Y	0	Sanctioned strength and Actuals of SSE/UBL/East & SSE/UBL/West is combined
			Track Maintainer, Gr.-II	2400	34	26	8	Y	Y	0	
			Track Maintainer, Gr.-III	1900	64	4	60	Y	Y	0	
			Track Maintainer, Gr.-IV	1800	177	237	-60	---	---	42	
		Hubali/West	Track Maintainer, Gr.-I	2800	0	0	0	Y	Y	0	
			Track Maintainer, Gr.-II	2400	0	0	0			0	
			Track Maintainer, Gr.-III	1900	0	0	0			0	
			Track Maintainer, Gr.-IV	1800	0	0	0			0	
		Dharwar	Track Maintainer, Gr.-I	2800	14	4	10	Y	Y	0	
			Track Maintainer, Gr.-II	2400	28	12	16	Y	Y	0	
			Track Maintainer, Gr.-III	1900	52	33	19	Y	Y	0	
			Track Maintainer, Gr.-IV	1800	142	173	-31	---	---	14	7 sick/absent
		Londa	Track Maintainer, Gr.-I	2800	11	0	11	Y	Y	0	
			Track Maintainer, Gr.-II	2400	22	24	-2	---	---	0	
			Track Maintainer, Gr.-III	1900	40	31	9	Y	Y	2	
			Track Maintainer, Gr.-IV	1800	110	135	-25	---	---	9	2 long sick/absent
		Castle Rock	Track Maintainer, Gr.-I	2800	11	5	6	Y	Y	0	
			Track Maintainer, Gr.-II	2400	22	14	8	Y	Y	0	1 long sick
			Track Maintainer, Gr.-III	1900	40	38	2	Y	Y	0	
			Track Maintainer, Gr.-IV	1800	110	127	-13	---	---	0	1 long sick
			TOTAL		**1698**	**1553**	**145**			**72**	
SR	Chennai	Avadi	Track Maintainer, Gr.-I	2800	14	13	1	Y	N	0	Work will be managed with adjacent gangs
			Track Maintainer, Gr.-II	2400	29	28	1			0	
			Track Maintainer, Gr.-III	1900	54	51	3			0	
			Track Maintainer, Gr.-IV	1800	133	126	7			0	
		Tiruvallur	Track Maintainer, Gr.-I	2800	14	1	13	Y	N	0	
			Track Maintainer, Gr.-II	2400	28	24	4		N	0	
			Track Maintainer, Gr.-III	1900	52	45	7		N	0	
			Track Maintainer, Gr.-IV	1800	134	155	-21		-	0	
		Washerman-pet	Track Maintainer, Gr.-I	2800	21	8	13	Y	N	0	
			Track Maintainer, Gr.-II	2400	41	36	5		N	0	
			Track Maintainer, Gr.-III	1900	76	77	-1		-	0	
			Track Maintainer, Gr.-IV	1800	186	95	91		N	0	
			TOTAL		**782**	**659**	**123**			**0**	
	Kharagpur	Santragachi	Track Maintainer, Gr.-I	2800	17	17	0	Y	Y	32	Position of shortage regularly shown in the PCDO
			Track Maintainer, Gr.-II	2400	34	32	2				
			Track Maintainer, Gr.-III	1900	63	56	7				
			Track Maintainer, Gr.-IV	1800	167	138	29				
		Kolaghat	Track Maintainer, Gr.-I	2800	10	11	-1	Y	Y	0	
			Track Maintainer, Gr.-II	2400	20	18	2			1	
			Track Maintainer, Gr.-III	1900	39	34	5			2	
			Track Maintainer, Gr.-IV	1800	102	101	1			14	
		SSE/P.Way/ Panskura	Track Maintainer, Gr.-I	2800	13	9	4	Y	Y	0	
			Track Maintainer, Gr.-II	2400	25	23	2			3	
			Track Maintainer, Gr.-III	1900	47	42	5			9	
			Track Maintainer, Gr.-IV	1800	124	127	-3			18	

Annexure 4 (Para 3.3.1)

Staff Position

Name of Zonal Railway	Name of Division	Name of PWI Office	Category of staff	Grade Pay (Rs.)	Sanction strength	Men in position	No. of vacancy	Whether action taken to fill up the vacancy (Y/N)	Whether maintenance work was hampered due to shortage of staff (Y/N)	No. of staff deputed in other works viz. other official establishments, Officers residence, offices of different departments etc.	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
SER		Jhargarm	Track Maintainer, Gr.-I	2800	12	12	0	Y	Y	0	
			Track Maintainer, Gr.-II	2400	25	14	11			0	
			Track Maintainer, Gr.-III	1900	46	45	1			0	
			Track Maintainer, Gr.-IV	1800	143	117	26			0	
		Gidhni	Track Maintainer, Gr.-I	2800	11	5	6	Y	Y	0	
			Track Maintainer, Gr.-II	2400	22	22	0			2	
			Track Maintainer, Gr.-III	1900	41	36	5			3	
			Track Maintainer, Gr.-IV	1800	109	106	3			5	
		Galudih	Track Maintainer, Gr.-I	2800	11	9	2	Y	Y	0	
			Track Maintainer, Gr.-II	2400	24	20	4			0	
			Track Maintainer, Gr.-III	1900	41	34	7			10	
			Track Maintainer, Gr.-IV	1800	75	68	7			43	
		Kharida	Track Maintainer, Gr.-I	2800	15	10	5	Y	Y	0	
			Track Maintainer, Gr.-II	2400	30	30	0			5	USFD- 2, ADEN - 2, PWI/ KAF - 1
			Track Maintainer, Gr.-III	1900	55	51	4			16	CETC - 1, USFD - 1, DEN - 5, PWI/ KAF - 3, LC gate - 6
			Track Maintainer, Gr.-IV	1800	152	136	16			45	CETC - 2, ADEN - 2, DEN - 3, IOW - 1, PWI/ KAF - 12, LC gate - 25
		Tamluk	Track Maintainer, Gr.-I	2800	17	14	3	Y	Y	0	
			Track Maintainer, Gr.-II	2400	35	24	11			7	
			Track Maintainer, Gr.-III	1900	64	27	37			8	
			Track Maintainer, Gr.-IV	1800	184	149	35			29	
SER	Chakradharpur	Rourkela	Track Maintainer, Gr.-I	2800	18	16	2	Y	Y	0	
			Track Maintainer, Gr.-II	2400	38	37	1			1	
			Track Maintainer, Gr.-III	1900	69	59	10			8	
			Track Maintainer, Gr.-IV	1800	178	116	62			0	
		Rajgangpur	Track Maintainer, Gr.-I	2800	20	7	13	Y	Y	1	
			Track Maintainer, Gr.-II	2400	38	39	-1			2	
			Track Maintainer, Gr.-III	1900	73	71	2			0	
			Track Maintainer, Gr.-IV	1800	207	144	63			2	
		Jharsuguda	Track Maintainer, Gr.-I	2800	10	10	0	Not Applicable	No	0	
			Track Maintainer, Gr.-II	2400	42	53	-11	Under Process		0	
			Track Maintainer, Gr.-III	1900	77	77	0	Not Applicable		0	
			Track Maintainer, Gr.-IV	1800	216	139	77	Under Process		0	
	ADRA	Damodar	Track Maintainer, Gr.-I	2800	16	7	9	Y	Y	8	Total 2 post vacant since 30/06/2016 due to expired of one staff and other normal retirement.
			Track Maintainer, Gr.-II	2400	31	18	13				
			Track Maintainer, Gr.-III	1900	57	70	-13				
			Track Maintainer, Gr.-IV	1800	164	171	-7				
	Ranchi	Muri-II	Track Maintainer, Gr.-I	2800	23	8	15	Y	Y	0	The figures incoporated in Col. 6 & 7 are the total of both the Sections, i.e MURI-BRKA and MURI-KSX Section.
			Track Maintainer, Gr.-II	2400	45	19	26			1	
			Track Maintainer, Gr.-III	1900	84	28	56			17	
			Track Maintainer, Gr.-IV	1800	211	258	-47			16	
			TOTAL		**3390**	**2884**	**506**			**308**	
			GT		**12291**	**10183**	**2106**			**470**	

Annexure 5 (Para 3.3.3)
(PARA-9.2 of Manual of Instruction on Long Welded Rail and Para 1504 of IRPWM Correction slip no. 104).
Deployment of Trained Permanent Way Staff (As on 31.03.2017) in LWR Section

Zonal Railway	Division	ADEN/AEN	SSE/P Ways responsible for laying and maintenance of LWR/CWR	No. of P. Ways Staff working on LWR/ CWR	No. of Staff trained by Holding special/regular courses/or Posses valid Competancy Certificate	No. of Staff working on LWR/CWR without training /Competecy Certificate	No of staff not attended refresher course since last three years	Remarks if any
NCR	Allahabad	Kanpur	Kanpur	256	256	0	0	
			West Kanpur	122	122	0	0	
			East Kanpur	194	197	0	0	
		Etawah	Etawah	209	25	184	5	
			Phaphund	126	0	126	0	
		Firozabad	Shikohabad	86	86	0	0	
			Firozabad	195	163	32	0	
		Allahabad	Allahabad	321	51	270	0	
		Mirzapur	Naini	38	38	0	0	
		Chunar	Chunar	24	24	0	0	
		Aligarh Jn.	Dadri	157	131	26	0	
			TOTAL	**1728**	**1093**	**638**		
ECR	Danapur	Danapur	Danapur	319	319	NIL	NIL	
			Ara	262	262	NIL	NIL	
		Buxar	Buxar	267	267	NIL	NIL	
			Dildarnagar Jn.	284	284	NIL	NIL	
	Mughalsarai	Gaya	Gaya	175	175	NIL	NIL	
			Rafigunj	200	200	NIL	NIL	
			Anugrah Narayan Road	226	226	NIL	NIL	
		Dehri-on-sone	Dehri-on-sone	260	260	NIL	NIL	
			Total	**1993**	**1993**			
SWR	Hubli	Bellary	Bellary	190	190	0	57	
		Bellary	Hospet	217	198	19	25	
		Gadag	Gadag	180	180	0	0	
		Hubli/Central	Hubli/East	269	261	8	48	Sanctioned strength and Actuals of SSE/UBL/East & SSE/UBL/West is combined
			Hubli/West					
			Dharawad	222	215	7	32	
		Belagavi	Londa	190	185	5	3	
		Castle Rock	Castle Rock	184	156	28	39	This section is having only SWR. No LWR exists
			TOTAL	**1452**	**1385**	**67**	**204**	
SR	Chennai Central	Avadi	Avadi	535	535	0	68	
		Tiruvallur	Tiruvallur	197	197	0	57	
		Washermanp	Washermanpet	112	112	0	0	
			TOTAL	**844**	**844**	**0**	**125**	
SER	Kharagpur	Shalimar	Santragachi-Tikiapara and Tikiapara - Howrah	243	241	2	14	2 No TM-IV initial course to be attended on dated 03/07/17 to 31/07/17
		Panskura	Bagnan-Bhogpur	107	106	1	96	96 nos. of staff have attended their refresher course training last during the year 2012.
			Bhogpur-Duan	128	128	0	15	
		Jhargram	Nimpura-TATA					
			Gidhani	130	5	125	126	
			Ghatsila-Rakhamines	78	0	78		Keyman and Gangmate are working on LWR/CWR without competency certificate, however, they have been imparted training such as RC, IC and crash courses
		Kharagpur	Nimpura- Gokulpur and Kharagpur - TATA	136	136	0		Staff are trained in regular courses.
		Tamluk	Tamluk	135	0	135	24	(last done in 2013-14)

Annexure 5 (Para 3.3.3)
(PARA-9.2 of Manual of Instruction on Long Welded Rail and Para 1504 of IRPWM Correction slip no. 104).
Deployment of Trained Permanent Way Staff (As on 31.03.2017) in LWR Section

Zonal Railway	Division	ADEN/AEN	SSE/P Ways responsible for laying and maintenance of LWR/CWR	No. of P. Ways Staff working on LWR/ CWR	No. of Staff trained by Holding special/regular courses/or Posses valid Competancy Certificate	No. of Staff working on LWR/CWR without training /Competecy Certificate	No of staff not attended refresher course since last three years	Remarks if any
	Chakradharpur	Rourkela	A Cabin - Panposh	135	135	0	0	Keyman and Gangmate are working on LWR/CWR without competency certificate, however, they have been imparted training such as RC, IC and crash courses
			Rourkela - Bamra	280	271	9	0	-
		Jharsuguda	Bamra-Jharsuguda	329	314	21	21	Out of 21 staff Long absentee 15
			Panposh-Bamra	296	276	20	36	Out of 36 Long Absentee 20
			Panposh-Jharsuguda	625	590	41	57	
	Adra	Adra/East	Damodar	122	106	16	16	All 106 staff done by regular course training organised by DETC/ADA but no competency certificate issued.
	Ranchi	Muri	Muri-Barakakana	121	119	2	12	Out of 12 staffs who have not attended RC training for the last three years, 2 staffs are long absent.
			TOTAL	**2865**	**2427**	**450**	**417**	

Annexure 6 (Para 3.3.4)

Training of Staff for Operating & Maintenance of Small Track Machine (As on 31.03.2017)

Zonal Railway	Division	AEN/Line(P.WAY)	Location of SSE/P. Ways	No. of Staff in deployed in operation of Small Track Machine	No. of Staff Trained in operation and maintenance of small track machine	No. of Staff deployed in Operation of Small Track Machine without training	Remarks if any
NCR	Allahabad	Kanpur	SSE/II/Kanpur	62	18	44	
			SSE/West/Kanpur	78	40	38	
			SSE/East/Kanpur	51	51	0	
		Etwah	SSE/Etawah	11	5	6	
			SSE/Phaphund	18	0	18	
		Firozabad	SSE/Shikohabad	14	14	0	
			SSE/Firozabad	15	10	5	
		Allahabad	SSE/Allahbad	13	0	13	
		Mirzapur	SSE/Naini	10	0	10	
		Chunar	SSE/Chunar	5	0	5	
		Aligarh	SSE/Dadri	17	1	16	
			Total	**294**	**139**	**155**	
ECR	Danapur	Danapar	Danapar	NAV	NAV	NAV	Trained track maintainers were deployed on small track machines operation. No post of machine operator exists.
			Ara				
		Buxar	Buxar				
			Dildarnagar				
	Mughal Sara	Mughal Sarai	Chandauli Mjhwar				
			Bhabhua Road				
		Dehri on sone	Dehri-on-son				
			Anugrah N Road				
		GAYA	Rafiganj				
			GAYA				
SWR	Hubballi	Bellary	Bellary	50	0	50	
		Bellary	Hospet/ML	60	0	60	
		Gadag	Gadag/ML	10	0	10	
SWR	Hubballi	Hubli/Central	Hubli/East	6	0	6	Sanctioned strength & Actuals of SSE/Hubli/East & SSE/Hubli/West is combined
		Hubli Central	Hubli/West	NAV	NAV	NAV	
		Hubli Central	Dharawad	17	0	17	
		Belgaum	Londa Jn.	15	0	15	
		Castle Rock	Castle Rock	6	0	6	
			Total	**164**	**0**	**164**	
SR	Chennai	NWL	Avadi	12	12	0	
		NWL	Tiruvallur	12	6	6	
		Washermanpet	Washermanpet	4	4	0	
			Total	**28**	**22**	**6**	
SER	Kharagpur	Santragachi	Tikiapara-Howarah & Santragachi-Tikiapara	4	0	4	Staff working on STM based on working experience.
		Kolaghat	Bagnan-Bhogpur	4	2	2	
		Panskura	Panskura	3	3	0	
		Jhargram	Nimpura-Tata	6	6	0	
		Jhargram	Gidhni	4	0	4	
		Jhargram	Galudih	3	1	2	
	Chakradharpur	Rourkela	Rourkela	5	5	0	
		Rajgangpur	Rourkela - Bamra	6	6	0	
		Jharsuguda	Jhasugura	8	8	0	Special traning required from Private workshop
	Adra	Adra	Damodar	8	4	4	
	Kharagpur	Kharida	Nimpura - Gokulpur and Kharagpur - Tata	No separate staff is deployed for operation of Small Track Machine. One EBS (Engineering Blacksmith) does the work in addition to other maintenance staff.	0	All the staff deployed in working of Small Track Machine are working without training in Operating and Maintenance of these machines.	
	Ranchi	Muri-II	Muri-Barkakana	3	3	0	
	Kharagpur	Tamluk	Tamluk	3	0	3	
			Total	**57**	**38**	**19**	
			Grand Total	**543**	**199**	**344**	

Annexure 7 (Para 3.4)

Availability of small track machines

Name of Zonal Railway	Name of Division	Name of SSE / P. Way Office	Type of Machine	Quantity available	No of defective / unservicable machine
1	*2*	*3*	*4*	*5*	*6*
NCR	Allahabad	Chunar, Nainy, Allahabad, Kanpur-II, Kanpur-East, Kanpur-West, Phaphund, Etawa, Shikohabad, Firozabad, Dadri	Concrete Sleeper Drilling Machine	0	0
			Self propelled light weight Trolly	0	0
			Hydraulic Rail joint Straightener	2	0
			Abrasive Rail Cutter	110	62
			Rail Cutting Machine (Saw Type)	19	9
			Rail Drilling Machine	52	18
			Chamfering Kit	46	0
			Hydraulic Rail Tensor (non-infringing type), 70t capacity	16	4
			Hydraulic Rail Bender (Jim Crow), Heavy duty	12	0
			Rail Creep Adjuster	1	0
			Hydraulic Sleeper Spacer	17	3
			Portable DC Welding Generator	22	7
			Heavy Duty Hydraulic Extractor for Jammed ERCs	7	1
			Toe Load Measuring Device (Mechanical)	8	7
			Electronic Toe Load Measuring Device	9	8
			Mechanical Track Jack	21	20
			Hydraulic Track Jack	136	58
			Portable track lifting & slewing device (TRALIS)	16	2
			Powered Material Trolley	0	0
			Attachment for Rail Dolly for PRC sleeper	10	0
			Hand Held Off Track Tamper	4	0
			Portable Shoulder Ballast Compactor	0	0
			Light Weight Rail (Mono) cum Road Trolley	0	0
			Portable Ballast Cleaner (Semi-Mechanised)	2	0
			Total	**510**	**199**
ECR	Danapur, Mughalsarai	Danapur, Buxar, Arah, Dildarnagar, Gaya, Mughalsarai	Concrete Sleeper Drilling Machine	0	0
			Self propelled light weight Trolly	2	1
			Hydraulic Rail joint Straightener	0	0
			Abrasive Rail Cutter	7	3
			Rail Cutting Machine (Saw Type)	14	0
			Rail Drilling Machine	17	5
			Chamfering Kit	7	0
			Hydraulic Rail Tensor (non-infringing type), 70t capacity	3	2
			Hydraulic Rail Bender (Jim Crow), Heavy duty	9	4
			Rail Creep Adjuster	0	0
			Hydraulic Sleeper Spacer	3	3
			Portable DC Welding Generator	9	4
			Heavy Duty Hydraulic Extractor for Jammed ERCs	8	2
			Toe Load Measuring Device (Mechanical)	9	7
			Electronic Toe Load Measuring Device	6	5
			Mechanical Track Jack	26	8
			Hydraulic Track Jack	143	23
			Portable track lifting & slewing device (TRALIS)	0	0
			Powered Material Trolley	5	0
			Attachment for Rail Dolly for PRC sleeper	13	0
			Hand Held Off Track Tamper	6	2
			Portable Shoulder Ballast Compactor	0	0
			Light Weight Rail (Mono) cum Road Trolley	51	6
			Portable Ballast Cleaner (Semi-Mechanised)	2	0
			Total	**340**	**75**
SER	Kharagpur, Chakradharpur, Adra, Ranchi	Santragachi, Kolaghat, Panskura, Jhargram, Gidhni, Galudih, Rourkela, Rajganpur, Jharsugada, Damodar Jn., Kharida, MURI-II,	Concrete Sleeper Drilling Machine	1	0
			Self propelled light weight Trolly	5	0
			Hydraulic Rail joint Straightener	0	1
			Abrasive Rail Cutter	20	7
			Rail Cutting Machine (Saw Type)	16	6
			Rail Drilling Machine	31	9
			Chamfering Kit	31	7
			Hydraulic Rail Tensor (non-infringing type), 70t capacity	7	3
			Hydraulic Rail Bender (Jim Crow), Heavy duty	13	1
			Rail Creep Adjuster	3	1
			Hydraulic Sleeper Spacer	22	1
			Portable DC Welding Generator	9	5
			Heavy Duty Hydraulic Extractor for Jammed ERCs	19	8
			Toe Load Measuring Device (Mechanical)	19	3
			Electronic Toe Load Measuring Device	10	3
			Mechanical Track Jack	179	52

Annexure 7 (Para 3.4)

Availability of small track machines

Name of Zonal Railway	Name of Division	Name of SSE / P. Way Office	Type of Machine	Quantity available	No of defective / unservicable machine
1	*2*	*3*	*4*	*5*	*6*
			Hydraulic Track Jack	272	125
			Portable track lifting & slewing device (TRALIS)	9	3
			Powered Material Trolley	7	0
			Attachment for Rail Dolly for PRC sleeper	47	0
			Hand Held Off Track Tamper	0	0
			Portable Shoulder Ballast Compactor	0	0
			Light Weight Rail (Mono) cum Road Trolley	59	0
			Portable Ballast Cleaner (Semi-Mechanised)	0	0
			Total	**777**	**291**
SR	Chennai	Avadi, Tiruvallur, Washermanpet	Concrete Sleeper Drilling Machine	0	0
			Self propelled light weight Trolly	0	0
			Hydraulic Rail joint Straightener	0	0
			Abrasive Rail Cutter	14	0
			Rail Cutting Machine (Saw Type)	2	2
			Rail Drilling Machine	5	0
			Chamfering Kit	1	1
			Hydraulic Rail Tensor (non-infringing type), 70t capacity	4	1
			Hydraulic Rail Bender (Jim Crow), Heavy duty	1	0
			Rail Creep Adjuster	0	0
			Hydraulic Sleeper Spacer	2	0
			Portable DC Welding Generator	3	0
			Heavy Duty Hydraulic Extractor for Jammed ERCs	0	0
			Toe Load Measuring Device (Mechanical)	1	1
			Electronic Toe Load Measuring Device	3	1
			Mechanical Track Jack	17	0
			Hydraulic Track Jack	18	0
			Portable track lifting & slewing device (TRALIS)	0	0
			Powered Material Trolley	0	0
			Attachment for Rail Dolly for PRC sleeper	9	0
			Hand Held Off Track Tamper	0	0
			Portable Shoulder Ballast Compactor	0	0
			Light Weight Rail (Mono) cum Road Trolley	22	0
			Portable Ballast Cleaner (Semi-Mechanised)	0	0
			Total	**102**	**6**
SWR	Hubli	Bellary, Hospet, Gadag, Hubli-East, Hubli-West, Dharawad, Londa, Castle Rock	Concrete Sleeper Drilling Machine	2	1
			Self propelled light weight Trolly	4	0
			Hydraulic Rail joint Straightener	0	0
			Abrasive Rail Cutter	16	5
			Rail Cutting Machine (Saw Type)	54	28
			Rail Drilling Machine	43	23
			Chamfering Kit	8	2
			Hydraulic Rail Tensor (non-infringing type), 70t capacity	5	0
			Hydraulic Rail Bender (Jim Crow), Heavy duty	2	0
			Rail Creep Adjuster	0	0
			Hydraulic Sleeper Spacer	6	3
			Portable DC Welding Generator	11	5
			Heavy Duty Hydraulic Extractor for Jammed ERCs	5	3
			Toe Load Measuring Device (Mechanical)	21	9
			Electronic Toe Load Measuring Device	3	1
			Mechanical Track Jack	85	20
			Hydraulic Track Jack	10	0
			Portable track lifting & slewing device (TRALIS)	7	3
			Powered Material Trolley	1	0
			Attachment for Rail Dolly for PRC sleeper	9	3
			Hand Held Off Track Tamper	8	2
			Portable Shoulder Ballast Compactor	0	0
			Light Weight Rail (Mono) cum Road Trolley	0	0
			Portable Ballast Cleaner (Semi-Mechanised)	0	0
			Total	**300**	**108**
			Grand Total	**2029**	**679**