DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LIMITED

RAILROAD MANUAL

July 2024

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FOREWORD TO DFC RAILROAD MANUAL (2024)

The Dedicated Freight Corridor Corporation of India Limited (DFCCIL) is committed to revolutionise the freight transportation landscape in India. DFC is following a modern Inspection, Monitoring and Maintenance systems best suited for the maintenance of its assets and to deliver a safe and reliable railway.

DFCCIL is in the process of fully adopting the modern automated Inspections machines for track, curves and turnouts. This manual covers monitoring the health of various assets through IT based condition monitoring tools on real time basis with least human interference. The quality of inspections is key for predicting and planning of maintenance.

Track Maintenance is focused on Mechanized Maintenance. The 2-tier system of track maintenance has been adopted on DFCCIL sections i.e. On-track Mechanized Maintenance Unit (OMU) covering track machines and Mobile Maintenance Unit (MMU) covering small track machines. All scheduled Track maintenance works are mandated to be done in pre-decided fixed corridor blocks which in turn is part of integrated Rolling Blocks for longer periods.

In due course of time the outsourced works shall be monitored by monitoring KPIs like TQIs, Emergency response time, Track availability. In such contracts agencies will plan and sequence and activities of the maintenance. I hope that in due course of time DFC will create the capability to deal with such contracts, ensuring safety as well as quality of the works.

This manual will serve comprehensive guide to the monitoring and maintenance of tracks of the Dedicated Freight Corridors (DFCs) as per the vision of maintenance.

I extend my gratitude to the Ministry of Railways, Government of India, for their unwavering support and invaluable inputs in the preparation of this manual. We are confident that this manual will significantly contribute to the successful operation and maintenance of the Dedicated Freight Corridors.

With best wishes,

New Delhi
July, 2024

MANAGING DIRECTOR
DFCCIL

PREFACE

This manual is the first edition of a comprehensive provisions dedicated to the maintenance of railway tracks. It is a meticulous compilation of the essential knowledge, best practices, and detailed procedures required for effective track maintenance.

The primary objective of this manual is to standardize and enhance the maintenance practices across all the CGM units so that safety along with reliable track availability with the designed speed is ensured uniformly. In addition, the maintenance shall be economical and efficient to prolong the life span of track components by optimising the maintenance activities.

This manual is structured to cover all aspects of railway track maintenance comprehensively. It includes all components of tracks, their inspections methodology and maintenance practices. The maintenance has been divided in two broad categories i.e. Geometrical maintenance, that covers maintenance up to rail seats including track fittings and Rail management, which is most critical part having direct interaction with wheels.

Higher stress has been given on safety part. The manual has given clear mandate to provide safety and protection of track from starting to closure of works. Upgrading knowledge of track maintenance officials through training is crucial for ensuring safety, efficiency, and effectiveness in track maintenance. This manual will facilitate timely training and development in maintenance setup.

I am confident that this DFC Railroad Manual will serve as an invaluable compilation for ensuring the safety, reliability, and efficiency of railway tracks maintenance. I advise all track officials to adhere to the guidelines and best practices outlined in this manual.

Together, let us strive for excellence in maintaining our railway infrastructure and contributing to the continued success of the vision of DFCCIL.

New Delhi
July, 2024

Director PP & Infra
DFCCIL

Acknowledgement

The Railroad manual has been meticulously prepared by experts who have experience of 30-40 years in track maintenance and have worked from field level up to highest level of ladder as GM, CRS & PCEs. These experts have deep technical insight on all aspects of track maintenance. The IRPWM 2020 with correction slips was base document and these experts reviewed and modified various paras as per the need of DFCCIL. The chapter wise editing and review of editing was done by following railway experts:

Name	Designation	Subjects
Shri Arvind Kumar Jain	Rtd. CRS/CR	Maintenance of CWR
Shri Rajeev Chaudhari	Rtd. GM/NCR	Permanent Way Renewals
Shri Vijay Sharma	Rtd. GM/NWR	Curves and Turnouts
Shri V.K. Govil	Rtd. CAO/NCR	Track Structure and Components
Shri Mahesh Gupta	Rtd. CAO/NWR	Maintenance of Permanent Way
Shri Amit Goyal	Rtd. PCE/SCR	Track Monitoring and tolerances
Shri A.K. Pandey	Rtd. PCE/WCR	Training & Competency
Shri S K Negi	Rtd. ED/DFCCIL	Duties of Permanent way officials

We would like to acknowledge the dedication of Track experts for putting together this manual. Their expertise and commitment to excellence are evident on every page, and their efforts will undoubtedly benefit track officials.

We would also like to acknowledge the IRICEN committee consisting of Shri Anil Kalra, Shri Anil Khare, Shri Anurag Rastogi, Shri SK Agrawal, Shri Shiva Kumar and Shri N.K. Mishra for scrutiny of Railroad Manual. Special thanks to DG/IRICEN Shri S.K. Jha and ADG/IRICEN Shri Satya Prakash for their support for technical inputs and permitting meetings in IRICEN for discussions and refinements of Railroad Manual.

GD Bhagwani
Executive Director
DFCCIL

Praveen Kumar
Executive Director
DFCCIL

Making of DFC Railroad Manual

With visionary approach of MD/DFCCIL, a committee was constituted on 18.03.2024 for making a customized dedicated Railroad manual suitable for the modern track structure of DFCCIL. The aim was to make a comprehensive guide designed to streamline maintenance processes and elevate technical capabilities of DFCCIL with inclusion of modern technologies.

To encapsulate the collective knowledge, experienced officers of Indian railways were enrolled in committee. Under the leadership of Sh. G.D. Bhagwani, ED/AM/EDFC, each member of the committee was assigned one chapter of IRPWM. Shri Anurag Yadav, GM/Track (Chief Track Engineer) was assigned the duty of coordinator and compiler of this manual.

The DFCCIL track is parallel to IR tracks at many places for significant lengths. Moreover, Indian railway rolling stocks are plying on DFCC track. Therefore, the safety standards have been kept as per Indian railways track.

During compilation, efforts were made to constrict as well as to extenuate the interlinking of various paras to make it more admissible. For this reason, a separate sequencing was conceptualized to make reading in a natural flow. DFCCIL track is LWR/CWR track therefore all the precautions related to LWR have been merged with relevant provisions of maintenance. Rail maintenance of CWR tracks has been made a separate chapter containing all prerequisites of enhancing the life of rails and with extra layers of safety.

Developmental editing of the manual was done by track cell team, especially Sh. Sumit Kumar, Manager/Track Maintenance and Sh. Nitin Malhotra, Manager/Track Planning. After compilation, the proof reading was done by members of the committee and suggestions were incorporated to the manual. Final proof reading with corrections was done by Sh. Arun Kumar Tiwari, GM/Technical.

Further, the draft was entrusted to IRICEN for technical scrutiny, where a committee was nominated to enrich the manual with their technical expertise. The observations of IRICEN have been compiled and approval of competent authority of DFCCIL was taken before publication of DFC RRM.

Anurag Yadav
Coordinator & Compiler
DFC Railroad Manual

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ABBREVIATIONS

ACD	–	Anti Creep Device
APM	–	Assistant Project Manager
ART	–	Accident Relief Train
AT	–	Alumino Thermit
ATS	–	Actual Toe of Switch
BCM	–	Ballast Cleaning Machine
BFR	–	Bogie Flat for Rail
CGM	–	Chief General Manager
CMS	–	Cast Manganese Steel
CMT	–	Chemical & Metallurgical Testing
CTE	–	Chief Track Engineer
CWR	–	Continuous Welded Rail
DFCRRM	–	Dedicated Freight Corridor Rail Road Manual
DTS	–	Dynamic Track Stabilizer
EDFC	–	Eastern Dedicated Freight Corridor
ERC	–	Elastic Rail Clip
ETKM	–	Equated Track Kilometre
FBW	–	Flash Butt Weld / Flash Butt Welding
G&SR	–	General and Subsidiary Rules.
GFN	–	Glass Filled Nylon
GMT	–	Gross Million Tonne
GRSP	–	Grooved Rubber Sole Plate.
HAZ	–	Heat Affected Zone
HH	–	Head Hardened.
IMD	–	Integrated Maintenance Depot
IMR	–	Immediate Removal.
IMSD	–	Integrated Maintenance Sub Depot
IRBM	–	Indian Railways Bridge Manual.
IRPWM	–	Indian Railways Permanent Way Manual.
IRSEM	–	Indian railways Signal Engineering Manual.
IRTMM	–	Indian Railway Track Machine Manual.
JOH	–	Junction of Heads
JPM	–	Junior Project Manager
KPI	–	Key Performance Index
LWR	–	Long Welded Rail
M&C	–	Metallurgical and Chemical (Directorate of RDSO)
MCI	–	Malleable Cast Iron
MM	–	Medium Manganese
MTS	–	Multi tasking Staff
NBML	–	Need Based Maintenance Limit
OHE	–	Over Head Equipment
OMS	–	Oscillations Monitoring System
OTT	–	Off Track Tamper
P&C	–	Points & Crossings
PL	–	Plastic Limit
PM	–	Project Manager

PRC	–	Pre-stressed Reinforced Concrete
PSC	–	Pre-stressed Concrete Sleeper
QAP	–	Quality Assurance Plan
RAW	–	Railway Affecting Works
RAT	–	Railway Affecting Tanks
RBMV	–	Rail Borne Maintenance Vehicle
RDSO	–	Research Design & Standards Organization
RIV	–	Rail Inspection Vehicle
RMU	–	Regional Maintenance Unit
ROB	–	Road Over Bridge
RUB	–	Road Under Bridge
S&T	–	Signal & Telecommunication
SD	–	Standard Deviation (Statistics)
SFT	–	Stress Free Temperature
SKV	–	Short Preheat Welding
SL	–	Shrinkage Limit
SM	–	Station Master
SOD	–	Schedule of Dimension
SWR/SWP	–	Short Welded Rail/ Short Welded Panel
TMS	–	Track Management System.
TQI	–	Track Quality Index
TRC	–	Track Recording Car
TRD	–	Traction Distribution Department
TRT	–	Track Relaying Train
TTM	–	Tie Tamping Machine
TVU	–	Train Vehicle Unit
TWS	–	Thick Web Switch
UIC	–	International Union of Railways
UML	–	Urgent Maintenance Limit
USFD	–	Ultrasonic Flaw Detection
UTS	–	Ultimate Tensile Strength
WCMS	–	Weldable Cast Manganese Steel
WDFC	–	Western Dedicated Freight Corridor
WILD	–	Wheel Impact Load Detector

CONTENTS

CHAPTER- 6
MECHANIZED INSPECTION OF TRACK GEOMETRY & PATROLLING

Hot and Cold Weather Patrolling

CHAPTER 7
TRACK MAINTENANCE (Excluding rails) & EMERGENCY RESPONSE

SLEEPERS AND FASTENING RENEWALS

MAINTENANCE OF TRACK ON BRIDGES AND BRIDGE APPROCHES

BALLAST RESILIENCE, CLEANING, RENEWALS AND DRAINAGE

CHAPTER – 1

TRACK STRUCTURE AND COMPONENTS

101. Classification of Dedicated Freight Corridors: – Dedicated Freight corridors are classified as under: –
   a) Eastern Dedicated Freight Corridor (EDFC) - Sanehwal to Sonnagar (1337 km)
   b) Western Dedicated Freight Corridor (WDFC)-New Dadri - JNPT – (1506 km)

102. The features of track structure of main lines and connecting lines for DFCCIL is given as under:
   a) Common features for EDFC and WDFC: -

Item	Description
Speed	Up to 100 Kmph
Desirable Ruling Gradient (For yards refer DFC SOD)	1 in 200
Sleeper/Sleeper Density (nos.)	PSC at 1660 Per KM
Ballast Cushion (in mm)	350
Crossing	Weldable CMS
Bridge Sleepers	Steel Channel Sleepers (Preferably H-Beam Sleepers)/PSC sleepers
Curves	Recommended degree of curve- 2.5 Maximum allowable degree of curve - 6 Maximum Cant deficiency -75 mm. Maximum Super elevation -165 mm. Maximum cant excess- 75 mm

   b) Particular features of EDFC and WDFC

Item	EDFC	WDFC
Rails	60 kg UIC grade 880 HH Rails in T/Os	Main lines- 60 kg E1- 1080 HH Connecting lines - 60 kg UIC grade 880
Turnout	Thick Web Switches on all Canted turnouts R-555, R-460, R-441, R-218	
SEJ	Improved SEJ/ Switch Type	

   c) Type of fittings:
      i. ERC-Mark V as per drawing no. RDSO/ T-5919.
      ii. Metal Liners as per drawing no. RDSO/T-8254 & T-8255.
      iii. GFN Liners as per drawing no. RDSO/T-8222 & T-8223.
      iv. CGRSP as per drawing no. RDSO/T-7010.

TRACK STRUCTURE

103. Cross Section of Track:

a) Single Line

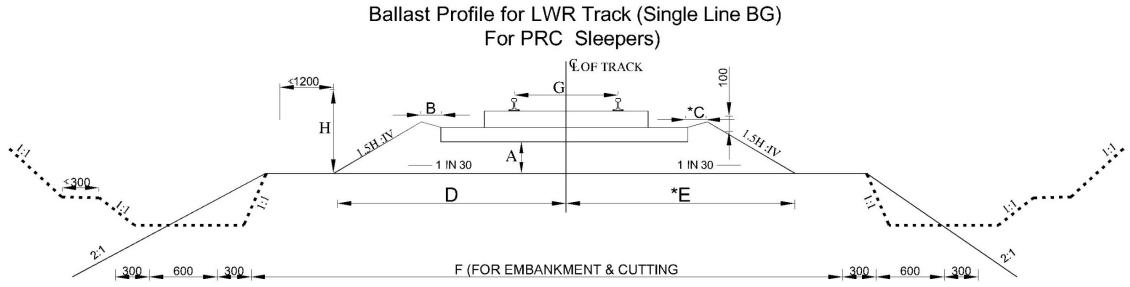


Fig.1.1

A	B	C*	D	E*	F	H	Quantity of Ballast per meter in M^3	
							Straight Track	Curved Track
250	350	500	2693	2851	8100#	646	2.030	2.120
350	350	500	2850	3009	8100#	751	2.585	2.690

Note: -

1. **On outer side of curves only.*
2. *Super elevation has not been considered in calculation of ballast quantity for curved track.*
3. *The Minimum cess width shall be 1200 mm.*
4. # *The shown formation width is for filling and for cutting minimum formation width will be 7500 mm excluding side drains.*
5. *All dimensions are in mm.*

b) Double Line:-

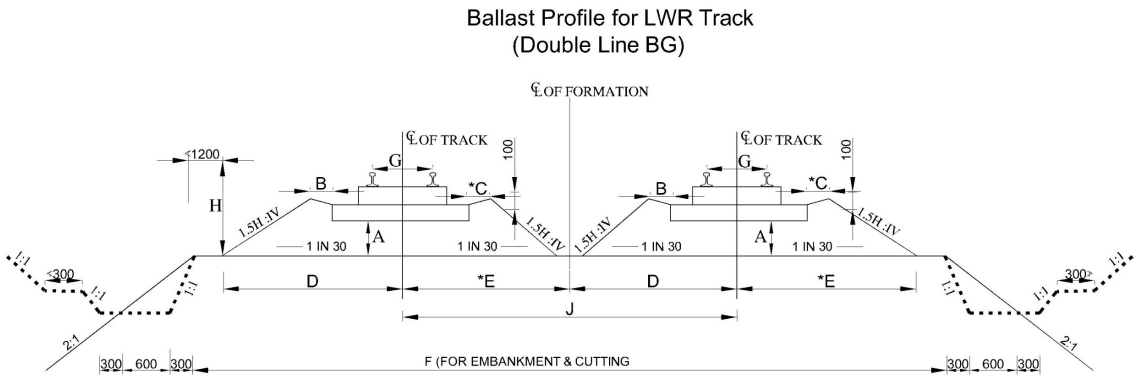


Fig.1.2

G Gauge	Type of Sleeper	A	B	C*	D	E*	F	H	J
1676 mm	PSC	250	350	500	2785	2943	14100#	707	6250
		350	350	500	2943	3101	14286#	812	6000

Note:

1. **On outer side of curves only.*
2. *Super elevation has not been considered in calculating various dimensions.*
3. *The cess width on the existing track is to be increased on a programmed basis wherever required so that minimum cess width as per side slope given above is ensured.*
4. *The Minimum cess width shall be 1200 mm.*
5. # *The shown formation width is for filling and in case of cutting, minimum width shall be 13500 mm excluding side drains.*
6. *All dimensions are in mm.*

104. FORMATION OF DFCCIL: The DFC has been constructed as per GE-14 rules of RDSO.

BALLAST

105. Ballast Specifications: Crushed Stone ballast to be used on all lines including points and crossings. Ballast shall be conforming to RDSO specifications for Track Ballast as per IS/RDSO-GE/0001, Feb 2023 with latest amendments.

106. Ballast Profile/Section/Depth of Cushion:-

1) Ballast profile: - The ballast profiles shall be provided for the various groups of track for LWR/CWR as given in Para 103. The approximate quantity of ballast required per metre run of track for standard ballast sections has also been indicated in the sketch of para 103.

Note:

i. Minimum Formation width to be ensured for new works/alteration to existing works in embankment and in cutting (excluding side drains), also indicated in the Para 103.

- For single line straight track –
  a. Minimum width of Embankment-8100 mm*
  b. Minimum width in Cutting (Excluding side drains)- 7500 mm.
- For double line straight track –
  a. Minimum width of Embankment-14286 mm**
  b. Minimum width in Cutting (Excluding side drains)- 13500 mm.
  * It can be reduced to 7600 mm on a case-to-case basis with the approval of the Railway Board.
  ** It can be reduced to 13500 mm on a case-to-case basis with the approval of the Railway Board.

ii. On curves, additional formation width over (i) above, shall have to be ensured as given below:
  a) Increase due to extra widening of ballast shoulder on outer side of curves in both single/double line, as indicated in Para 103.
  b) Increase due to requirement of extra clearances on curves as stipulated in the **EDFC SOD Para 1.11.3 (ii) and WDFC SOD Para 8.11.3 (ii).**

iii. Increase in formation width on curves shall be decided after considering the increase mentioned in (a) & (b) above.

iv. Minimum Cess width of 1200 mm shall have to be ensured for both straight track & on curve track, along with ensuring minimum Formation width as specified for Single/Double line including additional formation width on curves as described above.

v. If even after provision of additional formation width, cess width on the outer side of curves reduces below 1200 mm on account of increased ballast width due to superelevation, formation width shall be increased further, over and above additional width as stipulated in Note (ii) above, to meet the requirement of minimum cess width of 1200 mm.

2) Depths of Ballast Cushion –

a) The minimum depth of the ballast cushion below the bottom of the sleepers at the rail seat for BG should be as under –

In case of	Minimum depth of the ballast cushion for both corridors
Track Renewals (complete track renewals and through sleeper renewals)	350 mm
Doubling and New line construction	350 mm
Loop Lines	250 mm (Desirable -350 mm)

Private and Other Sidings	For permissible speed up to 50 Kmph.	250 mm
	For permissible speed more than 50 Kmph	350 mm

SLEEPERS & FASTENINGS

107. General: In general, PSC sleepers are used. On steel girder bridges, steel channel sleepers have been used. On Steel Girder Bridge and on Points and Crossing, Composite sleepers may be used.

108. Pre-stressed Sleepers:

a) Mono-block pre-stressed concrete sleepers have been used on DFC.

b) The PSC sleepers are conforming to RDSO specification No IRS: T-39 (Plain Track) and for Turnout sleepers RDSO specification No IRS: T-45.

c) PSC sleepers can be identified by the drawing No. and code of sleeper manufacturer with year of manufacture engraved on the top end surface of sleepers.

d) When PSC sleepers are used in yards with fish-plated track/SWR, the sleeper spacing at fish-plated joint shall be kept uniform. In addition, 1 m long fishplates may preferably be provided at such joints.

e) RDSO approved In Sleeper point machine may be used in place of ordinary point machine to ensure seamless tamping and improved maintenance as no need of removal and disconnection of point machine from the track for tamping of turnouts.

109. The minimum sleeper density for all main lines & connecting lines including siding with 50kmph and above shall be 1660 nos. per km and for loop lines and sidings for permissible speed less then 50 kmph, shall be 1540 nos. per km

110. Fastenings on PSC sleepers: Only approved types of fittings and Elastic fastenings shall be used with PSC sleepers. Some of the approved type of fastenings on PSC sleepers are as under:

a) Elastic Rail Clip (ERC): Manufactured from Silico-manganese Spring steel by approved/developmental suppliers as per RDSO specification IRS-T: 31. They offer a designed Toe load at design deflection.

b) Grooved Rubber Sole Plate (GRSP): Manufactured from rubber compound conforming to RDSO specification No IRS -T-47, the Grooved Rubber Sole Plate absorbs high frequency vibrations, shocks, and reduces noise.

i. For improved performance Composite GRSP with two layers of different types of rubber are developed, which has the top layer having higher modulus of elasticity (harder) while bottom layer is of softer Material.

ii. These are manufactured to RDSO specifications for Composite GRSP (provisional) number RDSO/M&C/RP-200/2007 for 10 mm CGRSP.

iii. As per the above referred specification, the harder layer should be kept in contact with Rail, Thus, the surface of CGRSP where the manufacturer's initials are embossed should be placed on rail seat, facing upwards.

c) Liner:

i. These are the fittings used in conjunction with the GRSP/ CGRSP and rail, on both sides of the rail foot to achieve the correct track gauge to provide for the

correct deflection of the ERC for the designed Toe load.

ii. Liners are made of two Materials viz., Glass filled Nylon (GFN) liners (as per "RDSO specifications IRS: T-44") and Metal Liners (as per "RDSO specifications for Metal liners – Provisional 2013"). In EDFC, GFN liners are used and in WDFC Metal liners have been used. Since there is no track circuiting in EDFC, therefore, during renewal (condition basis) the GFN liners shall be replaced by metal liners.

iii. Cut liners shall be used with ERC J clip at fish plated Joint/ Glued Joint.

RAIL AND RAIL FASTENINGS

111. Standard Sections of Rails –The rails are manufactured as per the Indian Railway Standards specification for flat bottom rail (IRS-T-12). In DFCCIL, flat-footed rails of 60 Kg (880 grade and 1080 grade) are being used. The weight per meter for 60 Kg/m rail of SAIL & Jindal is 60.34 kg. The UIC 60 profile has been changed to 60 E1 profile, which is accurately dimensioned profile developed from the previous dimensioned profile of UIC 60. In this profile, there is a minor variation in the profile of rail head top as compared to the UIC 60 profile. There is no difference in the dimensions of Rail flange and web including the fishing planes. The weight of 60 E1 rail per meter is 60.21 kg. For details, please refer IRS specification - T-12.

Marking of Rails:

Brand marks are rolled and indicated on one side of the web of each rail. These brand mark usually include:

a) Rail section
b) Grade of steel- 880/1080 grade (Now changed into R-260).
c) Identification mark of the manufacturer.
d) Month (using Roman numbers) and last two digits of year of manufacture.
e) The process of steel making e.g. for Basic oxygen - "O", for Electric - "E" etc.
f) Rolling direction

112. Identification of Different Qualities of Rails in the Field –

a) Prime Quality Rails – These rails are suitable for use in running track at all location and are classified as Class 'A' and Class 'B' rails based on tolerance in End straightness as given below. During replacement both Class A and Class B rails can be used.

End Straightness	Tolerances	Tolerances
	Class 'A' rail	Class 'B' rail
Horizontal	Deviation of 0.5 mm Measured as maximum ordinate from the chord of 2.0 m standard straight edge.	Deviation of 0.7 mm Measured as maximum ordinate from the chord of 1.5 m standard straight edge.
Vertical (up Sweep)	Deviation of 0.4 mm measured as maximum ordinate from the chord of 2.0 m standard straight edge.	Deviation of 0.5 mm measured as maximum ordinate from the chord of 1.5 m standard straight edge.

Vertical (Down Sweep)	NIL	NIL

b) **Industrial Use Rails (IU rails)** – There is no deviation in chemical composition or mechanical properties in 'Industrial Use' rails from that of 'Prime Quality' rails. The deviations exist only in tolerances for Parameters as mentioned in IRS-T-12. These rails can be used in guard rails on bridges. IU rails can be identified by blue paint on the end face of flange and both sides of flange for a distance of 500 mm from each end. The letter 'IU' (Industrial Use Grade) as the case may be in 15 mm size shall be stamped on both end faces of rails in addition to color marking.

c) **Colour Code:** The rails are painted with color code as given as per IRS-T-12.

d) **Longer rails:** As per IRS-T-12, the standard length of rails is 13 m or 26 m. However, in DFC, 13 m (60 kg UIC) and 25 m (60E1 1080 HH imported from Japan) rails have been used.

113. Recommended Rail Section –

a) Main line & connecting line –

i. EDFC-60kg/m rails with minimum 90 UTS (880 grade/R-260 grade).

ii. WDFC-Main line- 60 kg E1- 1080 HH/1175HT

iii. Connecting line - 60kg/m rails with minimum 90 UTS (880 grade/R-260)

b) Loop Lines - 60 kg/m minimum 90 UTS rails (880 grade/R-260 grade)

114. Fastenings on PSC sleepers

a) **Fish plates:** Fishplates are used to join the ends of rails using fish bolts and other fittings such as washers, etc. These are manufactured to comply with RDSO specification, IRS-T-1. Only 1 m long fish plates is to be used except in case of guard rails, where fish plate of 610 mm length are used.

b) **Joggled fish Plates:** Joggled fish plates with clamps or with far end bolts are used at welded joints or at rail fracture locations. Joggled fishplates shall comply with RDSO specification IRS-T-1.

c) **High performance Rail Clamp:-** High Performance Rail Clamps are being used in many railway systems to expedite relaxation or the speed restriction on the discontinuities of the track (rail flaw/ weld flaw/ rail fracture / weld fracture), RDSO approved High Performance Rail Clamps may be used for permitting speeds of 50 kmph and higher on track discontinuities.

d) **Modern Fastening: -** Approved Modern Fastenings can be used in place of ERC based fastenings in phased manner. These fastenings are capable of being supplied factory fitted on sleepers from the Concrete Sleeper Plants for laying in the field. The Modern Fastenings shall comply with the requirements of category 'C' fastening system as per EN 13481-1:2012 and EN 13481-2:2022.

BUFFER STOPS

115. FRICTION BUFFER STOPS: The Sliding Friction End Buffer Stop is designed to dissipate the Impact energy in a controlled manner via the sliding action of the friction shoes fitted between the frame and rail profile. This can be used in conjunction with hydraulic energy absorption system to provide a recoverable stroke for impacts and controlled sliding distance for high speeds. The main principle of working of 'Friction' buffer stop is to dissipate Kinetic energy of moving train along the braking distance by friction force offered by buffer stop.

116. A friction type Buffer stop consists of four parts: (a) Buffer stop Frame- to resist impact (b) Friction shoes- to provide frictional forces. (c) Length of Railway track- on which frictional shoes move to dissipate Energy. (d) Anti Climber shoe assembly- to prevent uplift of the Buffer stop frame.

117. Types of Buffer stops used:

a) 2000MT capacity: Buffer stop for design parameters of train mass of 2000 MT with Impact speed of 5 kmph have been used on siding track other than overrun of loop lines, ballast sidings, accident relief sidings, etc.

b) 6500MT capacity: Buffer stop for design parameters of train mass of 6500 MT with Impact speed of 10 kmph have been used in overrun of loop lines.

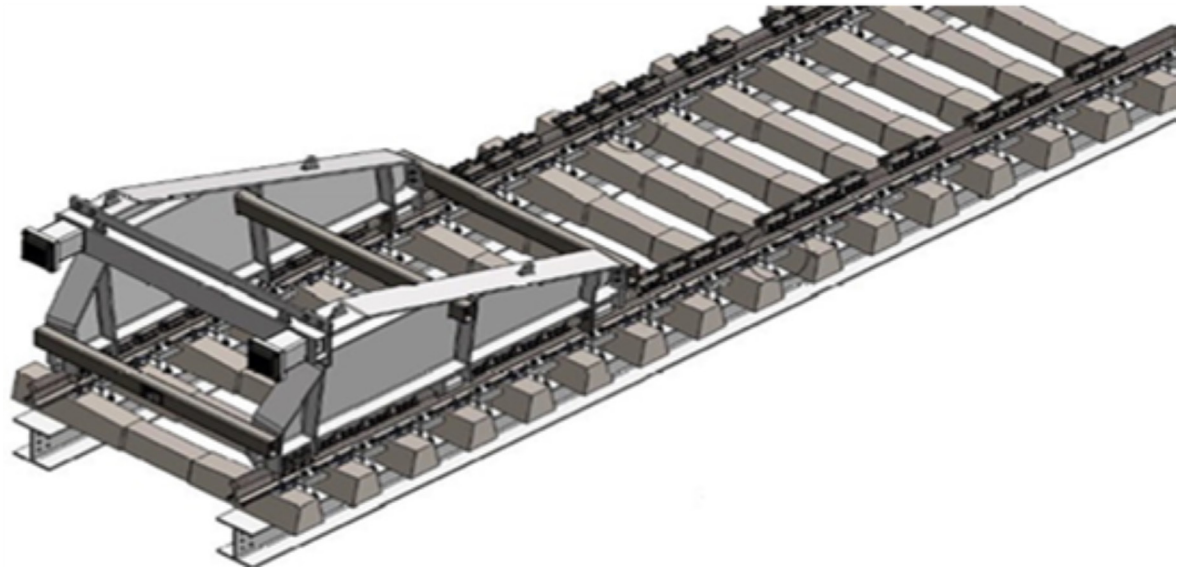


Fig. 1.3

c) CONVENTIONAL BUFFER STOPS: Conventional Buffer Stops of IR Design have been provided in EDFC & WDFC which will eventually be replaced by friction buffer stops.

INSULATED JOINTS & SWITCH EXPANSION JOINTS

118. Insulated joints – Track circuited sections are 'insulated' electrically from the track

on either side by insulated joints. The standard insulated joint in normal use, is made out of ordinary fishplates duly planed on the fishing planes for accommodating channel type insulation between rails and fishplates with ferrules/ bushes over the fish bolts and end posts between the rail ends. These are provided only in link line in DFC jurisdiction where connection of DFC line is with IR lines.

119. Switch Expansion Joint:

a) An expansion joint installed at each end of LWR/CWR to permit expansion/ contraction of the adjoining breathing lengths due to temperature variations.

b) Normally, SEJ are provided for the same rail sections.

c) In DFC two types of SEJs are used:

i. Single gap improved SEJ: A single 40 mm gap Improved SEJ has been used in EDFC.

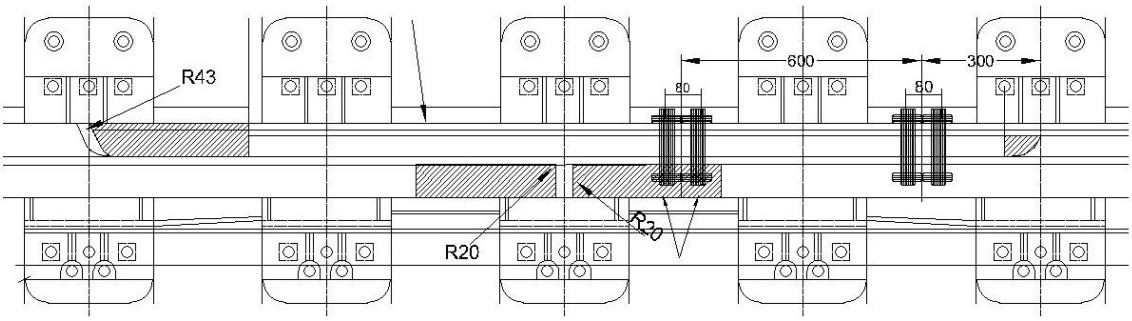


Fig. 1.4

ii. Thick web SEJ: In this SEJ thick web switch rail is kept fixed whereas Stock rail moves outside as per temperature variation.

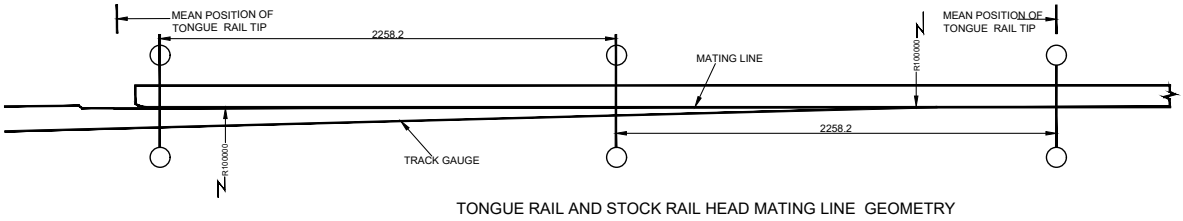


Fig. 1.5

TRACK STRUCTURE ON BRIDGES

120. Rail and rail joints on Bridges –

a) Longitudinal Profile of Rails – In standard plate girders no camber is provided. Open web girders of span 30.5 m and above are provided with camber. Track on these bridges is laid correctly following the camber of the girder.

b) The preferred position of the rail joint is at 1/3 the span from either end.

c) Greasing should be done on gauge face side of rails on steel bridges if fatigue cracks are noticed on rail gauge face.

d) SWR on Bridges –

i. No fish-plated joint should be located on the girder or within six meter from either abutment. In all such cases rail free fastenings, such as rail free clips shall be used, so that relative movement between rail and sleepers may take place.

ii. 26 m/25 m long rolled rail may be laid on bridges with 1.0 m long fishplate and 06 nos. of bolts. Joint gaps to be provided and maintained.

e) LWR/CWR on Bridges –Based on RSI studies (UIC 774-R (3)) LWR/CWR can be continued on ballasted deck bridges provided additional rail stresses are within permissible limits.

f) Precautions for arresting Creep – Track on girder bridges with un-ballasted deck is always laid with rail free fastenings in all cases. The tracks on the girder bridges not laid with LWR/CWR shall be isolated from LWR/CWR by a minimum length of 30 meter of well anchored SWR on either side.

g) At the time of laying, the gap should be maintained and during maintenance, gap should be adjusted as per provisions of Para 830 of DFCRRM.

121. Steel Sleepers on Bridges –

a. Preferably H-Beam steel sleepers, including its fittings, for Girder Bridges may be provided as per applicable latest RDSO drawings. If H-Beam steel sleepers is not possible to be provided then Steel channel sleepers, including its fittings, may be provided on girder bridges with the approval of CTE/DFC.

b) Sleeper spacing – Maximum center-to-center sleeper spacing should be 600 mm at all locations on the bridge except at the cross girder in open web girders, where the spacing may be suitably increased depending upon the top flange width of the cross girder. However, in case width of top flange of cross girder exceeds 370 mm, then special channel sleeper to be provided as per applicable RDSO drawing for such situations. The clear distance between joint sleepers should not be more than 200 mm.

122. Provision of Guard Rails on Bridges and Tunnels–

a) Location – Guard rails should also be provided on all major, important ballasted bridges and on such other minor bridges where derailment may cause serious damage. On all flat top and pre-stressed concrete girder bridges with deck slab, where guard rails are not provided the whole width of the bridge between the Parapet walls shall be filled with ballast up to the top of sleeper level. In case of ROB/FOBs, the guard rail shall be provided on the track adjacent to a column/ pier/abutment which is located within a distance of 8 m from center of track.

b) Design of Guard rails – The typical arrangement of a guard rail, with the important dimensions are shown in the sketch and table as shown below –

S l . No	PARTICULARS	SKETCH REF	Dimension (mm)
1	Clearance between guard rail and running rail	“a”	250± 50
2	Length of guard rails outside ballast wall and maintained to Clearances mentioned in Item-1	L1	1825
3	Length of guard rails to be bent so as to be brought together at the middle of the track.	L2	4875

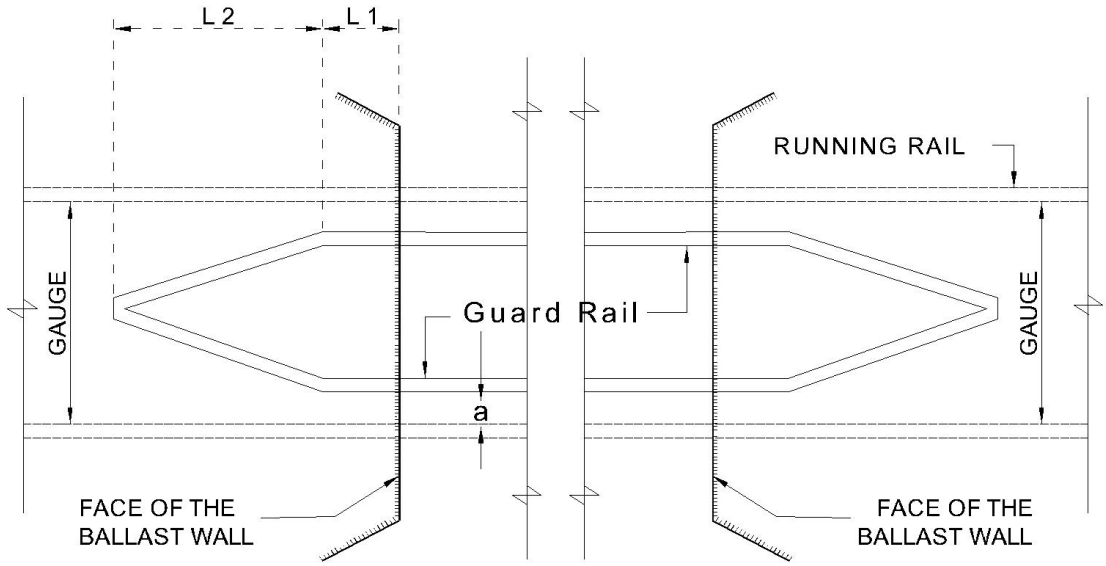


Fig. 1.6

The top table of the guard rail should not be lower than that of the running rail, by more than 25 mm. In the case of bridges on curves with canted track, the difference should be measured with reference to a straight line connecting the running tables of inner and outer rails.

c) Fixing of Guard Rails –

i. **Splaying of Guard rails** – In the case of through girder bridges on double lines, the Guard Rails should be splayed on both ends on both lines. In case of bridges other than through bridges on double lines, the splaying need to be done only in the facing direction of the particular line. The ends of Guard Rails should be bent vertically and buried, and a block of timber is fixed at the end to prevent entanglement of hanging loose couplings. However, the non-splayed end should be bent downwards after it is stopped at the end of the abutment, with V shaped wooden block or any other suitable material as approved by CTE may be provided.

ii. The fixing of Guard Rail on PSC sleepers on ballasted deck bridges and approaches shall be done as per approved RDSO drawings by proper tightening of rail screws.

123. Provision of Guard Rails in Tunnels:

a) Tunnel with Single track: -

i. On approach of tunnel: 100 m from portal face outside the tunnel to 25 m inside the tunnel.

ii. Inside Tunnel: In addition to 25 m from face of portal as stipulated under item(a)/i above, guard rail shall be provided inside tunnels as under:

1) Ballast less Track: Throughout the length of ballast less track.

2) Ballasted Track: Curves with radius up to 500 m along with transition portion but excluding locations provided with check rails. Guard rail would also cover critical locations like sub-station, column/structure etc.

b) Tunnel with Double tracks

i. On approach of tunnel: 100 m from portal face outside the tunnel.

ii. Inside Tunnel: Throughout the length of tunnel but excluding locations provided with check rails.

124. Provision of Side Pathways and Walkways- Side Pathways shall be provided on all girder bridges as per applicable RDSO drawings to ensure safety of maintenance staff. Properly secured walkways (or inspection gangways), made of chequered plates with hole, should be provided inside the track to cover the width available between the Guard Rails, and at other suitable locations to ensure safety of maintenance staff and to facilitate inspections.

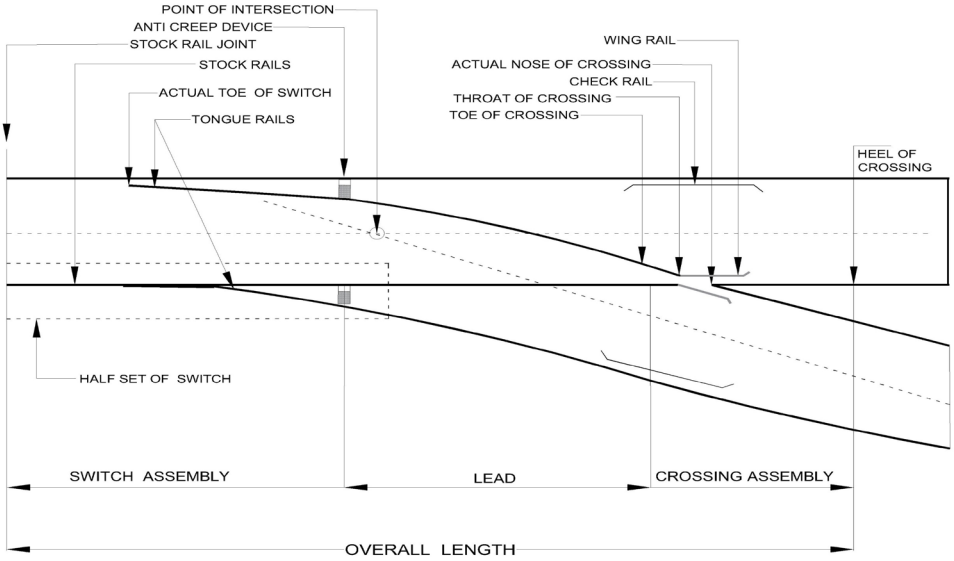
POINTS & CROSSINGS

125. Turnout: It is a geometrical installation of track to allow movement of train from one track to another track. The turnout consists of following sub-assemblies:

a) Thick web switch assembly

b) Lead assembly

c) Crossing assembly



TURNOUT

Fig. 1.7

126. Turnouts used in DFC:

a) CWR through Points & Crossings (except in Durgawati – Karwandiya section)

b) In Durgawati – Karwandiya section turnout are isolated from LWR by SEJs

c) In turnout designs, one anti-creep device is fitted between each switch blade and its matching stock rail. This is designed to monitor differential longitudinal movement of the switch blades relative to their stock rails caused due to temperature variation. Anti-creep device contains two parts viz pin & fork. The pin and fork are fixed to the rails using bolt and nuts. The ideal clearance between the pin and fork is 7 mm on either side.

d) The derailing switches are also fitted with anti-creep devices between the switch blade and its stock rail.

e) For turnouts laid on curves with Thick Web Switches, pre-curving of stock and tongue rails shall be done during their manufacturing.

127. Key Parameters for Turnouts used in DFC:
Geometric values of various Turnouts

Turnout Parameters	**Unit**	**1 in 12**			**1 in 8.5**
Switch entry angle	Degree	00 04º 37'	00 20º 00'	00 07º 21'	00 36º 08'
Radius	m	555	460	441.36	218
Design Gauge at 450 from ATS towards SRJ	mm	1676	1677	1676	1677
Design Gauge at 150 from ATS towards SRJ	mm	1678	1680	1678	1679
Design Gauge just before ATS	mm	1680	1683	1678	1682
Design gauge from ATS to JOH	mm	1678	1678	1676	1678
Total Turnout length (SRJ to 1st Field joint after heel of X-ing)	mm	48260	42667	45762	30768
SRJ to ATS	mm	745.5	1144	1500	1500
Turnout length from ATS	mm	47515	41523	44262	29268
Perp. Leg spread at Exit of Vee rail	mm	2090.7	2080	2233	2190

Distance of Turnout exit from TNC	mm	5128.1	4896	6736	4448
X-ing Length including Vee rail straight	mm	8426	7750	11694	7240
TR length (from ATS-Weld)	mm	16159	13510	14374	10704
Permitted Speed	Kmph	50	50	45	25
Clearance on both side of ACD	mm	7	7	7	7
Permitted Creep at ATS when ACD is intact	mm	13.00	12.00	13.00	11.00
Permitted Creep at ATS when ACD is broken	mm	17.00	15.00	15.00	10.00
Locations of USE in DFC		Bhau pur-Khurja-Sahnewal and Khruja-Dadri	Entire WDFC, Ganjkhwaja and Ex New Karwandiya to Chirailapa-thu (incl).	New Bhimsen-New DDU, New Durgawati-New Karwandiya	Entire WDFC normally on sidings and in exceptional cases on some loop lines

128. **Weldable Crossing:** The complete central part of the crossing is cast in one block from high-manganese steel as per EN15689-:2010. Closure rails are flash-butt welded to the four ends of the central block using a special flash-butt welding technique (intermediate piece welding). The bearing surfaces (seat of the plates) as well as the complete area of the running and head surfaces are milled and/or planed for achieving manufacturing accuracy for optimal wheel overrun.

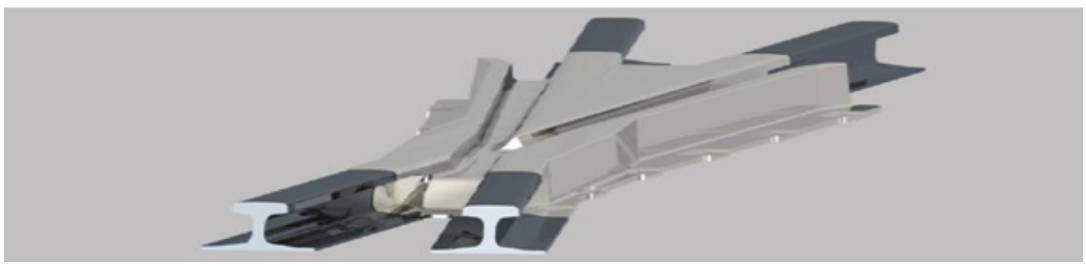


Fig. 1.8

129. **Check Rail :** The check rails are necessary to guide the wheels in the area of rigid crossings. They are made from the rolled section 33C1 and are bolted onto plates with check-rail chairs. The check rails shall be 20 mm higher with respect to running rail top. If the guiding area is getting worn, the check rail clearance shall be adjusted to the proper gauge by placing shims between checkrail bracket and check rail. Up to 10 mm of wear can be compensated by adjusting shims.

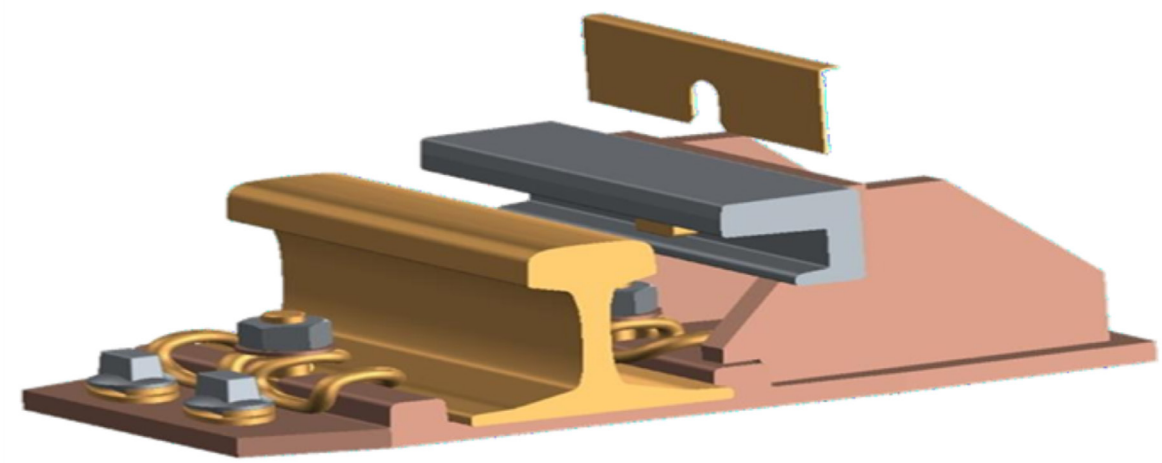


Fig. 1.9

130. **Type of Slide Chair used:**

a) **PIROLL System (Plate Integrated ROLLER system):** The PIROLL mounted on the sides of the slide plates or slide chair plates allows an easy setting process, as the switches are rolling on the rollers only during the setting operation. With the use of PIROLLs, the open switch is lifted about 1 mm to 2 mm (max) off the slide chair plates and therefore, the turnout works properly without lubrication of the slide chairs and slide plates even in polluted track areas. The mounting is made on approximately every second or third plate. The rollers are made from PA6 with slide bearing. When installing the turnout into the track, i.e. during tamping works or maintenance tamping work, the PIROLL can remain mounted on the base plates.

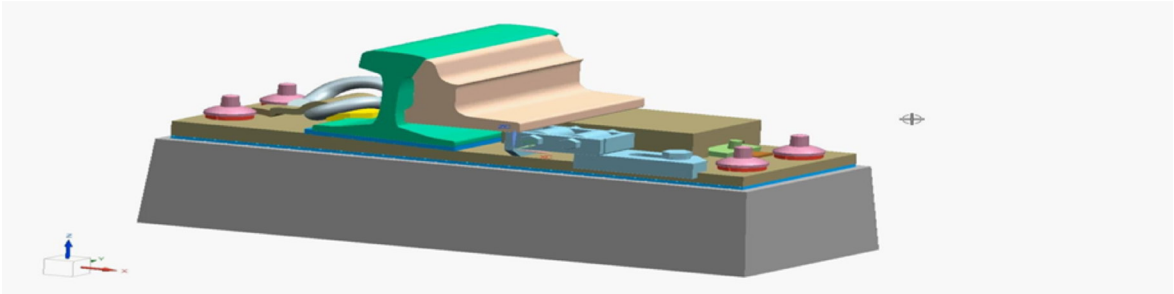


Fig. 1.10

b) Chromium Nickle plated slide chair without Piroll have been used in DFC except few exceptions. Periodic cleaning of such slide chairs are required to reduced friction between contact surface between slide chair top and bottom of rail flange.

131. For proper setting of tongue rail with stock rail in all 1 in 12 Turnout, SSD is generally used in WDFC and Back drive arrangement is provided in EDFC.

132. Back Drive: It is a mechanism that allows the transfer of the tongue rail displacement in turnouts with two claw locks. A system of squads is linked to the first claw lock through a connecting rod, allowing force transmission using driving rods between claw locks, assuring that the tongue rail fully couples against the stock rail. It transfers power from point machine located at TOE to JOH of the switch assembly of turnout. Various features of back drive are as under:

a) Back drive system is a positive drive system which transfer force through direct driving movement with minimum losses of energy.

b) The two sets of squads ensure proper coupling between tongue rail and stock rail and opening at JOH as per requirement.

c) It is compatible with 220 mm stroke point machine.

d) The Mechanical back drive System Through Squads is compatible with turnouts equipped with multiple asynchronous movement claw locks.

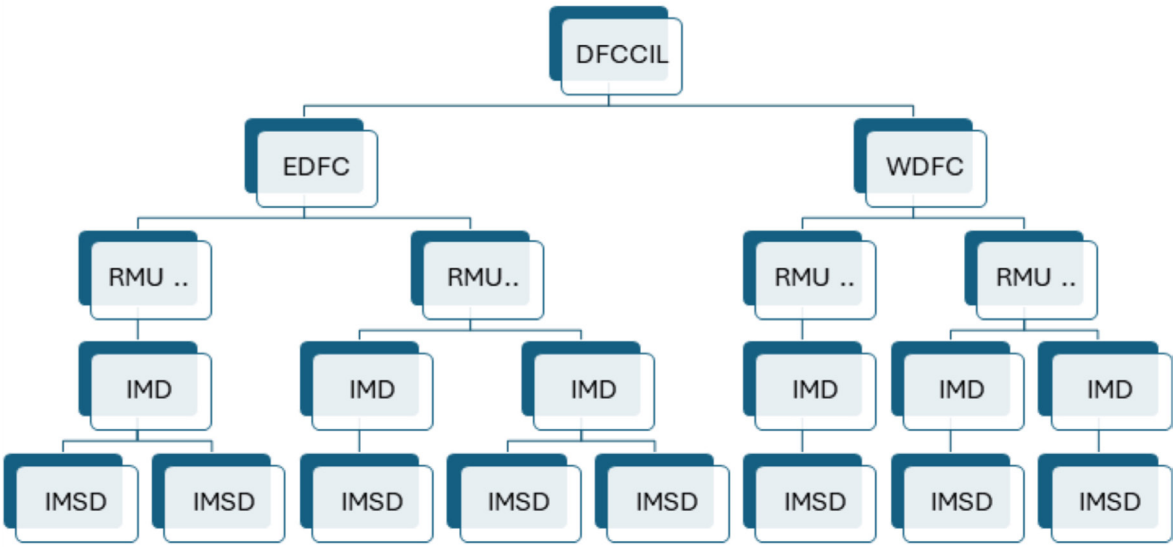
133. Torsional Type Back Drive: It is a mechanism connected with electric point machine used to maintain the gap at JOH of switch assembly by providing adequate force to the rails at JOH through driving shafts linked with the lost motion stretcher bar assembly. The torsion drive couples to the drive rod of the point machine of turnout and through a pull bar, torsion shaft transmits a force to the rear lost motion stretcher bar assembly in the turnout assuring that the switch butt fully against the stock rail along the length of the switch. Lost motion adjustment at rear is obtained by using a arrangement of a threaded rod, lock nuts.

LEVEL CROSSINGS

134. There is no planned LC in DFC network. Some LCs are yet to be eliminated till then chapter 9 of IRPWM shall be referred to.

CHAPTER – 2

TRACK MAINTENANCE SETUP



201. All track maintenance and engineering activities shall be guided and managed from Integrated Maintenance Depots (IMD) and Integrated Maintenance Sub Depots (IMSD) of DFCCIL. Such Integrated maintenance depots (IMD) are set up with jurisdictional length of approx 160 kms, throughout the DFC and Integrated maintenance sub depots (IMSD) with jurisdictional length of approx 80 kms. These IMDs and IMSDs shall act as common hubs for Civil, Electrical, Signal and Telecom engineering maintenance activities. All Civil, Electrical and S&T personnel will be stationed at IMD's/IMSD's with staff reporting to Depot Engineers- Civil, Electrical and S&T. Depot Engineers will report to Dy. CPM/IN-CHARGE who will be responsible for all maintenance activities under their jurisdiction. Normally Sanctioned strength of Civil Engg Maintenance activities are as under:

i. IMSDs Level

Level	Nos	Designation
E2	1	IMSD in charge
E1	1	IMSD sectional
E0	3	P-way Spl, Works, Misc.
N5-N7	1	Yard

ii. IMDs Level

Level	Nos	Designation
E4/E3	1	IMD in-charge
E2	1	Track
E1	2	TM & USFD, Bridge
E0	1	Store
N5-N7	2	In-charge small track MC (including welding supervision), Track Machine

iii. Track Machine Organization of DFC under GM/TMC/CO Level

Level	Nos	Designation
E5-E7	1	Field In-charge of entire DFC TMO
E4	3	In-charges for RGM, TRC, SPURT CAR
E3	2	APM/TM/EDFC, APM/TM/WDFC
E1-E0	19	RBM operator (one for each IMD)

iv. CGM/RMU Units Level

Level	Nos	Designation
E6 – E5	2	Overall In-charge of Civil Engg Assets (IMDs wise)
E4-E2	6	Contract Manager, Track, Bridge, Works, TM, IMD Coordinator
E1	4	Track, Bridge, Tender, Estimate, Contract Management, Land, store cell
E0	3	

202. All IMD/IMSDs shall have adequate space for parking, stabling and maintenance of track machinery equipment assigned exclusively for their jurisdictions. For track Machines, which are expected to be shared by multiple IMD/IMSDs, Corporate office shall assign a base depot for such equipment's stabling, parking and maintenance. The track machine (s) shall work under the direct supervision of an engineering official not below Executive level who will be responsible for taking the traffic block, for protection of the line, while the work is in progress and clearing of the block after completion of the work when the last machine clears the block section and certifying that the track is fit for train movement.

DUTIES OF ALL REGULAR P-WAY OFFICIALS POSTED in IMDs & IMSDs

203. P- way officials being directly responsible for the safety of the track shall have:

a) Knowledge of Rules and Regulations, up to latest correction slips, as laid down in DFCCIL's General Rules and Subsidiary Rules, Standard Schedule of Dimension,

Railroad manual, Circulars and Indian Railway's P-way Manual, Flash Butt Welding Manual, Fusion Welding Manual, Ultrasonic Testing Manual, Bridge Manual, Track Machine manual, Small Track Machine Manual, IRST-12, Cast manganese steel reconditioning manual, Indian Railways act & Indian Railway Code of Engineering department.

b) Keep the list of Railway Affecting Works (RAW) and Railway Affecting Tanks (RAT) with brief history and a list of vulnerable locations, where stationary watchmen are required to be posted.

c) Should be well versed with the various modules/inspection proforma of the Track Management System (TMS) and Bridge Management System (BMS).

d) Ensure by one-to-one interaction that all the staff under him/her are acquainted with the relevant rules and working methods connected with their duties.

204. Inspection should be done as per the prescribed P-way schedules of inspections as per Railroad Manual, duly making entries in concerned module like TMS/BMS/other register ,inspection of track machine prescribed by DFC. Accompanying TRC/OMS runs and shall also do monitoring and scrutiny of inspections by checking quality of inspections as well as method of inspections of all subordinate officials including USFD Testing officials. IMD and IMSD In-charge shall ensure time bound compliance of the inspection items.

205. In case of an accident, including a breach, affecting the running of trains, Officials should proceed to the site by the quickest available means. On the way, he/she should ascertain the requirements of materials and men at site and arrange for the same.

206. Officials shall accompany higher officials in their inspections and shall carry relevant manuals (hard copy) duly updated, Special instructions on various P-way/Bridge issues, list of Permanent and Temporary speed restrictions, TMS Information Dump of Assets and Inspections (section details, track diagram, TRC / OMS records, fracture details and analysis, inspection details of various assets, etc.) list of sanctioned works and their status, inspection notes of higher officers with compliance reports, working timetable and other specific papers and plans that are likely to be discussed, should also be carried for reference.

207. Officials shall ensure that preparatory works have been completed and due precautions have been taken well before the onset of monsoon, summer, and winter; he/she shall ensure availability of required equipment and proper training/ counselling of patrolmen and stationary watchmen according to the extreme weather and remedial action requirement. He/She shall ensure patrolling of track as per the instructions and patrol chart approved from CGM/RMU.

208. Officials should keep close co-ordination with the Operating, Signalling and Electrical Staff whenever they are required to work jointly.

209. Officials of section should have a thorough knowledge of important pre-requisites for the proper functioning of LWR/CWR, its limitations and precautions laid down for working on LWR/CWR and ensure that the maintenance instructions are strictly followed by all the staff dealing with maintenance of LWR/CWR.

210. Track Machine: - P-way officials shall be responsible for following duties:-

a) Officials shall monitor and ensure progress and quality output of various track machines working in the section, and shall ensure all prerequisites, pre-block,

during block and post-block activities according to track machine manual and be responsible for temporary storage and timely arrangement and transportation of HSD oil from the depots to various machines working in their jurisdiction.

b) For making lighting arrangement during night working.

c) Machine in charge shall be responsible for protection at the site of work and adjoining track wherever necessary with the safety of staff working with machine in the block section against danger of trains on the adjoining line(s).

d) Ensure that all inspection related to Track Machines by IMD/IMSDs In-charge are being done on time.

211. Officials shall immediately bring the defects, they are not able to rectify, to the notice of controlling officer and obtain advice. Senior officials should choose to inspect the track features which have comparatively more deteriorated.

212. Officials shall ensure imposition of necessary speed restriction wherever required. In case the temperature exceeds t_d + 20°C after the maintenance work has been completed on LWR/ CWR for the period of consolidation, prescribed speed restriction shall be imposed. He/She shall ensure proper ballast profile of the track and shall arrange to recoup the ballast, as per standard ballast profile, before the onset of summer.

213. Officials shall maintain and upkeep all correspondences up-to-date and see that the TMS records, Office records, Registers and Stores ledgers are maintained systematically and posted regularly and as required.

214. Officials shall be responsible for maintaining the land boundaries intact and free from encroachment by outsiders in his jurisdiction. Official should keep watch and in case of encroachment should inform Security Branch of DFCCIL and the concerned officers of Indian Railways immediately.

SPECIFIC DUTIES OF Integrated Maintenance Depot (In charge- Engg)

215. In addition to duties from Para 203 to 214 IMD (In charge) should do:

a) Planning of works and submission of detailed proposals with justifications to CGM/RMU (Regional Maintenance Unit) for sanction of works.

b) Execution and monitoring of works as per the tender conditions, approved plan & schedule of the work etc.

c) Ensure timely measurements and preparation of bills with prescribed test checks (for ballast -100%) for ensuring quality and quantity. 20% test check to be performed for all P-Way works including supply (except ballast) items.

d) Bring to the notice of the Dy CPM, any work pertaining to Track/Bridge which is considered beyond his capacity, or any other item considered necessary for the safe functioning of track.

216. He/She should do monitoring and scrutiny of inspections of assets by checking quality of inspections as well as correctness of method of inspections of all subordinate officials including USFD Testing officials for USFD testing and pre monsoon bridge inspection by IMSD IN-CHARGEs.

217. IMD in-charge shall:

a) Issue certificate of satisfactory behaviour of LWR/CWR after taking corrective

actions once in a year before summer and send it to Dy. CPM.

b) Keep a watch for any sign of buckling in the track.

c) Check store once in a year and see proper distribution of Imprest materials, upkeep and working of small track machines, Engineering indicators, protection equipment and other important items in stores and records in offices.

218. Ensure preparedness for action during extreme weather condition:

a) Preparatory works have been completed and due precautions have been taken well before the onset of Monsoon, Summer and Winter.

b) Keep the list of RAT/RAW with brief history and list of vulnerable locations, where stationary watchmen are to be posted.

c) Ensure availability of required equipment and proper Training /Counselling of Patrolmen and Stationary Watchmen according to extreme weather and remedial action requirement.

d) Ensure Patrolling of track as per the instruction and patrol chart issued from CGM/RMU.

e) Adjusting roster duty hours of Keyman for summer and winter months for ensuring safety of track.

219. Inspection and test check of USFD -Checking of work of USFD in-charge as specified in Para-266.

220. Track machine: -Monitoring, ensuring quality and output of all the track machines working in the Integrated Depot. IMD In-charge shall: -

a) Ensure all pre-requisite, pre block, during block and post -block activities for quality output.

b) Ensure sufficient lighting during night working and arrange fuel/Oil in advance.

c) In the eventuality of breakdown of machine, he shall take all possible action to clear the block section expeditiously.

d) Inspect the machine as per prescribed schedule and check the items/checklist laid down in IRTMM.

e) Co-ordinate with other departments like traffic, OHE and S&T in the field to facilitate working.

221. Control over expenditure-IMD In-charge shall exercise due care in passing requisition for materials and tools and in the execution of new and maintenance works, ensuring in all cases that the expenditure is within the allotment or provision available in the sanction estimate.

222. Measurement of Ballast: IMD in-charge may either measure and record the measurements of ballast or carry out 100% test check on quality and quantity, if measurements are recorded by any other DFC official.

223. Action in case of Emergency: -In case of an accident, including a breach, affecting the running of trains, he should proceed to the site by the quickest available means. On the way he/she should ascertain the requirements of materials and men at site and arrange for the same. He should also order for the Accident Relief Train as necessary and take all possible measure to restore the traffic quickly.

224. IMD In-charges shall have in their possession complete set of drawings and diagrams pertaining to their jurisdictions. He/She shall have in his possession the land plans

pertaining to his jurisdictions. Plans pertaining to their jurisdictions shall be maintained up to date by the IMD In-charge.

a) The type plans, pertaining to track sections and turnouts over their jurisdictions.
b) Plans and longitudinal sections of the line, to a scale of 50 meters to 1 cm horizontal (1:5000) and 5 meters to 1 cm vertical (1:500) and Index Plans and sections to a scale of 0.5 km to 1 cm horizontal (1:50000) and 10 meters to 1 cm vertical (1:1000) showing the physical features, alignment, grades, location of bridges and level crossings.
c) Drawing of bridges, level crossings (if any) and protective works and yard layouts over their jurisdiction.
d) Working drawings or diagrams pertaining to track and components of their sections, issued from time-to-time.
e) The Permanent Way track diagram of the railway line showing the type of track and fittings when laid, type of ballast, type of formation with classification of soil as per RDSO's Circular, blanket thickness, type of formation trouble (if any) and indication of how the railway boundary is demarcated. Chainage points in the track diagram shall be indicated correctly to the nearest meter.
f) The Permanent Way diagrams of station yards show complete dimensions of running lines, sidings, type of track and turnouts
g) The longitudinal section of the line shall be updated by surveying the longitudinal profile of the line at least once in five years.

225. The necessary action for elimination of humps, sags and unevenness or providing vertical curves as provided in manual be taken if the survey reveals variations in grades. Such an action may also become necessary because of track works viz. renewal of rail/sleepers, lifting/lowering of track, bridge works etc. He/she should also order Accident Relief Equipment in case of accident and take all possible measures to restore the traffic quickly.

SPECIFIC DUTIES OF IMSD (IN-CHARGE- Engg)

226. In addition to duties from Para 203 to 214, IMSD In-charge shall be responsible for:

a) Safety of the track in his/her jurisdiction.
b) Directly responsible for timely implementation (as per frequency/requirement) of monsoon/hot/winter patrolling, destressing, AT Welding, FB Welding, USFD Testing.
c) Ensure safety of the track (including track portion of bridges). He/she shall keep SOD free of infringement by cutting trees, removing scattered materials from formation, removing vegetation, cleaning drains in cuttings and tunnels before monsoon.

227. He/she shall be responsible for:

a) Repairs and restoration of traffic in case of an accident, derailment, buckling, wash-away, rail fracture, etc.
b) Carrying out casual sleeper / rail /fittings renewal, de-stressing, bad spot attention, oiling and greasing of joints and ERCs, fracture attention, SEJs/ Switches / Crossings replacement, rails / sleepers transportation through rail dolly, handling of material trains, welding, effectiveness of all fittings, soundness and squareness of sleepers, track drainage, ballast / rails/ sleepers unloading in block and other maintenance operation as per DFC-RRM, G&SR and complete

them within the block period.

c) Ensure time bound compliance of the items needing attentions.

d) The responsibility for avoidable fractures shall also rest with the IMSD (In-charge) of the section.

e) Record rail temperatures, de-stressing temperature, minimum and maximum rail temperatures and periodically check the rail thermometers used for recording rail temperature with reference to standard thermometer.

228. Officials should do advance planning of Corridor Blocks of 4 hours as per DFCCIL Maintenance system and should ensure effective utilization of the blocks and ensure maximum asset availability as per the KPI.

229. Execution and monitoring of Track work:

a) He shall ensure that all necessary material and tools are in possession and programme the work by organising the labour in an efficient manner and maintain detailed account of materials received and issued to the work.

b) Before commencing any work, he/she shall ensure that Engineering Signals are exhibited at the specified distances and Flagmen are posted with necessary equipment.

c) Arrange for repair and maintenance of small track machines available with him.

230. Preparation of plans and estimates of track works and submission of proposals to IMD In-charge for further action as well as execution and monitoring track works as per the tender conditions and approved plan & schedule of the work. He/she shall ensure timely measurement of work for bill preparation with proper test check to ensure quality.

231. Track machine: - He/She should plan and put up requirement of track machine in his/her section for attending the track and shall be responsible for following duties: -

a) Ensure safe movement of machine from siding to block section and back as per the provision given in IRTMM and G&SR.

b) Responsible for temporary storage and timely arrangement and transportation of HSD oil from the depots to various machine working in their jurisdiction for making lighting arrangements during night working.

c) Arrange for track protection and provide look out men for safety.

d) Undertaking and ensuring all prerequisites, pre-block, during block and post block activities according to track machine and quality output.

e) Ensuring various important parameters of track machines like tamping depth, squeezing pressure, wear and tear of tamping tools, squeezing time, condition of cutter bars etc. as per the type of machine and provisions of IRTMM to ensure quality and output of machine during block.

f) Co-ordinate with other departments like traffic, OHE and S&T in the field to facilitate working.

232. Store related issues: -IMSD (In-charge) is the in-charge of store depot and shall be accountable for each item of P-way in his jurisdiction. He/She shall: -

a) Submit the requisition for the procurement of various materials/small track machines well in advance for day-to-day maintenance.

b) Responsible for ensuring availability of track materials at nominated locations (close to road as well as track) in the section and responsible for offering the

scrap of released materials for their timely disposal.

c) Keep proper records issuance and receipt of materials and training out and spreading of ballast in the track and ensure to arrange for the repairs and maintenance of small track machines available with him/her in stores.

233. IMSD (In-charge) shall arrange to carry PWI kit and Gauge cum X level and other measuring devices/equipment etc. during inspection of senior officials.

234. Ensure preparedness for action during extreme weather conditions such as:
   a) Preparatory works have been completed and due precaution have been taken well before the onset of Monsoon, Summer and Winter.
   b) Keep the list of RAW/RAT with brief history and list of vulnerable location, where stationary watchmen are to be posted.
   c) Ensure availability of required equipment and proper Training /Counselling of Patrolmen and Stationary Watchmen according to extreme weather and remedial action requirement.
   d) Ensure Patrolling of track as per the instruction and patrol chart issued from CGM/RMU.

235. He/She shall be responsible for ensuring the land boundary intact and free from encroachment by outsider. He/She shall update the data in TMS/BMS timely in appropriate fields relating to all inspections.

236. Before deploying MTS/Outsourced personnel for patrolling/Stationary watchman, equipments should be duly checked, and proper training / counselling of patrolmen should be done.

SPECIFIC DUTIES OF IMSD (SECTIONAL- Engg)

237. In addition to duties from Para 203 to 214, IMSD Sectional shall be responsible for safety of the track in his/her jurisdiction. He/she shall work as per the direction of IMSD in charge for day-to-day maintenance works.

238. He/she shall be responsible for: -
   a) Repairs and restoration of traffic in case of an accident, derailment, buckling, wash-away, rail fracture, etc.
   b) Responsible for carrying out casual sleeper / rail /fittings renewal, de-stressing, bad spot attention, oiling and greasing of joints and ERCs, fracture attention, SEJs/ Switches / Crossings replacement, rails / sleepers transportation through rail dolly, handling of material trains, welding, greasing of ERCs, effectiveness of all fittings, soundness and squareness of sleepers, track drainage, ballast / rails/ sleepers unloading in block and other maintenance operations as per DFC RRM, G&SR and complete them within the block period.
   c) Be vigilant to locate faults/irregularities in the P-way and ensure prompt remedy.

239. Execution and monitoring of Track work: -
   a) He/She shall ensure that all necessary material and tools are in possession and programme the work by organising the labour in an efficient manner and maintain detailed account of materials received and issued to the work.
   b) Before commencing any work, he/she shall ensure that Engineering Signals

are exhibited at the specified distances and Flagmen are posted with necessary equipment.

c) During and after attention, he/she should observe the behaviour of track under passing trains to detect inadequate packing during routine inspections.

d) Arrange for the repair and maintenance of small track machines available with him/her and should be calibrated properly.

e) Ensure timely removal/cutting of trees in close proximity to track and liable to foul the track during a storm.

240. Before deploying MTS/Outsourced personnel for patrolling/stationary watchman, proper equipment should be checked, and proper training / counselling of patrolmen should be done.

241. The responsibility for avoidable fractures shall rest primarily with the IMSD/sectional of the section.

242. Track machine: - While deputed on machine for the supervision of the work of track machine, he/she should be responsible for following duties: -

a) Ensure safe movement of machine from siding to block section and back as per the provision given in IRTMM and G&SR.

b) Undertaking and ensuring all prerequisites, pre-block, during block and post block activities according to track machine and quality output.

c) Ensuring various important Parameters of track machines like tamping depth, squeezing pressure, wear and tear of tamping tools, squeezing time, condition of cutter bars etc. as per the type of machine and provisions of IRTMM to ensure quality and output of machine during block.

d) Co-ordinate with other departments like traffic, OHE and S&T in the field to facilitate working.

243. Checking of the track Parameters in floating condition and condition of track in floating condition and during passage of train, during working of track machines, and ensuring that the track Parameters are well within the tolerances.

244. Ensuring that track is free from obstructions and infringements for safe passage of traffic before clearing the traffic block. As required or stipulated IMSD/Sectional shall allow traffic at suitable speed restriction based on the condition of track after machine working.

245. IMSD/Sectional shall be responsible for counselling of Trackmen, Keyman, Patrolman and Stationary Watchman for their specific duties, safety and protection rules at the appropriate stage, better maintenance practices, and examine/check at frequent interval during routine trolley and other inspections.

246. IMSD/Sectional shall observe the track movement in yards especially at turnouts, SEJs, glued joints and other fish plated joints during passing of trains and shall take corrective measures to rectify the defects observed.

247. IMSD In-charge Section Register: - Each IMSD In-charge shall maintain a Section register containing all important information including a brief history of the section. The details as under shall be entered in the register: -

a) Administration –

i. Change in IMSD Sectional.

ii. Change in jurisdiction.

b) Permanent Way –

i. Formation – Sections giving frequent trouble with brief history and remedial measures adopted, if any.
ii. Track structure, method of maintenance, details of particular locations giving frequent trouble and remedial measures adopted if any.
iii. Details of kilometerages of track laid as short, welded panels, long welded rails, continuous welded rails, etc. incidence of buckling, maximum and minimum rail temperatures observed.
iv. Details of existing grades with location of grade posts and re-grading done, with brief details of lifting or lowering of track.
v. Complete details of existing curves with change in geometry or design parameters of curve.
vi. Particulars of deep screening carried out year wise.
vii. Major renewal carried out such as relaying, rail renewal, sleeper renewal and large-scale renewal of track components in the section should also be shown.
viii. Station yards and sidings – Extension or alteration to yard layouts, sidings, and platforms.

c) Bridges and Floods –

i. Yearly record of rainfall showing month wise distribution.
ii. Important repairs and renewal to bridges, details of extensive repairs to bridges, dismantling and rebuilding bridges, strengthening of girders, renewal of girders, extension of bridges and through renewal of sleepers, should be shown. Ordinary repairs need not be recorded.
iii. Damage due to floods – Extent of damage with particulars of rainfall, arrangements made for labor and material, time and labor spent for restoration and approximate cost. Cause of damage and notes of remedial measures.
iv. List of Railway affecting Works with brief history.
v. List of vulnerable locations, where stationary watchmen are to be posted.

d) Miscellaneous –

i. Encroachment and steps taken to remove them.
ii. Infringement particulars.
iii. Accidents attributable to Permanent Way with details.
iv. Any other important information if necessary.

e) Scrutiny of Inspections: The entries made in the section registers shall be brought up to date from time-to- time and these shall be scrutinized at the beginning of every year by IMD In-charge.

SPECIFIC DUTIES OF STORE IN-CHARGE IN IMD

248. Maintenance of P-Way Store: - One Executive shall be nominated as store in charge in IMD and shall: -

a) Maintain his store duly maintaining all records in the store module of SAP.
b) Keep his store premises neat and clean, and all P. Way Material properly stacked in an identifiable manner. The Material should be stacked in different categories and in different locations duly marking the boards for new, second hand and unserviceable or obsolete Material.

c) Dispose off all the scrap and obsolete material quickly as per the laid down procedure in this regard. He/She should maintain minimum imprest of the store as decided by Chief Track Engineer depending on type and condition of track, traffic density, terrain and other misc. features. Similarly, IMSD in-charge will be responsible for the material issued to them.

SPECIFIC DUTIES OF USFD IN-CHARGE IN IMD

249. USFD activity in general will be outsourced. USFD in-charge shall organise and monitor quality of USFD, calibration and sensitivity of the USFD testing equipment, ensure testing as per the laid down frequency in the jurisdiction of the IMD. He/She shall spend 2hrs with each USFD team fortnightly. He shall bring in the notice in backlog of USFD testing to IMD in-charge. Any Backlog in USFD testing shall be brought to the notice of IMD in-charge, so that arrangement in advance can be done. He/She shall keep USFD testing equipment in working order.

SPECIFIC DUTIES OF TRACK MACHINE IN-CHARGE IN IMD

250. He/She shall ensure that machines are utilized in continuous stretches as per planned programme avoiding frequent shifting of the machines. He/She shall ensure suitable accommodation for machine staff as required. He/She shall periodically inspect track machines working in his/her jurisdiction as per specified schedule. He/She shall monitor the output and quality of work done by the machines. In case the quality of work done by the machine is not satisfactory, he/she shall investigate and take suitable remedial measures in coordination with IMD In-charge. He/She shall co-ordinate and ensure for repairing of machine. In the stretches where the requirement of tamping is more than normal. He/She will investigate the cause and suggest suitable remedial actions to reduce the normal cycle. He/She will also be responsible for depot of the machine allotted to the IMD.

DUTIES OF JUNIOR EXECUTIVE

251. Record of Work of Artisans (Junior Executives): - Each artisan will be supplied with a diary in which entries will be made by the artisan showing his movement and the details of daily work performed by him. The IMSD Sectional will scrutinize the work during his inspection and make suitable observations in the artisan's diary. At the end of the month, these diaries will be sent to the Office of the IMSD In-charge.

252. Periodical (fortnightly) oiling and greasing of SEJs, Turnout fittings checking and retightening of fastenings at SEJs and other sleepers, if necessary. Tighten loose fittings and replacement of missing fastenings not requiring lifting or slewing of track. During his movement in the section he should keep a watch for sun kinks, loose or missing fastening which may result in buckling or any damage to LWR/CWR and SEJs.

253. He/she shall be proficient in execution of rail cutting, rail drilling, attending housing of switch, Operation of OTT, maintenance of SSDs/ Back drive, opening of SEJs and detection of crack by lens, greasing of Plate Screw Bolts and attending track fitting on bridges.

254. Nominated Junior Executive should be proficient in AT Welding and Motor Trolley driving.

255. He/she shall be responsible for keeping watch on Keyman, Patrolman and Stationary Watchman and work as Patrolman wherever required.

256. He/she shall assist IMSD sectional in attention of track and machine working.

DUTIES OF MTS

257. Periodical (fortnightly) oiling and greasing of SEJ, checking and retightening of fastenings at SEJ and other sleepers, if necessary. Tighten loose fittings and replacement of missing fastenings not requiring lifting or slewing of track in accordance with. To watch for sun kinks, loose or missing fastening which may result in buckling or any damage to LWR/CWR and SEJ.

258. He/she shall be proficient in rail cutting, rail drilling, attending housing of switch, Operation of OTT, opening of SEJs and detection of crack by lens, greasing of Plate Screw Bolts, attending track fitting on bridges.

259. Nominated MTS should be proficient in Motor Trolley operation.

260. He/she shall assist IMSD sectional/Junior Executive in attention of track and machine working.

261. MTS working as keyman shall inspect his entire beat in a week (@10 Tr.Km/day in Double line section and 8 Tr.Km/day in single line section) in rotation with outsourced Keyman.

DUTIES OF OUTSOURCED STAFF

GANG MATE, KEYMAN, PATROLMAN

262. IMSD In-charge shall ensure that every track maintainer/patrolman (outsourced) has knowledge of safety rules and competency certificate should be issued before deploying them on track. Gang mate, Keyman and Patrolmen shall be responsible for the maintenance and safety of track.

263. Gang Mate (Outsourced) shall ensure that:

a) The safety equipment and engineering signals supplied to the Gangs are kept in good condition and ready for use and that every person in the Gang has correct knowledge of all these safety equipment and engineering signals.

b) The Gang Mate shall be responsible for warning the Gang timely to enable them to get clear off the track. Gang Mate (outsourced) shall be responsible for the safe custody of tools used by himself, the Keymen (if provided by the P. Way contractor) and all Track Maintainers. Gang Mate should see that Track Maintainers while working on track must remove their tools clear off the track on the approach of a train.

c) Ensure attendance of gang and communicate to IMSD officials. He/she shall be responsible for safety vest of the gang and be responsible for medical condition of gang. No work, which may involve danger to trains, should be undertaken by the Gang Mate except under the personal supervision of the IMSD Sectional/ IMSD In-charge, a competent DFC servant authorised by special instructions.

d) He shall ensure compliance of the instructions given by the P. Way officials of the DFC in a reasonable time.

e) In case, he notices any danger to track, he shall take action for protection of

track and pass on information to DFC officials.

264. Duties of Keyman:

a) The Keyman shall inspect the entire beat once a day or as decided by competent authority on foot, both the tracks and bridges, and return along the opposite rail to that taken on outward journey in case of single line. On double line, Keyman will carry out one round of inspection in morning hours by going along up line and then returning along down line or vice-versa. If he considers that the line is likely to be rendered unsafe, or that any train is likely to be endangered in consequence of any defect in the permanent way or works, or due to abnormal rain or flood or any other occurrence, he shall protect the track and immediately inform DFC officials by pressing the panic button of GPS or any other suitable mode of communication.

b) In the event of an accident, he should lookout for broken fittings of wagons and track components and see that these are not disturbed until these have been seen and recorded by a responsible DFC official.

c) While walking, the Keyman should look for defects such as missing fittings, loose fish bolts, loose bolts on joggled fish plates, SEJ, fittings in switches and crossings, fittings on girder bridges, broken or notched sleepers, broken plates and attend them as necessary.

d) Keyman shall carry two red flags and one green flag, ten detonators, a clip applicator, Alloy Spanner D/E, Spanner Tubular, Tapered Gauge, Tapered Pin, Keyman Diary, spare fittings and a rail closure of 30 mm size.

e) If the Keyman finds that fittings are consistently becoming loose even after repeated attention, he should report the matter to the Gang Mate, IMSD Sectional/ IMSD In-charge. If the defects are serious, it should be informed at once to the Gang Mate of the gang, duly protecting the line in the meantime, if necessary, according to rules.

f) The Keyman shall keep a special watch on the rails and welds marked for observation by the USFD team. If the Keyman notices any condition of danger, such as broken rail, broken weld or wash away of ballast, theft of fittings in large numbers etc., the line shall be protected at once as per rules, and the Keyman shall take such action as is possible and report the matter to the Gang Mate, the nearest Station Master and IMSD Sectional/IMSD In-charge.

g) Keyman, in addition to the normal round of the entire beat inspection and tightening of loose fittings, should attend (like cleaning of bushes, Dee-weeding etc.) one OHE mast /hectometre post on one line thoroughly on every day and carryout other works assigned by Mate. This thorough attention should consist of checking of each bolt and fittings including fittings of fishplates, joggled fishplates, & PSC/other sleepers in these OHE mast /hectometre post of the beat during that day and tightening them, wherever required. Missing ERCs, liners, keys and other missing fittings shall be recouped by Keyman, who would also ensure correct driving of fittings in this stretch.

h) To watch for sun kinks, loose or missing fastening which may result in buckling or any damage to LWR/CWR and SEJ. On noticing any buckling or damage to track, the Keyman shall take necessary action to protect the track and report the same immediately to Station Master ,IMSD Sectional and IMSD in-charge. However, the Keyman will continue to perform duties of daily inspection. To keep a sharp vigil in cold mornings, especially during winters to detect any fractures. In case of rail/weld fracture, the Keyman shall take prompt action to

protect the track and carry out emergency repairs to permit the restoration of traffic promptly and report to IMSD Sectional/IMSD In-charge and nearest Station Master of DFC, however the train movement shall be permitted only by an DFC employee.

i) When materials, such as dynamo-belts, engine parts etc are found on-track, the Keyman should collect them and arrange for handing them over to the nearest Station Master.

j) The Keyman shall maintain the Keyman's diary supplied to them up to date wherein he shall write all special work done, missing fittings and their recoupment with location and date. The special fittings like joggled fishplates and other materials provided in the section, which are vital for safety and for restoration of traffic should also be mentioned in the book.

k) He should carefully watch the passing train on any line for any unusual like hanging part/ hot axle / any abnormal sound/ brake jamming etc. and in case of unusual immediately inform the nearest SM.

265. Duties of Patrolman / Stationary watchman: -

a) Monsoon Patrolman shall walk to and fro over the beat in accordance with the chart pertaining to the "patrol-section" looking out for subsidence, slips, signs of erosion, trees blown across the track during storms or any other causes likely to endanger the safety of track. He should keep a watch on bridges and their approaches. He should apprehend damage when the flood exceeds danger level at any of the bridges, when there is damage to the protection work on bridges or on their approaches even before danger level is reached, the water on one side of the embankment is at a much higher level than on the other side, when any obstruction such as a fallen tree is blocking the waterway of a bridge. If the track shows signs of a settlement or any portion of the line is likely to be rendered unsafe due to abnormal rain, flood or any other cause; take immediate steps to stop trains . When no danger is apprehended, stand on the cess on the left-hand side facing the train and exhibit his number plate, turning the light of his lamp onto it, so that the number can be seen from the passing train. The Patrolman should also blow the whistle when the engine and the brake-van of the train passes. Exchange the reports as to the conditions on their beats with adjacent patrolmen and stationary watchmen on the way. On double line he should repeat this procedure alternately on UP and DN tracks. A Mobile Watchman is posted on vulnerable location due to monsoon, unconsolidated track in summer or temporary repair locations.

b) Hot Weather Patrolman - He shall patrol the track during the hottest part of the day, to look for prominent kinks, incipient buckles or tendency towards buckling. Protect the track at the site of the prominent kinks, incipient or actual buckles and report the same to nearest Station Master and IMSD Sectional/ IMSD In-charge immediately. Patrolman should walk over his beat slowly over one rail in one direction and on the other rail in the return direction. On double lines, repeat this procedure alternately on UP and DN tracks. Be vigilant and look out for kinks in the rail, especially during the hottest part of the day. When a kink is observed, immediately examine at least 100 sleepers ahead and in the rear of the kink for any floating/misaligned condition of track. Should the track reveal a floating/misaligned condition, under which a buckle may be anticipated, or the patrolman has detected actual buckling of track, the patrolman will take immediate steps to protect the affected portion and continue to display of

hand signals as per rules in force. After protecting the track, the patrolman will arrange to advise the Gangmate, IMSD Sectional/IMSD In-charge of his apprehension of a buckle/actual buckle.

c) Cold Weather Patrolman - He shall patrol the track during the coldest part of the night and lookout for weld/rail fractures and excessive gaps at SEJ. The patrolman will take immediate action in case of weld/rail fractures and excessive gaps at SEJ to suspend the traffic and protect the line and report to nearest Station Master, IMSD SECTIONAL/IMSD In-charge. He shall walk over the beat in single line along one rail in one direction and on the other rail in the return direction.

INSPECTION SCHEDULE AND AUTHORISE LEVEL OF SUPERVISION

266. Inspection Schedule of IMD/IMSD officials is as under:

Items of Inspection	**IMD In-charge**	**IMSD In-charge**	**IMSD sectional**
Foot inspection	10% per IMSD per year.	100% in 2 months in rotation with sectional	100% in 2 months in rotation with In-charge
Curves	5% curves having TQI value less than 100 in successive TRC runs	All curves having TQI value less than 100 or OMS peaks more than 0.2g in last TRC/ OMS run in rotation with sectional and other curves once in a year in rotation with sectional	All curves having TQI value less than 100 or OMS peaks more than 0.2g in last TRC/ OMS run in rotation with In-charge and other curves once in a year in rotation with in-charge
*Point & X-ing- Main line	Once in a year	Once in 3 months in rotation with sectional	Once in 3 months in rotation with In-charge
P & X -ing Joint Inspection with S&T Dept.	-	Once in 3 months in rotation with sectional	Once in 3 months in rotation with In-charge
Point & Crossing - LL, Sidings	-	Once in a year in rotation with sectional	Once in a year in rotation with In-charge
Steel channel sleeper	-	Once in 3 months in rotation with Sectional	Once in 3 months in rotation with In-charge
AT welding	Witness One weld per month per IMSD	Witness one weld/ month along with checking of welding equipment	-
USFD test check	2 hrs. with USFD team in 3 months	2 hrs. with USFD team monthly	2 hrs. with USFD team monthly

Inspection of Yard lines	–	Once in 6 months in rotation with Sectional	Once in 6 months in rotation with In-charge
Dead end	–	Once in a year in rotation with Sectional	Once in a year in rotation with In-charge.
Inspection of Land boundary	At his discretion	Once in a year	As and when construction activity noticed near Railway Boundary
Trolly inspection	Once in 6 months	Once in 2 months	-
FP/LV	Once in a month	Once in a month	Once in a month
Monsoon Patrolling	During FP once in a month	During FP in night once in a month	Once in 15 days
Hot weather Patrolling	During FP in Day once in a month	During FP in Day once in a month	Once in 15 days
Winter Patrolling	During FP in night once in a month	During FP in night once in a month	Once in 15 days
TRC run	Accompany Every run	Accompany Every run	Accompany Every run
OMS run- Monthly	Review OMS results in every month	Accompany Every run	Accompany Every run
CWR/SEJ	Twice in a year (During hottest and coldest months)	Once in 15 days in rotation during 2 hottest & 2 coldest month, otherwise once in 2 months in rotation with sectional	Once in 15 days in rotation during 2 hottest & 2 coldest month, otherwise once in 2 months in rotation with In-charge
High Embankment, Cutting	Once in a year before monsoon of locations given trouble in last monsoon season	Once in a year before Monsoon	Once in a month during monsoon
Side drains, catch water drains, bridge waterways	Once in a year before monsoon of locations given trouble in last year.	Once in a year before Monsoon	Once in a month during monsoon
RAW/RAT	Twice in a year (before & after monsoon)	Accompany IMD in charge	Accompany IMD in charge
Tunnel	Once in a year before monsoon	Once in a year before monsoon and every month during monsoon	-

*Every year, atleast One detail and three short inspection of point & crossing has to be done at IMSD level. All efforts should be made to club this inspection with Joint point & crossing inspection with S&T.

267. Inspection Schedule of Dy.CPM is as under: -

Items of Inspection	**Schedule**
Curves	At his discretion
Trolley inspection	Once in a year
FP/LV	Once in a month
Monsoon Patrolling	During FP once in a month
Hot weather Patrolling	During FP in Day once in a season
Winter Patrolling	During FP in Night once in a season
TRC run	Accompany Every run
OMS run- Monthly	Review OMS results in every 3 months
CWR/SEJ	All CWR where Anti creep device is breaking
High Embankment, Cutting	Locations of Bridge approaches given trouble in last monsoon season.

268. Work chart and authorised level of supervision: -

Sl. No	**Nature of work**	**Lowest level of staff/ Supervisor in charge of work**
1	**Maintenance operation**	
(a)	Mechanised Tamping, Lifting (general lift), Alignment, Minor alignment of curves, Deep screening etc.	Executive/P-way
(b)	Manual Packing, Alignment	Junior Executive
(c)	Lifting/Lowering of track	Executive/P-way
(d)	Lifting, aligning, packing etc., in case of emergencies at temperatures higher than those permitted	Executive/P-way
2	**Rails, sleepers and fastenings**	
(a)	Packing or renewal of single isolated sleeper not requiring lifting or slewing of track	MTS
(b)	Renewal of fastenings not requiring lifting	MTS/Keyman
(c)	Renewal/recoupment of fastenings requiring lifting	Executive/P-way
(d)	Casual renewal of sleepers and fastenings over long stretches	Executive/P-way

(e)	Renewal of Defective rails	Executive/P-way
(f)	Carrying out welding of rail joints at site	Executive/P-way
3	**Ballast**	
(a)	Making up of shortage of ballast in shoulders at isolated places	Jr. Executive
(b)	Replenishment of ballast & Checking ballast section before the onset of summer	Executive/P-way
(c)	Screening of ballast other than Deep screening	Executive/P-way
(d)	Deep Screening	Executive/P-way
4	**Curve Realignment**	
(a)	Minor Realignment of curves	IMSD Sectional
(b)	Major realignment of curves under special instructions from IMD In-charge	IMSD Sectional/In-charge
5	**Hot weather work**	
(a)	Imposing speed restriction if the temperature exceeds t_d + 20° Celsius after maintenance work is completed manually or by machines, till period of consolidation.	IMSD Sectional
(b)	Organizing hot weather patrolling during summer months	IMSD Sectional
(c)	Ensuring that hot weather patrolman turns out promptly for duty during the required period of patrolling and during other periods when rail temperature exceeds t_d + 20° Celsius	IMSD Sectional
(d)	Hot weather patrolling, watching stability of track, presence of large number of sleepers with defective packing, alignment of track, checking if the profile of ballast is disturbed, tendency for lateral/vertical deformation of track	Hot weather patrolman
(e)	Inspection in summer months and checking on the working of hot weather patrolmen.	IMSD Sectional
6	**Cold weather patrolling**	Cold weather patrolman
7	**De-stressing - all operations regarding De-stressing**	IMSD Sectional
8	**Rail fracture**	
(a)	Emergency repairs	Keyman/ Trackmen with valid competency Certificate
(b)	Passing the train at restricted speed of 10 KMPH	MTS or above

(c)	Temporary repairs	Executive/P-way
(d)	Permanent repairs	Executive/P-way
9	**Buckling**	
(a)	Protection of track and secure safety of trains in case of buckling, rail fractures, or any abnormal behaviour of track	Patrolman
(b)	Emergency repairs	Executive/P-way
(c)	Permanent repairs	IMSD Sectional
10	**Emergencies- Action in case of damage to track following derailments, breaches etc.**	IMSD Sectional/In-charge
11	**SEJ**	
(a)	Checking of SEJ, oiling and greasing and re-tightening/ renewal of fittings once a fortnight	Keyman
(b)	Inspection of SEJ	IMSD Sectional

CHAPTER – 3

WELDING OF RAILS

AT WELDS

301. Rails are manufactured domestically in the length of 120 m/130 m. After manufacturing joints are made and 260 m long panel is prepared and transported by BFR to site. In addition to this 13m/26 m rails are also manufactured and supplied for casual uses. In WDFC imported rails of 25m have been used. It is desirable that there should be minimum fish plate joints.

302. For longer length, rails are either jointed by fish plate joint, AT Welds/Flash-Butt Welds.

303. **Alumino-Thermic welding (AT Welding):** This welding is done by exothermic chemical reaction between Fe_2O_3 and Aluminum thereby releasing Fe and the slag Al_2O_3. Ends of rails are preheated for proper bond with molten Fe. Short pre-heating is done by air-petrol fuel mixture, Oxy-LPG and compressed air petrol fuel mixture.

a) Composition of thermit welding team shall be as under:-

Sl. No.	Designation	Numbers
1	Welder Grade I/Grade II	1
2	Welder Grade III/Skilled Artisan	2
3	Helper Khalasi/Khalasi	5
4	Gangman	As per workload

b) In case of Head Hardened Rails, procedure of welding, post welding, heat treatment & gap of welds for Rails shall be as per OEM instructions or as per special instructions issued by CTE.

c) In case of junction welds (different UTS of rails), procedure of welding shall be as per RDSO guidelines/OEM instructions/ special instructions issued by CTE.

d) Before allowing welding, the welding operators Competency certificate and its validity shall be checked.

304. Selection of rails to be welded:- For both new as well as second hand rails, before welding it should be ensured that the end bends of the rails are within +0.5 mm, -0 mm in vertical and + 0.5 mm in lateral direction when checked with one metre straight edge as shown in Fig. 3.1(a), (b) and (c) in Annexure - 3/1 and fish boltholes are to be eliminated to make the weld amenable for USFD testing for lack of fusion. New rails to be welded shall conform to the tolerances stipulated in the specification IRS-T-12 (Indian Railway Specification for Flat Bottom Rails).

a) Rails shall be free from corrosion or excessive wear. The height of rail and width of railhead shall not be less than the values as indicated below.

Rail section	Normal height of new rail (mm)	Minimum height of old rail (mm)	Width of head of new rail (mm)	Minimum width of head of old rail (as measured at the gauge corner) (mm)
60 kg/m	172	163	72	66

b) Rails shall be tested before welding with Ultrasonic Flaw Detector apart from visual inspection, so that rails having cracks and internal flaws are not welded. The rail flange bottom is to be visually inspected to ensure freedom from defects like dent, notch, corrosion, etc. The rolling marks on the web of rails shall be checked before welding to ensure that generally rails of different Grades of rails are not welded together.

c) The rail ends to be welded shall be checked and aligned both in horizontal and vertical planes to the dimensional limits given in Fig 3.2 Annexure - 3/1. If required, rail ends may suitably be cropped by sawing & using abrasive disc cutter and not by flame cutting.

305. Portion for welding- Thermit welding portions and consumables to be used for welding shall be from RDSO approved sources as per latest IR standards specification for fusion welding of rails by Alumino-Thermit process (SN. IRST-19-2021) only. Welding Parameters viz. preheating time, preheating pressure, mould waiting time etc., as approved by the RDSO for the source and particular welding technique shall be ensured, while executing the AT weld at site.

a) Shelf life of portion: No specific shelf life has been indicated for AT welding portions. AT welding portion is sensitive to moisture. Once the portion absorbs moisture, the same cannot be removed even by drying as chemical reaction takes place in the ingredients. Such portion should not be used for welding. Portions should be used in rotation i.e. first in-first out. Following procedure may be adopted for permitting use of portions beyond two years after the date of manufacturing. One sample per batch of 300 or part thereof shall be tested for reaction test. If the reaction is normal, the batch represented by the sample can be used without further tests. In case the reaction is found to be quiet or boiling, a test joint should be made from one more sample selected from the batch and joint should be tested for Weld Metal Chemistry Test and Load deflection test(as per latest IR standards specification for fusion welding of rails by Alumino-Thermit process (SN. IRST-19-2021)). These tests should be conducted at the Flash Butt Welding Plant. If the values obtained in above tests are within the specified values the batch represented by the sample can be used, otherwise batch should be rejected. The rejected portions are to be disposed-off by igniting five portions at a time in pit away from the store.

b) Storage and transportation of Portions: - The manufacturer of portion shall provide guidelines containing best safety practices with every package for guidance of the user covering various aspects in safe handling, storage, transportation and disposal of Thermit materials. Tubes of igniters should be stored in a locked steel cupboard, or other secure steel container. On no account must these be stored in the same building as the portions. The package containing igniters should be kept in tin cases/steel containers. For detailed guidelines on storage and transportation standards specification for fusion welding of rails by Alumino-Thermit process (SN. IRST-19-2021), shall be referred.

306. Equipment, staff and Traffic block for welding: - The list of one set of AT welding equipment by short pre-heating process is given in Annexure - 3/2. A minimum traffic block of 70–75 minutes duration, depending upon the type of preheating technique adopted, should be obtained for complete operation of welding and to ensure good quality of AT weld. The traffic can be allowed only after 30 minutes have elapsed after welding of the joint. Suitable speed restriction shall be imposed until the grinding operation is completed. A Thermit welding done in-situ shall be joggled fish plated with two clamps and supported on wooden blocks of length 300-450 mm until tested as good by USFD. Painting of weld collar should be done as approved by CTE on all welds to protect them against corrosion immediately after the welding. The painting should be repeated after 4 years in non corrosive environment and every year in corrosive environment. Each joint shall have a distinctive mark indicating month, year of welding, agency and welder/supervisor identification code number (as appearing on his competency certificate) at non-gauge face side of AT weld on head as detailed in IR standards specification for fusion welding of rails by Alumino-Thermit process

307. Training and certification of welder and welding supervisor shall be ensured as per annexure I of Indian Railway standards specification for fusion welding of rails by Alumino-Thermit process. Welding shall be carried out as per approved welding procedure laid down in Indian Railway AT Welding manual and OEMs instructions (if any).

a) Acceptance tests: - All the welded joints shall be cleaned and examined carefully to detect any visible defect like cracks, blow holes, shrinkage, mismatch, surface finish (smooth surface finish required) etc. Any joint, which shows visible defect, shall be declared defective. The bottom of the joint shall be checked by feeling with fingers as well as inspected with the help of a mirror for presence of 'fins' at the parting line of the mould. If fin is observed in any joint, the joint shall be declared defective. All finished joints shall be checked for dimensional tolerances

i. Vertical alignment: Variation not more than +1.0 mm, – 0.0 mm measured at the end of one metre straight edge.
ii. Lateral alignment: Variation not more than ± 0.5 mm measured at centre of one-metre straight edge.
iii. Finishing of top surface: + 0.4 mm, – 0.0 mm measured at the end of 10 cm straight edge.
iv. Head finishing on sides: ± 0.3 mm over gauge side of the rail head measured at the centre of 10 cm straight edge.

All the welded joints shall be ultrasonically tested as per the provisions of 'Indian Railway Manual for Ultrasonic testing of rails and welds' as early as possible in any case not later than 30 days. Subsequent USFD testing of AT weld shall be done as per provisions given in IR Manual for USFD Rail & Welds. In addition, one out of every 100 joints shall be selected at random within one month of welding and subjected to hardness, transfers load, deflection test as per IRST -19-2021 to ensure that the joint shall comply with the provisions laid down there in. The cumulative number of AT welds found defective in ultrasonic testing and in other criteria shall be limited to 1%.

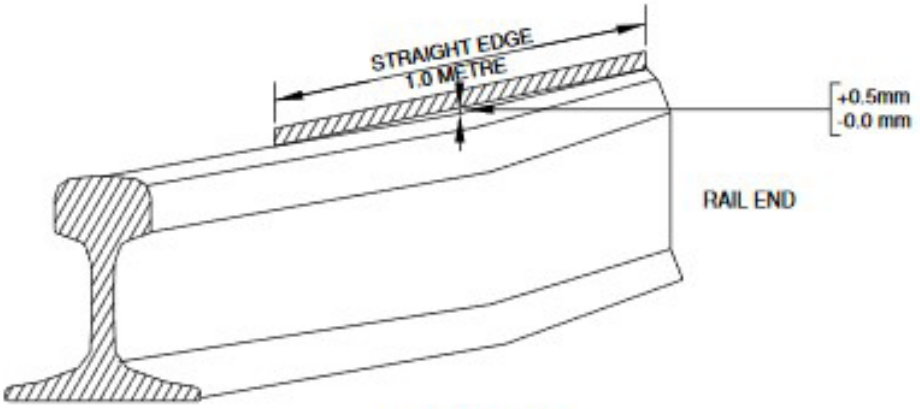
308. Joggled fishplates with far end bolts/clamps shall be provided on AT welds, which have undertaken traffic equal to or more than 50% of stipulated fatigue life (GMT) of the rail. Joggled fishplate with clamps on good AT welds shall be provided on banks having height 5 m or more. Joggled fish plate with clamps on good AT welds shall be

provided on bridges (having length of waterway as 100 m or more) and on its approaches upto 100 m length. Joggled fishplate with clamps on good AT welds shall be provided on curves of 3° or sharper.

309. Record of joint geometry: - In case of welding by outsourced agency, the details of geometry of each joint shall be jointly signed by the firm's and DFC representative and kept as record. Any joint found not conforming to the above stipulations should be cut and re-welded, free of cost, by the firm.

310. List of Equipment- For Alumino–Thermic welding of rail joints by short preheating process per welding team Tools and equipment viz. Pre-heating arrangement, Crucible and Mould used for A.T welding shall be as per the Approved A.T welding technique of a particular firm by the RDSO.

Annexure 3/1



ELEVATION

FIG :3.1(a) TOLERANCE ON THE END BENDS IN THE VERTICAL PLANE

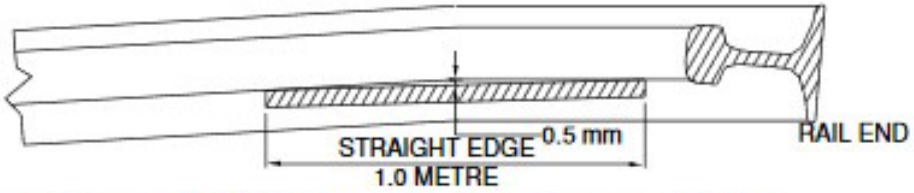
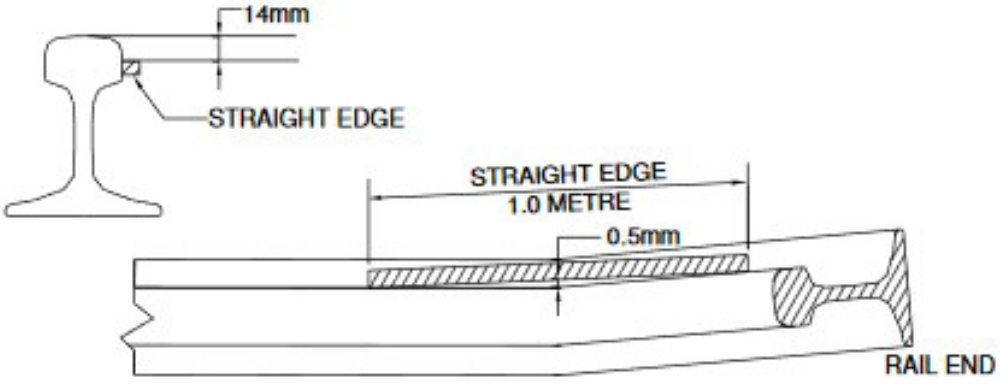


FIG :3.1(b) TOLERANCE ON THE END BENDS IN THE HORIZONTAL PLANE



PLAN

FIG :3.1(c) TOLERANCE ON THE END BENDS IN THE HORIZONTAL PLANE

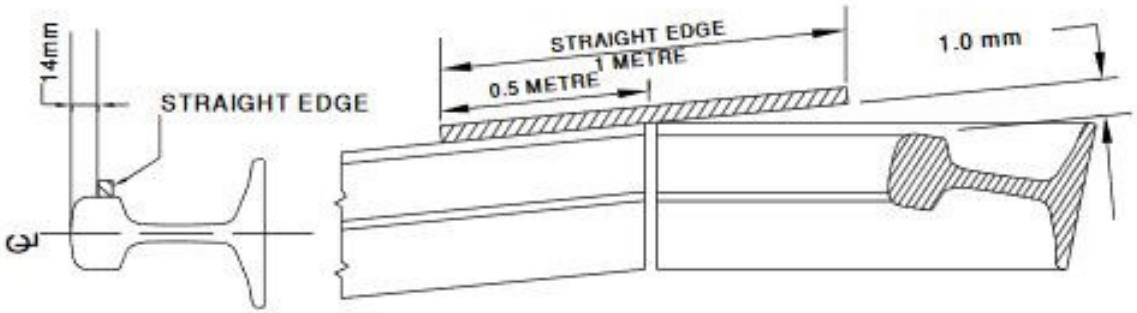


FIG. 3.2 (a) TOLERANCE FOR LATERAL MISALIGNMENT AT THE TIME OF WELDING

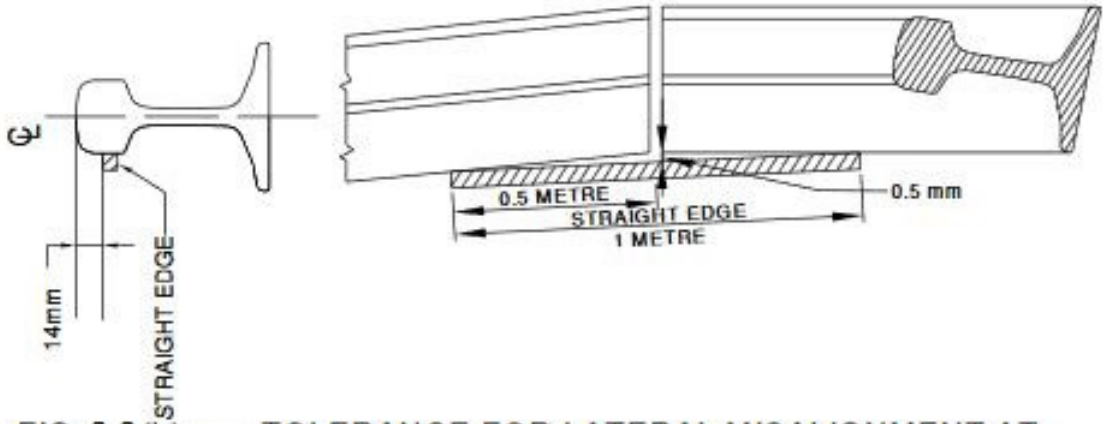


FIG. 3.2(b) TOLERANCE FOR LATERAL MISALIGNMENT AT THE TIME OF WELDING

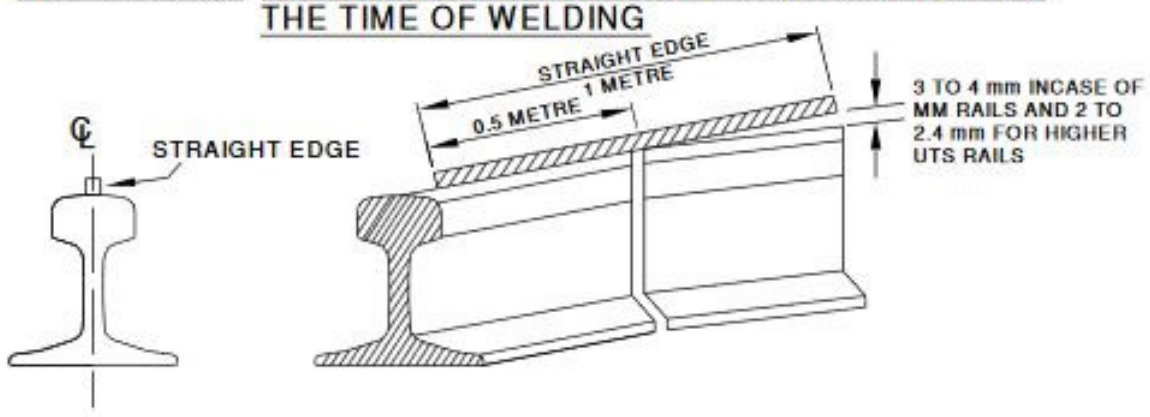
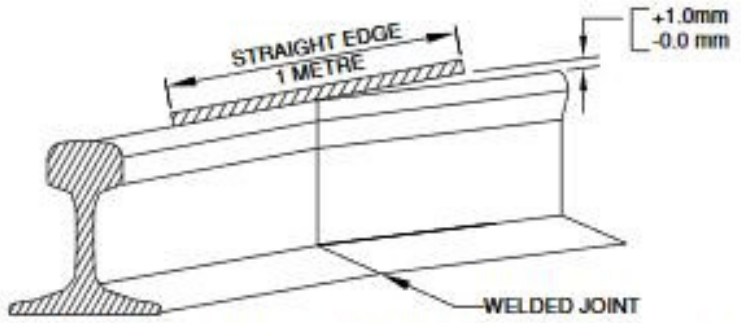
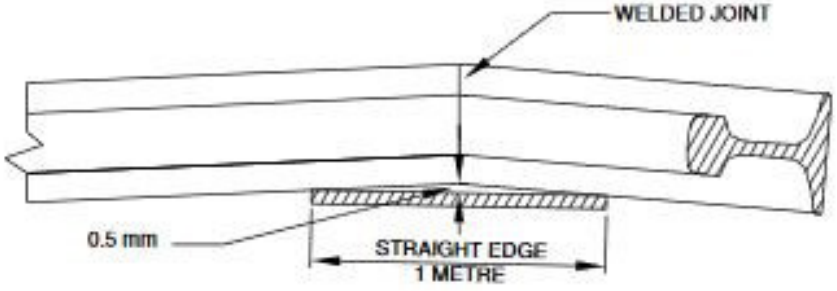


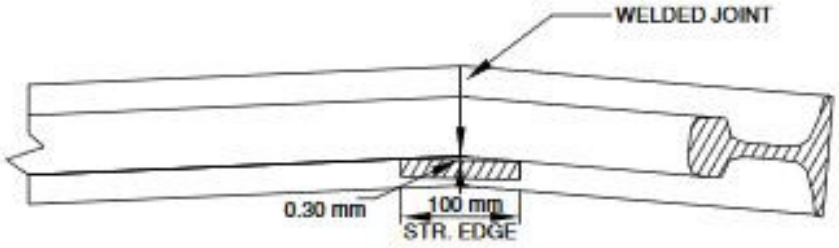
FIG. 3.2(c) TOLERANCE FOR VERTICAL ALIGNMENT AT THE TIME OF WELDING



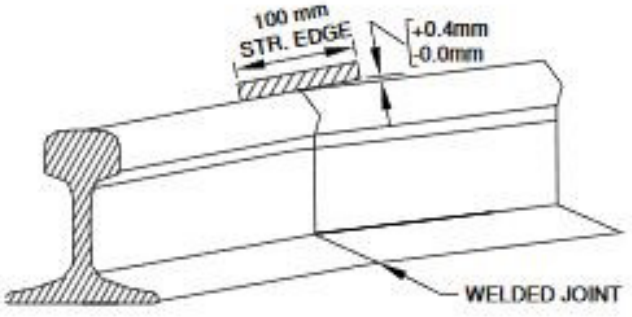
TOLERANCE FOR VERTICAL MISALIGNMENT OF WELDED JOINT



TOLERANCE FOR LATERAL MISALIGNMENT OF WELDED JOINT



TOLERANCE FOR FINISHING ON SIDES OF HEAD OF WELDED JOINT



TOLERANCE FOR FINISHING TOP TABLE SURFACE OF WELDED JOINT

Annexure 3/2

List of Equipment for Alumino–Thermic welding of rail joints by short preheating process per welding team

Sl. No.	Description	Quantity		Life in terms of No. of joints
		Mass welding	Repair welding	
A.	**PRE-HEATING EQUIPMENT**			
A1.	**Air- Petrol Pre-heating**			
1.	Pressure tanks with pressure gauges complete	2 Nos.	1 No.	500
2.	Vaporisers (burner) complete	2 Nos.	1No.	500
3.	Nozzle prickers	4 Nos.	2 Nos.	50
4.	Nozzle keys	1 No.	1 No.	500
5.	Vaporiser stand	2 Nos.	1 No.	1000
6.	Goose neck attachment to vaporiser	4 Nos.	2 Nos.	50
A2.	**Compressed Air-Petrol Pre-heating**			
1.	Suitable compressor system with pressure gauges	2 Nos.	1 No.	Periodical maintenance half yearly 500
2.	Torch (Burner) complete	2 Nos.	1 No.	300
3.	Torch (burner) keys	1 No.	1 No.	500
4.	Torch (burner) stand	2 Nos.	1 No.	1000
5	Goose neck attachment to vaporiser	4 Nos.	2 Nos.	50
A3.	**Oxy- LPG Pre-heating**			
1.	Oxy- LPG torch (burner)	2 Nos.	1 No.	150-200
2.	Oxygen cylinder with pressure gauge	2 Nos.	1 No.	100
3.	LPG cylinder with pressure gauge	2 Nos.	1 No.	100
4.	Torch (burner) stand	2 Nos.	1 No.	500
5.	Connecting Hose pipe	4 Nos.	2 Nos.	75-100
B.	**OTHER EQUIPMENT**			
1.	Crucible complete- Crucible shell & Crucible lining	2 Nos.	1 No.	500 & 50
2.	Crucible caps	2 Nos.	1 No.	50

3.	Crucible forks	2 Nos.	1 No.	500
4.	Crucible stands	2 Nos.	1 No.	1000
5.	Crucible rings	2 Nos.	1 No.	500
6.	Mould pressure (clamp)	2 sets	1set	1000
7.	Cleaning rod round	2 Nos.	1 No.	500
8.	Tapping rod	1 No.	1 No.	1000
9	Straight edge 1 m long	2 Nos.	1 No.	--
10.	Straight edge 10 cm. long	2 Nos.	1 No.	--
11.	Aluminium/steel rod for thermal plugging	2 Nos.	2 Nos.	--
12.	Leather washers for pump	4 Nos.	2 Nos.	100
13.	Gap gauges and height gauge	2 Nos.	1 No.	--
14.	Filler gauge	2 Nos.	1 No.	--
15.	Tools for punching the marking	2 Sets.	1 Set	--
16.	Mould shoes	6 Pairs	2 Pairs	100
17.	Stop watch	1 No.	1 No.	--
18.	Pyrometer/Thermal chalk for measurement of rail temperature	1 No.	1 No.	--
19.	Wooden wedges for rail alignment	24 Nos.	12 Nos.	--
20.	First aid box filled with medicines bandages, cotton etc.	1 No.	1 No.	--
21.	Mirror 150 x 100 mm with handle	2 Nos.	1 No.	--
22.	Tool box containing –			
i)	Hot sets (chisels) (for Emergency use only)	2 Nos.	2 Nos.	--
ii)	Funnel tin (for pouring petrol)	1 No.	1 No.	--
iii)	Adjustable spanner	1 No.	1 No.	--
iv)	Hammer 1 kg	1 No.	1 No.	--
v)	Sledge hammer double panel 5 kg.	2 Nos.	2 Nos.	--
vi)	Steel wire brush	1 No.	1 No.	--
vii)	Blue goggles	2 Pairs.	1 Pair.	---
viii)	Paint brush 50mm	1 No.	1 No.	--
ix)	Slag container (bowl)	2 Nos.	1 No.	500
x)	Asbestos gloves	4 Pairs.	2 Pairs.	500
xi)	Hose clips	4 Nos.	4 Nos.	--

xii)	Pliers	1 No.	1 No.	--
xiii)	Rail file 350 × 40 × 6 mm (For Emergency use only)	4 Nos.	2 Nos.	--
23.	Weld trimmer(Cutter)	1 No.	1 No.	100
24.	Insulation hood for control cooling(for 110 UTS rail welding)	1 No.	1 No.	--
25.	Rail profile guided grinding trolley (Grinding wheel).	1 No.	1 No.	50
26.	To ensure quality, protective clothing, shoes gear & Leather gloves.			

Note:

1. For crucible lining, Magnesite powder and sodium silicate should always be available.
2. All the items should be replaced on condition basis.

FB WELDS

311. Flash Butt Welds - Flash butt welding uses the principle of heating and softening of interface by electric current and then butting the rail ends under pressure for welding. Weld Parameters for different rail sections/chemistry have been prescribed by manufacturers and are unique to the welding plant. These shall be approved by RDSO in accordance with Para 5.6 of "Indian Railway Manual for flash butt welding of rails". The welding operators are also to be certified by prescribed authority.

312. Rail Welding by Mobile flash butt welding plant: -

a) Flash butt welding of new or second handrails shall be carried out as per detailed procedure given in "Indian Railway Manual for Flash Butt Welding of Rails", which gives the details of type and suitability of rails to be welded, pre-welding inspection, preparation of rail ends, procedure of execution of welding, finishing of welded joints, acceptance tests etc.

b) Quality Assurance Program for mobile flash butt welding shall be got approved from RDSO as detailed in Annexure - X of Indian Railway manual for flash butt welding of rails. After having obtained approval of QAP from RDSO, approval for field welding shall be granted after execution of 30 welds on track (carried out in two shifts), if they satisfy the weld acceptance criteria defined in Indian Railway manual for flash butt welding of rails, (visual, dimension, ultrasonic, hardness, transverse testing, macro and micro examination). Flash butt welding work shall be carried out in presence of IMD In-charge and the approval shall be granted by Chief Track Engineer. The welding team is also to be certified by prescribed authority as per Para 13 of Indian Railway Flash Butt welding manual.

c) Suitability of rails for welding: - For suitability of old/new rails for flash butt welding, "Indian Railway Manual for Flash Butt welding of Rails" should be referred.

313. Acceptance Tests: -

a) Visual Inspection: All welds and rails shall be inspected visually for welding, trimming, clamping or profile finish imperfections, such as tears, cavities, cracks, damage and thermal damage, in particular, in the electrical contact ar-

eas. There shall be no sign of tearing, chisel mark or cavity in weld metal due to trimming and upset shall not be raised more than 3 mm and there shall be no depression in accordance with Annexure - IV-A & B of Indian Railway Manual for flash butt welding of rails, as applicable.

b) Step across the weld: All the welds shall be measured in as welded condition to determine step across the weld. No step shall be permitted except as provided in Para 3.3.3 and 3.3.4 of Indian Railway manual for flash butt welding of rails.

c) Dimensional Check: Finished weld samples shall be checked for weld geometry and shall conform following finishing Tolerances for Welds with new rails.

Sl. No.	Parameter	Value
1	Vertical misalignment	At the centre of a 1 m straight edge +0.3mm, -0.0 mm
2	Lateral misalignment	± 0.3 mm at the centre of a 1 m straight edge
3	Head finishing (in width)	Side of rail head should be finished to ± 0.25 mm on gauge side at the centre of 10 cm straight edge
4	Finishing of top table surface	at the centre of 10 cm straight edge + 0.2 mm, - 0.0 mm
5	Web zone (under side of head web, top of base, both fillet each side)	+ 3.0 mm of the parent contour - 0.0 mm
6	Upper sides, under surfaces and edges of rail foot shall be ground smooth. The edges of foot should be rounded and bottom of rail foot ground smooth without any minus tolerances to ensure proper seating on sleepers, unhindered movement of welded panels on end unloading rakes, avoid damage to elastic rail pads and eliminate stress riser.	

d) For Flash-Butt Welding in old rails Indian Railway manual for flash butt welding shall be referred.

e) Ultrasonic test: All Flash-Butt Welds shall be tested manually with USFD machine by trained personnel as per the procedure laid down in “Indian Railway Manual for Ultrasonic testing of rails and Welds”. Welds having defects shall be rejected. Results shall be maintained, and entries shall be made in TMS within 3 days. Defective joint shall be distinctly marked and shall be cut & removed before the panel is laid in the track.

f) **Lab Tests:** Hardness Test, Transverse load test, Macro examination and Micro examination shall be conducted as per procedure and frequency prescribed in the “Indian Railway Manual for flash butt welding of rails”. In case, a sample joint does not comply with the requirements of the test, two more sample joints will be made and tested. If both the sample joints meet the requirements of the tests, welding may continue. In case of failure of any of the retest joints, welding shall be discontinued with this particular plant and RDSO should be consulted for investigation and fixing revised welding Parameters for the F.B welding plant to do further welding.

CHAPTER – 4

LONG WELDED RAILS & SHORT WELDED RAILS

LONG WELDED RAILS

401. 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 welded rail greater than 250 m will normally function as LWR. Continuous welded rails (CWR) are LWR rails that passes through turnouts. The thermal variations create compressive (at high temperature) and tensile forces (at low temperature) within the rail. At some temperature the rails will neither be in tension or in compression called Stress free temperature (SFT). When the ambient temperature significantly increases or decreases from the SFT, the metal can expand and causes the rails to buckle or contract and cause the rails to fracture. The laying and maintenance procedures are therefore designed to ensure that CWR is installed and maintained in a manner that effectively manages these thermal variations.

402. Shoulder ballast for curves sharper than 440 m radius should be increased to 600 mm on outside of curve and should be provided for 100 m beyond the tangent point. LWR/CWR may be continued through reverse curves. Shoulder ballast of 600 mm over a length of 100 m on both side of the common point of a reverse curve would be provided. In case there is a straight track between the reverse curves, this 100 m would be considered from the center of the straight track. No such measure would be required if the length of straight track between the reverse curves is more than 50 m.

403. LWR/CWR can be continued over bridges with ballasted deck without bearings like slabs, box culverts and arches.

404. Track structure for LWR/CWR is as follows:

a) LWR/CWR shall be laid on stable formation having stipulated formation width and ballast cushion (below the bottom of the sleeper) and with approved PSC sleepers and its matching fastening system.

b) In Zone I, II the LWR can be permitted up to 6.5° of curve and Zone III, IV the LWR can be provided up to 6° of curve with 60 Kg rail and sleeper density of 1660 nos. per Km. The steepest gradient permitted for LWR/CWR shall be 1 in 100.

c) New rails used in LWR/CWR shall, as far as possible, be without fish-bolt holes. Joining of rail ends temporarily during installation of LWR/CWR shall be done by 1 m long fishplates with special screw clamps/joggled fishplates having slotted grooves & bolted clamps as per RDSO relevant approved drawings with suitable speed restriction.

d) Before permitting LWR/CWR on ballasted deck bridges, RSI Analysis shall be done and for permitting LWR/CWR on un-ballasted deck, Indian Railway guidelines shall be followed.

e) Location of SEJ: SEJ is to be installed 15 metres away from the abutments.

Temperature zone as per IR LWR map	Range of Temperature	Maximum length of single span girder bridge
IV	71 to 76 ºC	75 m

III	61 to 70ºC	87 m
II	51 to 60ºC	110 m
I	40 to 50ºC	146 m

405. Points and Crossings: Where special canted Turnouts approved by DFCCIL have been provided, LWR/CWR shall be taken through Points & Crossings.

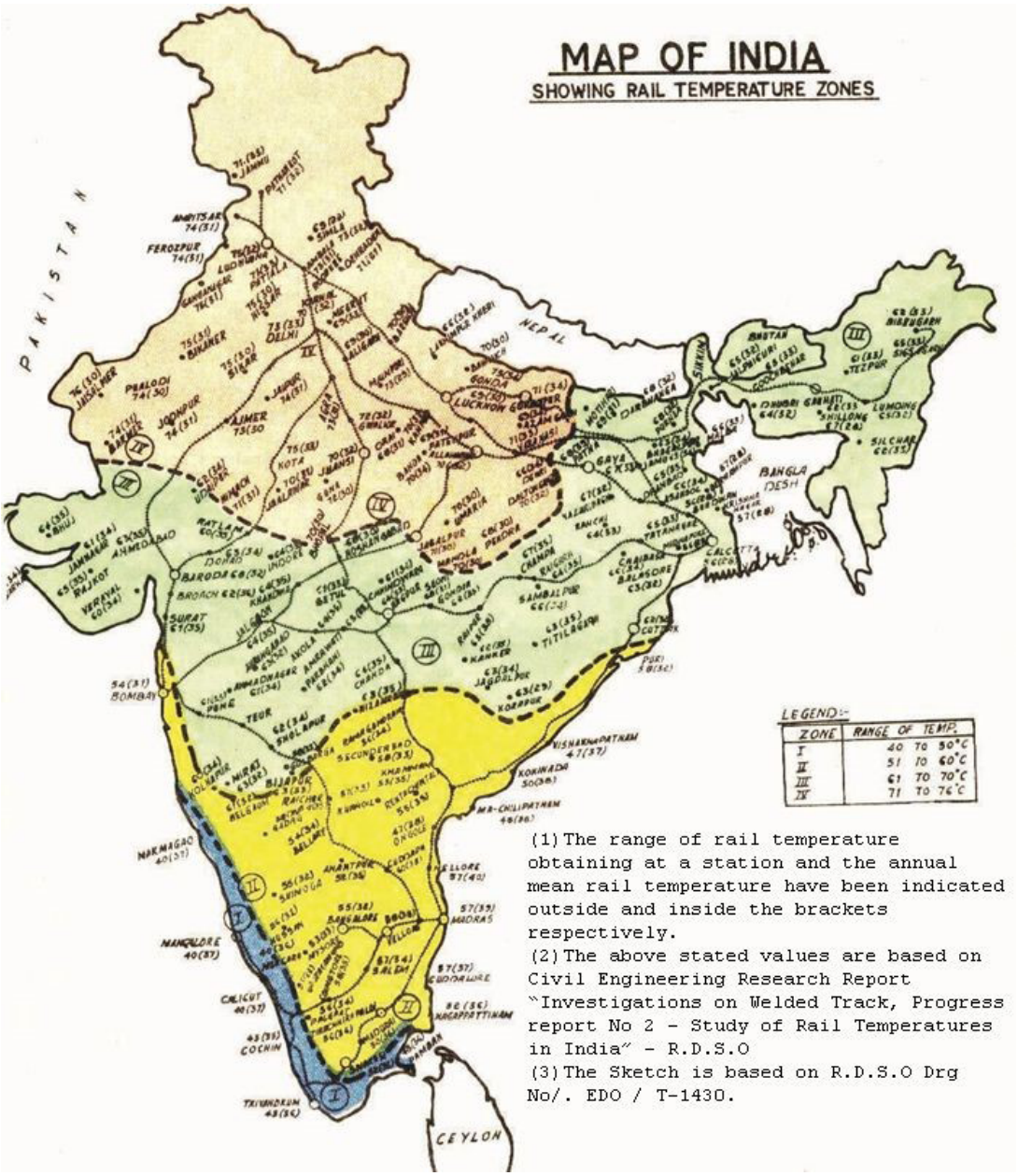


Fig. 4.1

SHORT WELDED RAILS

406. Laying of Short Welded Rails – The gaps to be provided for SWR at the time of laying shall be in accordance with table below depending on the installation temperature (t_i) and the Zone in which the rails are laid. Initial laying gaps for SWR for various installation temperatures

For Zone I and II	
Rail temperature at the time of installation (t_i)	**Initial laying gaps (in mm)**
	For 26/25 m rolled rails
t_m - 17.5°C to t_m - 12.6°C	10
t_m - 12.5°C to t_m - 7.6°C	9
t_m - 7.5°C to t_m - 2.6°C	7
t_m - 2.5°C to t_m + 2.5°C	6
t_m + 2.6°C to t_m + 7.5°C	5
t_m + 7.6°C to t_m + 12.5°C	3
For Zones III and IV	
t_m - 22.5°C to t_m - 17.6°C	10
t_m - 17.5°C to t_m - 12.6°C	9
t_m - 12.5°C to t_m - 7.6°C	7
t_m - 7.5°C to t_m - 2.5°C	6
t_m - 2.4°C to t_m + 2.5°C	5
t_m + 2.6°C to t_m + 7.5°C	3

Other provisions of SWR like conditions of laying, gap survey, adjustment of gap, adjustment of creep, buckling of track, Para 830 shall be referred.

407. Thermal Forces in LWR/CWR:

a) Temperature changes cause movement of the ends of LWR/CWR in the breathing lengths but the central portion of LWR/CWR does not expand/contract. This results in building up of thermal forces in the central portion. The thermal force (P) is calculated by :-

$P = E A \alpha t$

Where,

P = Thermal force in the rail (kg)

E = Modulus of elasticity of rail steel, (2.11×10^6 kg/cm^2)

A = Area of cross section of the rail (76.86 cm^2 for 60 Kg rail)

α = Coefficient of linear expansion of steel, (1.152×10^{-5}/^{0}C)

t = Variation of rail temperature from t_d /t_o (°C)

t_d= Destressing Temperature.
t_m= Mean Temperature
t_0= Stress free Temperature

b) The Range of t_d or t_0 shall be within the limits of rail temperature shown below:

Temperature Zone	Rail Section	Range
I, II, III, IV	60 Kg or above	T_m + 5 °C to T_m + 10 °C

c) The level of maximum thermal stresses in LWR depends upon variation of Rail temperature from the stress-free temperature. The thermal force diagram in LWR is shown as under (Fig 4.2):

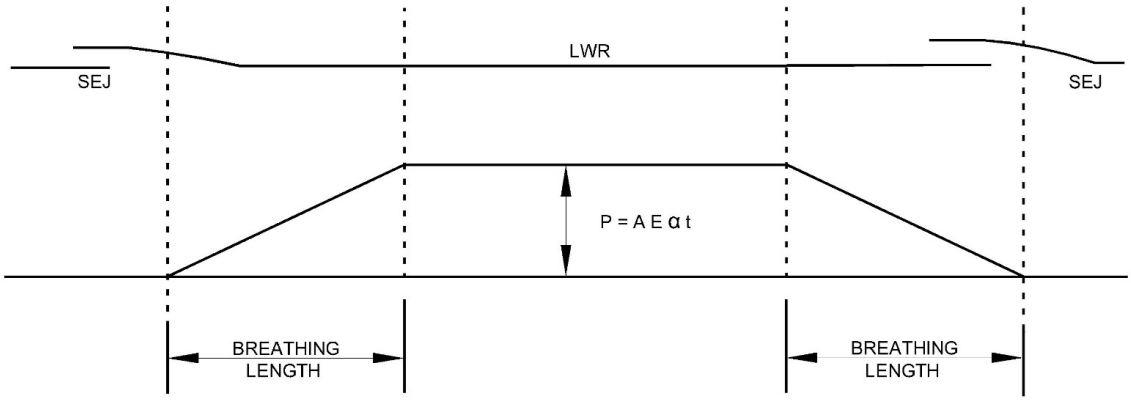


Fig. 4.2 Force diagram in LWR/CWR

CHAPTER – 5

CURVES

501. Determination of Radius:-

a) Determination of Radius: - The radius of a curve is determined by measuring the versine on a chord of known length, from the equation,

$$R = \frac{125 \times C^2}{V}$$

Where;

R = Radius in metres;
C = Chord length in metres; and
V = Versine in millimetres.

b) Curves can be designated by the radius in metres or by its degree. The angle subtended at the centre by a chord of 30.5 metres, is the degree of the curve.

$$1^\circ \text{ curve is thus of } \frac{360 \times 30.5}{2\pi} = 1750 \text{ metres radius}$$

c) For measuring versine's of a curve, 20 metres overlapping chords should normally be used with stations at 10 metres intervals. For checking the radii of turnout and turn-in curves overlapping chord of 6 metres should be used and the versine measuring stations should be located at every 3 metres. The turnout curve can also be checked by offsets from the straight. The versine is obtained by stretching a fishing/ nylon chord or wire stretched between the end of chord length decided upon, and the measuring distance between the chord/wire and gauge face of the rail at the middle point of the chord. Care should be taken that the chord or wire is applied to the side of the head of the rail at the gauge point.

502. The Reference Rail for Level: - The level of inner rail of any curve is taken as reference level. The super-elevation is provided by raising the outer rail. For reverse curves, however, stipulation as laid down in Para 508(c) shall apply.

503. Safe Speed on Curves:

a) Fully transitioned curves– The maximum permissible speed for transitioned curves should be determined (based on the assumption that the centre-to-centre distance between railheads is 1750 mm) using the following formulae:

$$V = 0.27\sqrt{R \times (C_a + C_d)}$$

Where,

V = Speed in Kmph.
R = Radius in metres.
C_a = Actual cant in mm.
C_d = Permissible cant deficiency in mm.

b) Non transitioned curves with cant on virtual transition– The determination of the maximum permissible speed on curves without transition involves the concept of the virtual transition. The change in the motion of a vehicle from straight to curve conditions takes place over the distance between the bogie centres, commencing on the straight at half the distance before the tangent

point and terminating on the curve at the same half distance beyond the tangent point. Normally, the length of virtual transition is taken as 14.785 m over which Super-elevation is gained with maximum permissible cant gradient as per Para 505.

c) For curves laid with inadequate length of transition or without transition, the safe permissible speed should be worked out on the basis of actual cant/cant deficiency, which can be provided taking into consideration the limiting values of cant/cant deficiency gradient and the rate of change of cant and cant deficiency.

d) The speed as determined above shall not exceed the maximum permissible speed of the section.

504. Super-elevation and Cant Deficiency: - Maximum cant on curved track shall be 165 mm.

a) The equilibrium super elevation/cant necessary for any speed is calculated from the formula.

$$C = \frac{G \times V^2}{127 \times R}$$

Where,
C is cant/Super-elevation in mm,
G is the dynamic gauge (nominal gauge of track + width of railhead) in mm;
R is the radius of the curve in metres.

b) The length of Transition shall be calculated by assuming value of cant deficiency as zero till Cant of 165 mm is reached.

c) Cant Deficiency– Maximum value of cant deficiency is 75 mm.

d) Cant excess – Maximum value of cant excess shall be 75 mm.

505. Length of Transition Curve and Setting-out Transitions:-

1) The desirable length of transition 'L' shall be maximum of the following three values–

(a) $L = 0.008\ C_a \times V_m$

(b) $L = 0.008\ C_d \times V_m$

(c) $L = 0.72 \times C_a$

Where,
L = the length of transition in metres.
V_m = max. permissible speed in Kmph.
C_d = cant deficiency in mm.
C_a = actual Super-elevation on curve in mm.

The formula (a) and (b) are based on rate of change of cant and of cant deficiency of 35 mm per second. The formula (c) is based on the maximum cant gradient of 1 in 720 or 1.4 mm per metre. The length of transition so calculated should be rounded off to the next higher value in multiple of 10 m.

2) In exceptional cases where room is not available for providing sufficiently long transitions in accordance with the above, the length may be reduced to a minimum of 2/3 of the desirable length as worked out on the basis of formula (a) and (b) above or ½ of the desirable length as worked out on the basis of (c) above whichever is greater. This is based on the assumption that a rate of change of cant/cant deficiency will not exceed 55 mm per second and the maximum cant gradient will be limited to 2.8 mm per metre or 1 in 360.

3) At locations where length of transition curve is restricted, and therefore, may be inadequate to permit the same maximum speed as calculated for the circular curve, it will be necessary to select a lower cant and/or a lower cant deficiency which will reduce the maximum speed on the circular curve but will increase the maximum speed on the transition curve. In such cases, the cant should be so selected as to permit the highest speed on the curve.

506. Compound curves– In case of a compound curve, which is formed, by two circular curves of different radii but curving in the same direction, common transition curve may be provided between the circular curves. Assuming that such compound curve is to be traversed at uniform speed, the length of the common transition connecting the two circular curves can be obtained from–

(a) $L = 0.008 (C_{a1} - C_{a2}) \times V_m$

(b) $L = 0.008 (C_{d1} - C_{d2}) \times V_m$

Whichever is greater.

Where,

C_{a1} and C_{d1} are cant and cant deficiency for curve No.1 in mm;

C_{a2} and C_{d2} are cant and cant deficiency for curve No.2 in mm;

L is length of common transition in metres; and

V_m is max. permissible speed in Kmph.

The Cant gradient should be within the permissible limits as stated in Para 505(a) & (b) above. Common transition may be provided when the length of common transition as worked out above is more than the length of virtual transition as specified in Para 503 (b).

507. **Reverse Curves**– In case of a reverse curve, which is formed by two circular curves in opposite directions, common transition curve may be provided between circular curves. The total length of common transition, i.e., from first circular curve to second circular curve, may be obtained from–

(a) $L = 0.008 (C_{a1} + C_{a2}) \times V_m$

(b) $L = 0.008(C_{d1} + C_{d2}) \times V_m$

Whichever is greater;

Where,

C_{a1} and C_{d1} are cant and cant deficiency for curve No.1 in mm;

C_{a2} and C_{d2} are cant and cant deficiency for curve No.2 in mm;

L is length of transition in metres; and

V_m is max. permissible speed in Kmph.

508. Running out Super-elevation:

a) On transitioned curves, Cant should be run up or run out on the transition, not on the straight or on the circular curve, increasing or decreasing uniformly throughout its length.

b) On non-transitioned curves, Cant should be run up or run out on the 'virtual transition'.

c) In longitudinal profile of transition on the reverse curve the level of one of the rails is maintained and the super elevation is run out on the other rail by lowering it over half the transition length and raising it to the required amount of

cant over the remaining half portion of the transition.

509. Indicators/Board/QR barcodes Provided in Curves: -

a) Curve Board/QR Barcode–Each approach of a curve should be provided with a curve board/QR Barcode at the tangent point fixed on the outside of the curve. This Board/QR barcode should indicate the radius of the curve, the length of the curve, length of transition in metres and the maximum cant provided on the circular portion of curve in millimetres.

b) Rail Posts Indicating Tangent Points– On the inside of the curve, rail posts should be erected on each approach of the curve, to indicate the positions of the beginning and end of transition curves. These rail posts may be painted in red and white colours respectively. In the case of non-transitioned curve, similar rail post should be erected on the tangent track and on the circular curve over which the cant is run out, indicating the beginning and end of the virtual transition.

c) Indication of Cant on track – Super-elevation or cant should be indicated by painting its value on the inside face of the web of the inner rail of the curve and at every station, beginning with zero at the commencement of the transition curve.

d) The value of Cant should be indicated on the circular curve at its beginning and at the end.

510. Permissible Speed over Curved Main Line at Turnouts: - Subject to the permissible run through speed governed by the interlocking standard, speed over the main line will be determined taking into consideration the maximum cant that can be provided on the main line and the permissible amount of cant deficiency. In the case of turnout of similar flexure, the maximum cant that can be provided, on the main line will be the sum of equilibrium cant for the turnout and permissible cant excess. In the case of turnouts of contrary flexure, the maximum cant on the main line (negative Super-elevation on turnout) will be the difference between the maximum permissible cant deficiency and cant determined for turnout. In both the cases, the permissible speed on the main line will be worked out by the formula as given in Para 503(a). The speed of trains over non interlocked facing points shall not exceed 15 Kmph in any circumstances and the speed over Turnout and cross over shall not exceed 15 Kmph, unless otherwise prescribed by special approval.

511. No Change of Super-elevation over Turnouts: - Turnouts should not be taken off the transitioned portion of a main line curve and if in case it is unavoidable, approval of concerned ED/corridor is required. There should be no change of cant between points, 20 meters outside the toe of the switch and the nose of the crossing, except in cases where points and crossings have to be taken off from the transitioned portion of a curve. There should be no change of gradient within 30 m of SRJ/Back leg of Crossing.

512. Curves of Contrary Flexure: - On the main line curve from which a curve of contrary flexure takes off, the cant of the main line (which is the negative Super-elevation on the turnout), and the permissible speed on the main line shall be determined from the allowable cant deficiency and cant on the main line. The speed so determined shall be subject to limitations governed by the standard of interlocking and the sectional speed.

513. Curves of Similar Flexure: -

a) Not followed by reverse curves– On a main line curve from which a curve of similar flexure takes off, not followed immediately by a reverse curve, the turn-out curve shall have the same cant as the main line curve.

b) Followed by reverse curves– A change of cant on the turnout may be permitted starting behind the crossing (after the last exit sleeper) and being run out at a rate not steeper than 2.8 mm per metre and subject to the maximum cant on the main line turnout being limited to 65 mm.

c) The permissible speed on the main line is then determined from the allowable cant-deficiency and subject to limitations governed by the standard of inter-locking and the safe speed limit.

514. Curves with Cross Overs: - On curves on double line connected by cross over road, the speed and the cant for both roads are governed by the inner road to which the cross over road is a curve of contrary flexure. On the outer road, it is a curve of similar flexure. The permissible speed and the necessary cant on the inner road shall be calculated in accordance with Para 512 above. The same speed and the same cant shall be allowed on the outer road. The outer track shall be raised so that both roads lie in the same inclined plane to avoid change in cross level on the cross over road. Where this is not possible, both main line and the turnout should be laid without cant and suitable speed restriction shall be imposed.

515. Compensation for Curvature on Gradient: - Compensation for curvature should be given in all cases where the existing gradient when added to the curve compensation exceeds the ruling gradient. The compensation to be allowed should ordinarily be (70/R) %. (i.e., 0.04% per degree of curvature), where R is the radius of curvature in metres.

516. Vertical Curve: - A vertical curve shall be provided only at the junction of the grade when the algebraic difference between the grades is equal to or more than 4 mm per metre or 0.4%. The minimum radius of the vertical curve is 2500m.

517. Re-alignment of curves: The criteria for realignment of a Curve, based on service limit for station-to-station versine variation, shall be as per Para 615. Realignment is to be done as per design parameters i.e. geo coordinates of curves.

518. Check-Rails on Curves: - Check-rails reduces the risk of derailment on the sharp curves. Check-rails should be provided on the inside of the inner rail of the curve, with appropriate clearances between the checkrail and the running rail for all curves of 5 Degree or more as mentioned in DFC SOD.

519. Wear on outer Rail of Curve- The wear in the outer rail of the curve can be reduce effectively by:

a) Lubricating the gauge face of outer rails on the curve. Track mounted automatic gauge face lubricator shall be provided on curves with 1.25 Degree (in case rail grinding of rails are being done) or sharper otherwise on curves of 2 Degree or sharper.

b) Maintaining correct curve geometry and superelevation.

c) Provision of suitable check rail.

d) Adopting slack gauge PSC sleepers as per approved drawings depending upon curvature of the track.

e) While lubricator shall be installed on straight track at the beginning of the transition portion of curve.

f) Lubricator should be located away from the switches/ crossing and other areas where discontinuity in LWR/ CWR track may exist.

CHAPTER – 6

MECHANIZED INSPECTIONS OF TRACK GEOMETRY & PATROLLING

601. Mechanized inspections:

a) Track Recording Car
b) Oscillation Monitoring System
c) Unattended Track Inspection System(UTIS)
d) Survey Trolley (Works with accuracy)
e) Pre-tamping survey by Track machine

602. **Track Recording Cars:** - TRC enable collection of discrete values of various track geometry Parameters on selected sampling interval under loaded condition. The TRCs work on inertial principle of measurements for various track geometry Parameters except Gauge.

a) TRC run should be done at maximum permitted speed of the section without any stoppages and TRC run shall be done at the interval of Six months or as decided by CTE. During TRC run, CGM/RMU In-charge or Senior most officer of Engineering department along with IMD & IMSD In-charges shall accompany TRC. Proper records shall be maintained with the details of officers which are accompanying during TRC run.
b) The CGM/RMU under which TRC is stabled shall arrange all logistics (including HSD), various C&W inspections, temporary power supply to TRC, housekeeping of TRC and other arrangement required for officials accompanying TRC from Corporate Office.
c) Proper messaging arrangement should be in place to alert the information of UML peaks to Dy.CPM/Track, IMD In-charge, IMSD In-charge & IMSD Sectional of the concerned section in addition to OCC Engineering control.
d) TRC measures lateral and vertical accelerations with the help of accelerometers placed at coach floor / bogie frame. The acceleration values obtained are integrated twice to get loci of the location of accelerometers. The relative displacements between rail and accelerometer locations are obtained from displacement transducers (LVDT)/LASER based contactless sensors. The loci of accelerometers are combined with relative displacement between accelerometers and rail obtained from sensors to derive the vertical and lateral profile of the rail. These measurements are further corrected for roll and yaw motion of coach using gyroscopes.
e) For measurement of Gauge Parameter Contactless laser-based gauge sensor is used up to 100 kmph.
f) Before the start of any run (daylight hours only), it should be ensured that quick calibration of the system has been done satisfactorily.
g) The Track Recording Cars should be run at the maximum speed of Section. Any recording done below speed of 20 Kmph is taken as "non-recorded".

603. The following Track geometry Parameters are measured by the Track Recording Cars:

a) Unevenness of Left & Right Rail
b) Alignment of Left & Right Rail
c) Twist
d) Variation of gauge over nominal gauge, which is 1676 mm for DFC.
e) Vertical and lateral accelerations on coach floor above bogie pivot, in test vehi-

cles

f) Curve details

g) Speed of Recording

604. Chords for measurements: - TRC shall record the measurements both on long & short chords & field Units shall utilize the results of short chords as maximum permitted speed is 100 kmph: -

SN	Parameter	Short Chord for dynamic measurement/ Base (m)	Long Chord for dynamic measurement/ Base (m)
1	Unevenness	9.0 (UN-1)	18.0 (UN-2)
2	Alignment	9.0 (AL-1)	15.0 (AL-2)
3	Twist	3.0 (TW-1)	15.0 (TW-2)

605. Reporting of TRC results: - While recording the Track Parameters, On-line reports are generated by TRC for each block of 200 meters and for the entire kilometer. SMS alerts would be generated for cases of exceedances of UML during TRC recordings. These alerts would be sent through TMS to the concerned officials.

a) Details of every block of 200 m: -

i. Standard Deviation values of Unevenness of Left & Right Rail

ii. Standard Deviation value of Alignment of Left & Right Rail

iii. Average of Variation of gauge over nominal gauge (1676 mm)

iv. Maintenance Instructions corresponding to gauge (MI-G) based on Need Based Maintenance Limit (NBML) and Urgent Maintenance Limit (UML) values for average/mean gauge

v. Average speed

vi. Vertical and Lateral Running Index on coach floor above bogie pivot (accelerometer location) and in test vehicle (Locomotive) in Laser Contact less TRCs

vii. Parameter Index for Unevenness (UNI-1) and Alignment (ALI-1) on short chords.

viii. Track Quality Index (TQI)

ix. Maintenance Instructions corresponding to SD (MI-SD) based on PML and NBML for Unevenness and Alignment.

b) Results reported for whole kilometer:

i. Total Number of peaks above Need Based Maintenance Limits (NBML) on short chord for Alignment and Unevenness.

ii. Total Number of peaks above Need Based Maintenance Limits (NBML) and Urgent Maintenance Limit (UML) on short base for Twist.

iii. Total Number of peaks above Need Based Maintenance Limits (NBML) and Urgent Maintenance Limit (UML) for Gauge.

iv. Total Number of peaks above Urgent Maintenance Limit (UML) for vertical and lateral acceleration.

v. Parameter Indices for Unevenness (UNI-1) and Alignment (ALI-1) on short chord.

vi. Track Quality Index (TQI) on short chord i.e. TQI-S.

vii. Average Speed.

viii. Vertical and Lateral Running Index on coach floor above bogie pivot (at accelerometer location).
ix. 10 highest peak values of alignment and unevenness Parameters with location on short chord out of the maximum peak values measured for each 50 m block of a kilometer.
x. 10 highest peak values of Twist Parameter with location on short base out of the maximum peak values measured for each 50 m block of a kilometer.
xi. 10 highest peak values of variation of Gauge (over nominal gauge of 1676 mm) Parameter with location out of the maximum peak values measured for each 50 m block of a kilometer
xii. 10 highest peak values of vertical and lateral accelerations with location out of the maximum peak values measured for each 50 m block of a kilometer.
xiii. 10 Maximum peak values of Twist on short base exceeding Urgent Maintenance Limits (UML) with location.
xiv. 10 Maximum peak values of Gauge (over nominal gauge of 1676 mm) exceeding Urgent Maintenance Limits (UML) with location.
xv. 10 Maximum peak values of vertical and lateral accelerations exceeding Urgent Maintenance Limits (UML) with location.

606. Action to be taken after Track Recording by TRC:

a) Spots/blocks requiring attention as per Parameter limits, and acceleration peak limits set as UML should be noted by the IMD In-charge and IMSD In-charge accompanying the car for giving requisite action/attentions as per Para 614.

b) Track recording results should be uploaded in TMS by RDSO after end of days recording and analyzed in the CGM/RMU office.

i. A comparison of the records of each section shall be made with the previous run.
ii. Analysis shall be done for identifying the blocks/locations needing Planned, Need Based and Urgent attention for onward transmission to concerned maintenance units.
iii. Analysis of data to generate various reports/charts using TMS to take up the maintenance and precautionary action as detailed in Para 616. Alerts with respect to UML will also be generated by TMS after uploading data in TMS. UML to be attended as a priority.
iv. Maintenance units shall act for maintenance as detailed in Para 616.

607. Parameter Indices: - For characterization of the Track Quality, the Parameter wise Indices viz. unevenness index (UNI-1) and Alignment Index (ALI-1) on short chord for each block of 200 m are computed as under:

a) Alignment Index: (ALI_1):

$$ALI_1 = 100 \times e^{-\left[\frac{((SD_{M-AAL-1}-(SD_{NTL-AL-1}))}{((1.3\times SD_{NBML-AL-1}-(SD_{NTL-AL-1}))}\right]}$$

b) Unevenness Index: (UNI_1):

$$UNI_1 = 100 \times e^{-\left[\frac{SD_{M-AUN-1}-SD_{NTL-UN-1}}{((1.3\times SD_{NBML-UN-1}-(SD_{NTL-UN-1}))}\right]}$$

Where,

ALI_1	Alignment Index on short chord i.e. on 9.0-meter chord
UNI_1	Unevenness Index on short chord i.e. on 9.0-meter chord
$SD_{M\text{-}AAL\text{-}1}$	Average of measured SD value of alignment of left and right rail on short chord
$SD_{NTL\text{-}AL\text{-}1}$	SD value of New Track Limit of alignment on short chord
$SD_{NBML\text{-}AL\text{-}1}$	SD value of Need Based Maintenance Limit of alignment on short chord
$SD_{M\text{-}AUN\text{-}1}$	Average of measured SD value of unevenness of left and right rail on short chord
$SD_{NTL\text{-}UN\text{-}1}$	SD value of New Track Limit of unevenness on short chord
$SD_{NBML\text{-}UN\text{-}1}$	SD value of Need Based Maintenance limit of unevenness on short chord

608. Track Quality Index (TQI): - This index gives an overall assessment of the track. The value 100 indicates that track is maintained as per tolerances prescribed for new track. The TQI values based on the following expressions are only an indicator; the actual maintenance of track shall be planned based on SD values and peak values of different track Parameters in comparison to respective benchmark values. The TQI could be worked out by expressions given below using indices for short chord in DF-CCIL.

$$TQI_S = (\frac{UNI_1 + ALI_1}{2})$$

609. Oscillation monitoring system (OMS): - The OMS equipment used for Oscillation monitoring uses a portable accelerometer and transducers converting the oscillations into electrical signals, which can be recorded electronically and processed. The OMS equipment used should preferably be GPS enabled and OMS recording on DFC routes are to be done at frequency of one month. The real time output of the equipment is in the form of the value of peaks exceeding the limiting value, their locations, and Running index. These values are available for both vertical and lateral accelerations. The OMS equipment shall be kept on the coach floor (as close to the bogie pivot as possible) on the free end of the coach. The stored data should be uploaded in TMS for analysis and maintenance planning. Suitable Speed Restriction shall be imposed for OMS peaks above 0.30g and all the peaks above 0.20g shall be attended within a reasonable time. Track should be attended in such manner that peaks are not repeated and repeated peak locations shall be inspected by IMD in-charge. Preferably this location should be attended by OTT.

610. Unattended Track Inspection System(UTIS): - Smart Loco is an onboard monitoring system, installed on Locomotive to monitor the health of various vital components of Loco and report it to a base station on real time basis and generate alerts. The unattended track inspection system (UTIS) can be mounted on Smart locomotive for assessing the track health including condition monitoring of track components, generating alerts and facilitate predictive maintenance of Track on dedicated routes on DFC. The unattended track inspection system may have following sub-systems;

a. Line scan video inspection system for condition monitoring of track components.

b. Measurement of acceleration at axle box level

c. System for drivers view video recording.

611. Recording of defects: - To assess the track quality, vertical and lateral acceleration peaks exceeding 0.2 g are to be considered. It is desirable to keep the track OMS peak free.

612. New Track Tolerances: - To be measured three months after speed is raised to normal. SD Values for Unevenness and Alignment and Peak Values for Unevenness and Alignment are to be measured by TRC.

a) Gauge in floating conditions for New Track: For new track and through renewal of track, following tolerances would be applicable-

i. For Straight including curves of radius up to 350 m and more:- (-5 mm to +3 mm)
ii. For curves of radius less than 350 m:- Up to +10 mm

b) Other New track Parameters for floating condition: (Considering track gauge 1676mm)

SN	Parameter	Description of Measurement	Value
1	Gauge	Sleeper to sleeper variation	2 mm
2	Expansion gap	Over average gap worked out by recording 20 successive gaps	± 2 mm
3	Joints	Low joints not permitted High joints not more than Squareness of joints on straight	+ 2 mm ±10 mm
4	Spacing of sleepers	With respect to theoretical spacing	± 20 mm
5	Cross level	To be recorded on every 4th sleeper	± 3 mm
6	Alignment	On straight on 10 m Chord	± 2 mm
7		Variation over theoretical versines: (On 20 m Chord). On curves of Radius more than 600 m	5 mm
8		Variation over theoretical versines: (On 20 m Chord). On curves of Radius less than 600 m	10 mm
9	Longitudinal level	Variation with reference to approved longitudinal sections.	50 mm

c) For measurements recorded by TRC.

i. SD Values for Unevenness and Alignment:

Sl. No.	Parameter	Speed up to 100 Kmph
1.	UN-1	2.0 mm
2.	UN-2	-
3.	AL-1	1.4 mm

4.	AL-2	-

ii. Peak Values for Unevenness and Alignment:

Sl. No.	Parameter	Speed upto 100 Kmph
1.	UN-1	6.0 mm
2.	UN-2	-
3.	AL-1	4.0 mm
4.	AL-2	-

613. Planning of maintenance – Condition based machine packing has been adopted. In case TRC Run is not done, then packing should be done after 2 years. For assessing the condition of the track, TRC shall be used. Based on TRC results, locations requiring Planned Maintenance, need based Maintenance and Urgent maintenance are to be identified. Sequence on maintenance is decided as per the gravity of limits. Machine tamping of loop lines shall be condition based.

a) Planned Maintenance Limit (PML):

i. These tolerances provide guidance to plan through maintenance of track in a complete block section. These Limits, if exceeded, require that track geometry condition be analyzed and considered for planned maintenance operations.

ii. The Planned Maintenance Limits (PML) for Unevenness and Alignment are based on Standard Deviation (SD) values, as these Parameters affect Running quality.

iii. Peak based limits are not stipulated for unevenness and alignment for planned maintenance as the planned maintenance is to be carried out by track machines for which the planning will be based on standard deviation values only.

b) Need Based Maintenance Limit (NBML):

i. These limits are defined for applying timely correction before the defects size grows to the level of Urgent Maintenance Limit (UML); requiring traffic slow down. Allowable time for attention to defects exceeding the NBML would depend upon the magnitude of the defects and various factors affecting track geometry deterioration such as sectional speed, axle load, traffic volume etc.

ii. The Need Based Maintenance Limits (NBML) are based on Standard Deviation and Peak Values for Unevenness and Alignment. For Gauge and Twist, these limits are based on Peak Values.

c) Urgent Maintenance Limits (UML):

i. These limits are so specified that upon their exceedances, the permitted speed should be reduced, which can be restored only after attending the track.

ii. These are laid in terms of acceleration limits on comfort consideration and peak values for Gauge and Twist.

614. Maintenance limits: Based on TRC and OMS results, various limits of PML, NBML and UML for Unevenness, Alignment, Gauge and Twist Parameters are stipulated as under:

SN	Parameter	Planned Maintenance Limit (PML)	Need Based Maintenance Limit (NBML)	Urgent Maintenance Limit (UML)
1	Unevenness			Vertical and lateral acceleration peak of 0.30 g
1.1	UN-1	SD-5.0 mm	SD-6.8 mm Peak-20 mm	
2	Alignment			
2.1	AL-1	SD-3.3 mm	SD-4.9 mm Peak -15 mm	
3	Gauge			
3.1	Mean gauge over 200 m section over nominal gauge			
(a)	Straight	-	-8 mm to +10 mm	-10 mm to + 12 mm
(b)	Curve with radius 440 m or more	-	-5 mm to +14 mm	-7 mm to +17 mm
(c)	Curve with radius less than 440 m	-	-5 mm to +18 mm	-7 mm to +20 mm
3.2	Isolated defects –Nominal track gauge to peak value			
(a)	Straight	-	-10 mm to +12 mm	-12 mm to + 15 mm
(b)	Curve with radius 440 m or more	-	-7 mm to +17 mm	-11 mm to +20 mm
(c)	Curve with radius less than 440 m	-	-6 mm to +22 mm	-8 mm to +25 mm
4	Twist (TW-1)		5 mm/m	7 mm/m

Note: In case of curve, the limits for alignment prescribed are above average versine.

615. Action to be taken based on TRC results:

a) Action to be taken on exceedance of UML: Spots/blocks exceeding track Parameter limits, and acceleration peak limits set as UML should be noted by the IMD/IMSD in-charges accompanying the TRC, and suitable speed restrictions have to be immediately imposed, which shall be relaxed only after suitable attention/maintenance of track at concerned location.

b) Action to be taken on exceedance of NBML: The blocks requiring Need Based Maintenance based on laid down SD based NBML and isolated spots based on laid down Peak based NBML shall be identified through TMS. All such blocks and isolated spots should be attended to within a reasonable time of TRC run so that good running quality is maintained, and the track geometry does not exceed the UML. The reasonable time would be different for different sections depending upon the magnitude of defects and cause of the defect. The officials responsible for maintenance at various levels must plan the deployment of maintenance resources keeping in view the relative priority and availability of maintenance resources. Gap between two successive NBML locations in block sections/yards

should also be tamped while attending these NBML locations if this gap is less than/equal to 200 m. (1 TRC block). While attending an NBML block in the yard in which any portion of the turnout falls, the entire turnout should be tamped.

c) **Planning of through tamping based on PML:** The track stretches requiring planned maintenance shall be analyzed in floating/moving stretches of 10 KM in block section with the help of TMS. In the case of PML locations, if length is more than 40% in floating/moving stretches of 10 KM, then full 10 KM stretches should be tamped. Yard should be planned for through tamping if the percentage of blocks exceeding PML is more than 50%. The yards stretches should be taken as 100 meters from the farthest turnout on both side of yards.

616. **Realignment criteria for Curves:** -The running over a curve depends not only on the difference between the actual versine and the designed versine but also on the station-to-station variation of the actual versine values, which determine the rate of change of lateral acceleration, on which depends the riding comfort. In case exceedances of the Limit as per Table below is observed during inspection, local adjustment may be resorted to in cases where the variation of versine between adjacent stations is only at a few locations, at the earliest possible. If more than 20% of stations are having versine variations above the limits prescribed, complete realignment of curve should be planned within a month.

SN	Speed on curve	Limits of Station-to-Station Variation of Versine (mm)
1	100 Kmph and up to 50 Kmph	20 mm; or 20% of average Versine on circular portion, whichever is more.
2	Below 50 Kmph	40 mm; or 20% of average Versine on circular portion, whichever is more.

617. **Track Parameters in floating conditions for Maintenance:** Parameters for geometry are Gauge, Cross level, unevenness, Alignment in straight track and Gauge, cant, Unevenness and Versine in curves. Gauge (Nominal-1676 mm) and cross level/cant is measured by the Gauge measuring device and Unevenness and Alignment is measured on 9 m chord. Measurement of gauge, Cross level, alignment & unevenness should be checked to see the effectiveness of Track Machine Tamping, Off Track Tamper, and renewal of Track. The parameters are as follows:

a) **Gauge:** The Gauge for manual measurement in floating conditions are as under provided that generally a uniform gauge can be maintained over long lengths. In case of exceedances of these limits, the results of last TRC/OMS shall be analyzed for planning suitable maintenance action:

On straight Track	-6 mm to + 6 mm
On curves with radius 440 m or more	-6 mm to +15 mm
On curves with radius less than 440 m	Up to + 20 mm

b) **Twist:** It is desirable to maintain the track geometry for smooth running at Sectional Speed. The limits of twists as per measurement in floating condition, for guidance of the Engineering officials regarding condition of track from Smooth running perspective shall be as under; (to be calculated on a base of 3.0 m)

On straight and curve track, other than transition	3.5mm/m
On transition of curve-	2.1mm/m

618. Track Parameters for low speeds: - For guidance of field officials, following track Parameters are stipulated in floating conditions, for maintenance of tracks where speeds are low such as worksite, yard line, etc.

Speed (in Kmph)	Peak value of UN (on 3.6 m chord) in mm	Peak value of twist (on 3.0 m chord) in mm	Permissible gauge range
Up to 45	22	18	-10 to +27 mm
Up to 30	24	21	-10 to +27 mm
Up to 15	33	25	-12 to +27 mm

619. Stability of trains against derailment: The stability of trains against derailment depends upon several factors such as track geometry, vehicle characteristics, state of their maintenance and speed of the vehicle at relevant point of time etc. Rail wheel interaction is, thus, a complex phenomenon and, therefore, safety tolerance for track alone cannot be prescribed in Isolation. Accordingly, safety tolerances for maintenance of track have not been prescribed in DFC. Each derailment case, therefore, needs careful examination of all available evidence, in respect of track, rolling stock, speed and other factors considered relevant, to arrive at the cause. The provisions and tolerances mentioned herein before and elsewhere in this Manual are with a view to maintain track geometry for good riding comfort considered and deviation from these maintenance Parameters should not be considered alone for cause of accident without examining all evidence mentioned above.

Track Patrolling

620. Hot Weather Patrolling: Period for hot weather patrolling shall be laid down by the Corporate Office for each section and patrol charts shall be prepared by Dy. CPM of concerned RMU Unit where necessary. Patrolling shall be organised by IMSD Sectional accordingly. In addition, the IMSD Sectional and other track officials shall be vigilant during summer and on hot days. Hot Weather Patrolling is to be done on days when actual rail temperature reaches t_d + 25° C. The beat of one Patrolman on single line is 2 km and on double line it is 1 km due to inspection on both the lines. Changes in beat length and manpower deployment as given above, if found necessary, may be decided by the Dy.CPM of the CGM/RMU unit depending on prevailing local conditions, frequency of train service, weather conditions etc. The patrolman shall preferably be provided with a GPS tracking device, to monitor his movements to ensure effective patrolling. During Patrolling, the Patrolman will walk over his beat slowly over one rail/on sleeper non gauge side of rail in one direction and on the other rail/ on sleeper non gauge sleeper side of rail in the return direction. On double lines, he will repeat this procedure alternately on UP and DN tracks. When a kink is observed, he shall immediately examine at least 100 sleepers ahead and in the rear of the kink for any floating condition of track. He should visually check each sleeper, 100 sleepers on either side of the kink, to determine any floating condition. If the patrolman has detected actual buckling of track, he will take immediate steps to protect the affected

portion by display of hand signals as per rules in force. After protecting the track, the patrolman will arrange to advise the IMSD Sectional of his apprehension of a buckle/ actual buckle. The IMSD Sectional on receipt of advice of a danger of buckle will proceed to the site quickly with all available men. On arrival at site, he will first ensure protection of affected portion. He should then inspect the condition of track 100 m on either side of this suspected zone and commence heaping of surplus ballast, if available, on the shoulders and upto the rail head and keep on compacting the ballast with available tool. No attempt should be made to slew or align the track or disturb the existing ballast section. The rail temperature will also be noted by one of these officials at the place of apprehended/actual buckle. The rail facing the sun will be covered up to the level of rail head on the outside by ballast or leaves etc. to bring down the temperature of the rail. The hot weather patrolman should always carry the following equipment:

a) HS Flags - Red 2
b) Staff for Flags 1
c) Detonators 10

621. Cold Weather Patrolling: Cold weather patrolling shall be started when rail temperature goes below t_d-30° C. Patrol charts will be prepared, and Patrolling shall be organized by Dy. CPM accordingly. Period and section where cold weather patrolling is to be done shall be laid down by Dy.CPM of the RMU based on Rail /weld fracture analysis. The patrolman shall preferably be provided with a GPS tracking device, to monitor his movements to ensure effective patrolling. The beat of one Patrolman on single line is 4 km and on double line it is 2 km due to inspection on both the lines. Changes in beat length and manpower deployment as given above, if found necessary, may be decided by the Dy.CPM of the RMU depending on prevailing local conditions, frequency of train service, weather conditions etc. He shall patrol the track during the coldest part of the night and lookout for weld/rail fractures and excessive gaps at SEJ. He shall protect the track at the site of weld/rail fractures or excessive gaps at SEJ and report the same to nearest Station Master/IMSD Sectional/IMSD In-charge. He will walk over his beat slowly along one rail in one direction and on the other rail in the return direction. On double line, he will repeat this procedure alternately on UP and DN tracks. He will be vigilant and look out for rail/weld failure. He will also notice the gaps at SEJs if they fall in his beat. In case he notices a rail/weld failure or gap at SEJ becomes more than the designed maximum gap, he will take immediate action to suspend the traffic and protect the line as per Para 1113. After protecting the track, the patrolman will arrange to report to Keyman, IMSD Sectional who shall arrange for making emergency repairs to pass the traffic. Cold weather patrolman should carry the following equipment's:

a) 10 fog signals in a tin case
b) Two tri-colour hand signal lamps/Rechargeable LED torch
c) One match box
d) Two red flags and one green flag
e) One three-cell electric torch
f) One staff
g) Number plate
h) Spanner
i) Protective clothing according to local dress regulations including industrial safety shoe / Gum boots, Safety jacket, Raincoat, Helmet with Head light.

622. Monsoon Patrolling–During the monsoon, certain section of the railway line, as may be specified, shall be patrolled to detect damage by flood, such as breaches, settlements, slips and scours and immediate action be taken to protect trains, when so warranted. The procedure is as following:

a) The Dy CPM will define sections on Monsoon patrolling. He will issue patrol charts for each of the sections when and where monsoon patrolling is required to be done. Patrol charts should show all vulnerable locations where stationary watchmen are posted. Before commencement of monsoon the Patrol charts shall be supplied to IMD/IMSD officials and OCC.

b) Ordinarily patrolling will be carried out by a single Patrolman, but in regions where danger from wild animals exist, patrolling in pair may be allowed.

c) The length of each patrol beat should not normally exceed 5 km. Where the block section is more than 10 km, an intermediate flag station if any, or any other suitable point may be fixed as intermediate station to keep the length of beat at about 5 km.

d) The walking speed of a Patrolman may be taken as 3 Kmph. The maximum distance covered by a Patrolman should not normally exceed 20 km in a day. A period of at least half an hour rest is desirable between consecutive beats.

e) The Patrolman shall patrol his beat length at the end of which, he will exchange his patrol book with that of the next Patrolman and retrace his beat. The intermediate patrolman shall do likewise. In this way each patrol-book will be conveyed from one station to the other and back again. Owing to proximity of stations, patrol books may be passed through one or more intermediate stations, before it is returned to the original station. If a Patrolman on arrival at the end of his beat does not find the next Patrolman to take over the book, he must proceed ahead, until he meets him. The Patrolman should report the absence of any Patrolman from his beat to the Mate the next day.

f) The Patrolman shall be provided with a GPS tracking device, to monitor his movements to ensure effective patrolling.

623. Equipment of Monsoon Patrolmen–

a) One staff (preferably foldable).

b) Number plate 15 cm Square to be painted in white letters on black background.

c) 10 detonators in a tin case.

d) Warning signals (a red flashing rechargeable LED torch/hand signal lamp at night or red flag during day). Three warning signals on double/multiple lines, Ghat sections, suburban and automatic block territories and two warning signals on single line sections.

e) Protective clothing according to local dress regulations including industrial safety shoe / Gum boots, Safety jacket, Raincoat, Helmet with Head light.

f) One match box.

g) Two red flags and one green flag (day patrol only).

h) Patrol book in a tin case.

i) One three cell Electric torch.

j) Whistle thunderer.

k) One haversack.

l) Where patrolling is undertaken in pairs or stationary patrol consists of two men, the equipment need not be duplicated but the additional Patrolman will be provided with an extra rechargeable LED torch/hand signal lamp, whistle thunderer, protective clothing and one spanner, and light crowbar for emer-

gency use.

m) The IMSD In-charge shall submit a certificate to the Dy. CPM through IMD In-charge a month in advance, before the commencement of the monsoon that he has made all arrangements for monsoon patrolling and for watching vulnerable locations/bridges and that the patrolmen and the watchmen have been made conversant with their duties, rules for the protections of the line and vulnerable locations in their beats.

624. In the event of any portion of the line being breached or otherwise rendered unsafe for traffic the following procedure shall be observed: -

a) In the case where two patrolmen are employed–

i. Protecting the line–

1. The danger signal must be exhibited in both the directions.
2. The two patrolmen shall then proceed in opposite directions showing the danger signals (red flag by day and red light by night) and when at 600 m from the point of danger, each should place one detonator on to the rail; they shall then proceed to a distance of 1200 m from the point of danger where they should place three detonators on the rail about 10 metres apart. On the double line the detonators must be placed on the line, in the direction on which the trains will approach.
3. Should the nature of obstruction be such as to render it impossible for either of patrolmen to get across the gap, as for instance a wash away with strong flood, one of the men should show the danger signal and endeavour to stop trains approaching the gap from the other side while the other man should proceed towards the station on his side of the gap, fix the detonators and act as in (2) above.

ii. Reporting the damage to Station Master and Gangmate–

1. After protecting the track one of the two patrolmen who is nearest to the station and in case mentioned in (3) above, the patrolmen who has protected the track will proceed in all haste, showing the danger signal, to the station and inform the station master of the danger. On his way back, if he meets with any gang quarter, he should inform the Mate of the occurrence and the gang must immediately proceed to the affected kilometrage and take necessary action to attend to the repairs.
2. After protecting the track, the other Patrolman will proceed to the site of obstruction, and remain there showing the danger signal, until the first Patrolman joins him. In case the other Patrolman has not been able to locate the gang hut on his way back from the station, one of them should proceed to the gang hut and inform the Gangmate.

b) In case where One Patrolman is Employed–

i). Protection of line–

a) When damage is detected on single line–

1. Place a red lamp during the night and a red flag during the day in a prominent position to warn a train, which may approach from one direction. Then run in the opposite direction from which train is likely to come, with a danger signal (red flag by day and red light by night) and place one detonator at 600 m and three detonators at 10 metres apart at

1200 m from the site of obstruction/ damage.

2. Return to the site of obstruction/ damage and protect the other side with detonators similarly.
3. In the event of it being impossible to get the other side of the obstruction/ damage (as in a wash away) place the red lamp so that it can be seen from a great distance as possible by a train approaching from that direction and protect the other side with the detonators etc. as detailed in sub-Para (a) (1).

b) When damage is detected on double line–

1. Place the red flag/lamp in prominent position so as to warn an approaching train on one track. Then run along the other track on which train is expected first and place the detonators as in sub-Para (a) (1)
2. Run back and protect with detonators the line on which the lamp/flag was prominently placed earlier.
3. Reporting the damage to the Station Master– the Patrolman will return to the site of obstruction after protecting the line in both the directions and shall remain at the place of obstruction and send word about the danger through the first DFC employee or other persons he is able to contact at the spot itself.

CHAPTER – 7

TRACK MAINTENANCE (Excluding rails) & EMERGENCY RESPONSE

701. Mechanized Track Maintenance System: - The 2-tier system of track maintenance is to be adopted on DFC sections. The track should be maintained with the objective of restoring it to the best possible condition consistent with its maintainability by Mechanized system of maintenance. However, few activities like picking up of slacks, Cleaning of side drains, deweeding, tree cutting/trimming may be done manually using possibly small track/other machines for better output. Manual through packing, Deep screening, Shallow screening, manual picking up of slacks are not to be used. If it is resorted in any exceptional circumstances, then IRPWM may be referred for methodology. Generally, track should be kept in good condition. Special care should be given to SEJs/breathing lengths, Steel Channel sleepers on bridges, Points & Crossings and Horizontal and vertical curves. Zero missing fitting shall be ensured at all the places on tracks.

702. On-track Mechanized Maintenance Unit (OMU): On track machines for track maintenance include Tie – tamping machines for plain track and points and crossings, shoulder ballast cleaning machines, ballast cleaning machines, ballast regulating machines, dynamic track stabilizers. The maintenance team shall be provided to support associated activities like pre, during and post tamping operations. These machines shall be used as per the various instructions stipulated in Indian Railways Track Machines Manual. In addition, RBMV shall be also part of OMU for transportation of man & material. OMUs shall be deployed to carry out the following jobs:

a) Lifting, aligning and leveling the track to bring it close to the designed alignment and level.
b) Tamping of plain track as well as Points & Crossings.
c) Shoulder ballast cleaning.
d) Ballast profiling/redistribution.
e) Track stabilization.
f) Periodical deep screening, and
g) Picking up and transportation of Material.

703. Mobile Maintenance Unit (MMU): There will be one Mobile Maintenance Unit (MMU) under each IMD. It will be headed by One official of IMSD and have a hired team of 20 persons including a black smith and welder. MMU is an activity based outsourced maintenance teams supported with small track machines and tools to carry out routine maintenance which cannot be done by large machines. MMU shall carry out transportation, loading-unloading, maintenance, and casual replacement of Rails, sleepers, SEJs and Turnouts etc. The MMU shall possess the equipment and other accessories as prescribed by DFCCIL administration. For repairs and casual renewals, location-wise imprest of tested rails of various lengths (13 m, 9 m, 6.5 m etc.) shall be prescribed for each IMD/IMSD by CTE DFC. Second hand rails are not to be used in Welding. If in any exceptional circumstances, it is required to be used, then IRPWM may be referred. Details of maintenance work carried out by the contractor's team and 15 days' advance planning should be entered in work diaries and the same should be checked by IMD in-charge and Dy.CPM during their inspections. They should record

their observations in the diary. Activity based outsourced maintenance teams shall perform the following functions:

a) Directed attention to track (using off-track tampers -OTT) where tamping machines have not been deployed or for small stretches of track needing spot attention.
b) Need-based attention to turnouts, SEJs, (if any) and Bridges/RUBs and their approaches.
c) Greasing of ERCs including liner seat, lubrication of joints, casual changing of rubber pads and other fittings.
d) Opening of Plate Screws once a year.
e) Minor cess repairs.
f) Cleaning of side drains, catch water drains and water ways.
g) Pre, during & post tamping attention.
h) Examination of rails, sleepers and fastenings including measurement of toe load of ERCs.
i) Weld collar painting, cess cleaning, cutting of tree branches/shrubs for improving visibility.
j) Attention of fittings etc. to Turnouts, SEJs, Track on Bridges, Guard rails and special features of track.

704. Checking work of Contractor's Gangs: - Work should be done in the presence of DFC official in charge of site.

a) IMSD sectional should inspect condition of rails and sleepers and their fastenings and check cross levels, gauge, squareness of sleepers, packing, joint maintenance, profile of ballast and depths of cess below rail level. The Executive /P-Way should examine worn out tools and equipment every month and have it replaced, when necessary,
b) Each gang should have minimum 10 detonators (to be provided by DFC), two set of hand signal flags, red and green (2 hand signal/LED lamps at night), Feeler gauge, Rail thermometer (preferably Laser type), 2 no. whistle thunderers, T-Square, Level-cum-gauge, 4 Off track tampers, sufficient no's of shovels, Powrah, crow-bars, Ballast-forks or rakes, mortar pans or baskets, Marking chalk. Hemp cord, 30 cm Steel scale, 1 m straight gauge Jumper and Gloves (for electrified sections). The Executive /P-Way should check the accuracy of the spirit level/gauge and straight edge every month, the result of this examination being entered in the Gang supervisor's s diary book.
c) IMSD sectional should ensure that at least 4 men in each outsourced gang is aware of the following rules in which the men should be examined periodically, and certificate to be issued.
   i. Safety First's rules.
   ii. Protecting the lines in an emergency or during work, affecting the running of trains, method of fixing and safety range of detonators, showing of signals with or without hand signal flags during day and with hand signal/LED lamps during night only if advised by DFC officials.
   iii. Patrolling of the line to be done by gang during heavy rains / storms and hot weather on LWR lengths, only if advised by DFC officials.
   iv. They are not authorized to use green flag or green light or pass the train from fracture site.

705. Rolling Block Programme and Maintenance Planning: - All works which obstruct running lines are to be done under traffic blocks. Planned Maintenance (repair & replacement) and execution of infrastructure work shall normally be executed as per Rolling Block Programme as stipulated in guidelines issued by Corporate Office of DFCCIL.

a) Annual Programme of Track Maintenance: - The annual machine requirement with tentative months will be proposed by Dy.CPMs in March of the preceding year. The annual machine deployment programme shall be issued by CTE of DFCCIL for tamping of track, track renewal, deep screening and shoulder screening machines based on yearly requirement of track maintenance, which will be periodically reviewed based on TRC results. Field engineers will also make annual (two half-yearly, first: April to September and second: October to March) programme of regular track maintenance and works incidental thereto which shall be consistent with annual machine deployment programme.

b) Maintenance Planning – Every IMSD in charge should prepare a perspective maintenance plan of his section in advance based on various track recording results and exception reports from TMS. This should also take account of foot and footplate inspections and inspections of higher officials so that optimum utilization of various resources, track machines, traffic blocks, and labor etc. is possible. IMSD (In-charge) should also ensure that arrangements are made for adequate materials, tools, labor, manpower and necessary caution orders/ blocks, as may be necessary. Rail Renewals, complete Track Renewals, Sleeper Renewals, Destressing, Deep Screening, Shallow screening shall preferably be done in winter months from October to February. The monthly and weekly maintenance planning shall be based broadly on annual plan to include:

i. Track maintenance,
ii. Maintenance of yards including point and crossings,
iii. Maintenance and realignment of curves,
iv. Welding of joints,
v. Destressing of long welded rails etc.

706. Yearly report on the condition of Permanent Way:

a) IMSD In-charge shall submit yearly reports on the status of track in his charge, to Dy. CPM through IMD In-charge. In this Report the IMSD In-charge shall make candid statement of the defects in the track, reasons for defects and proposals for rectifying them.

b) IMD In-charge should check the track during his various inspections and verify the conditions mentioned by the IMSD In-charge and study the proposed remedial actions. Remedial actions as necessary should be ordered within his power or referred to the Dy. CPM for further orders.

c) Dy. CPM should scrutinize the yearly reports of the IMSD In-charge, and the comments forwarded by the IMD In-charge and give his orders thereon to the IMSD In-charge through the IMD In-charge. The IMD In-charge and IMSD In-charge should promptly attend to the orders issued by the Dy. CPM.

d) This report will be a base for fixing annual ceiling for the Unit. Submission of yearly reports does not absolve the IMSD In-charge of this basic responsibility of maintaining the track in fit condition for the load and speed sanctioned for the section. Following sample format is provided for yearly report:-

Item No.	Particulars of Item	IMSD In-Charge's Remarks			IMD IN-CHARGE Remarks	Dy. CPM/ Track Remarks	Details to be entered under column problems areas by IMSD In-charge
		Major important work done in the last 1 year	Problem Areas	Assistance Required			
1	2	3	4	5	6	7	8
1	Track						Rails, Fastenings, Sleepers, Ballast, Formation & Drainage
2	Point and Crossings						Details of turnouts requiring frequent attention
3	Bridges & Approaches						Details of bridges having problem of creep, condition of sleepers and fittings
4	Vulnerable locations						

707. Record of track maintenance work shall be maintained in TMS. Entries in TMS for departmental work as well as contractual works must be made by concerned IMSD Sectional, which shall be periodically scrutinized by IMSD Incharge/IMD In-charge by his own login Id. DFCCIL has developed DFIS app which facilitate internet-based Block working on real time basis by mobile phone. Arrangement of OTP has been made to safe guard the misuse of DFIS app.

708. Based on the inspections and as per Rolling Block Planning, IMSD In-charge will decide maintenance priority based on the available resources. He will arrange machines, materials and manpower in advance before taking up a work. He will ensure that maximum and minimum temperature of rail during maintenance is within the prescribed limits.

709. Procedure for maintenance activity: The first activity after reaching the site is measurement of rail temperature and assessment of maximum and minimum temperature. If, for the whole P-way maintenance activity duration, the expected Rail temperature is within the permissible range, then only all related activity shall be started after taking all precautionary safety measures. The presence of minimum Jr. Executive level official is essential at the site when tamping is done by Off-Track tampers. After the block is granted, he will ensure to protect the track before starting the work. The following shall be ensured: -

a) At no time, not more than 30 sleeper spaces in a continuous stretch shall be opened for manual maintenance or shallow screening with at least 30 fully boxed sleeper spaces left in between adjacent openings. Maintenance of track in between lengths shall not be undertaken till passage of traffic for at least 24 hours.

b) For correction of alignment, the shoulder ballast shall be opened out to the minimum extent necessary and that too, just opposite the sleeper end. The ballast in shoulders shall then be put back before opening out crib ballast for packing.

c) In exceptional circumstances when more than 30 sleeper spaces have to be opened for any specific work, like through screening of ballast etc. during the period of the year when minimum daily rail temperature is not below t_d-30°C or maximum does not go beyond t_d+10°C, up to 100 sleeper spaces may be opened under the direct supervision of designated IMSD sectional.

d) Tamping of track with general lift not exceeding 50 mm including correction of alignment shall be carried out during the period when prevailing rail temperatures is within specified temperature limits (t_d+10°C and t_d-30°C.) for elimination of minor sags, which develop through improper maintenance. Lifting is to be done by track machines only. The easement gradient for the passage of trains should not be steeper than 25 mm in one rail length of 25/26 metres. Correct level pegs as per design level should be fixed at suitable intervals, before lifting commences. The operation should be repeated until the required level is attained when the track should be finally ballasted, through packed and boxed, the cess being made up to proper level and required width. Lifting beyond the designed level shall not be done.

e) If rail temperature after tamping operation exceeds t_d+20°C during the period of consolidation, then the speed restriction of 50 Kmph shall be imposed. Lifting where needed, in excess of 50 mm shall be carried out in stages with adequate time gap in between successive stages such that full consolidation of the previous stage is achieved prior to taking up the subsequent lift.

f) Lowering of the track should not be resorted to except where it cannot be avoided and if resorted to, it should be done by Ballast Cleaning Machine under suitable speed restriction and under the protection of Engineering signals. In exceptional case for manual lowering IRPWM may be referred to.

710. Planned tamping of plain track and Points & Crossings: - Systematic tamping of plain track as well as Points & Crossings should be planned on long continuous lengths, based on results of TRC/OMS and history etc. A minimum depth of 150 mm of clean ballast cushion below the bottom of the sleepers is recommended for the proper functioning of the tie tampers. Adequate ballast should be available in the shoulders and cribs. In case adequate ballast is not available, planning and execution of deep screening of ballast, where required, as well as recoupment of ballast should be done well in advance. Realignment of curves should be planned as per geo coordinates. For achieving quality output following is required:

a) Pre-tamping attention: -

i. Proper preliminary survey data shall be available for machine working so as to bring the track back to original alignment of some re-designed alignment

ii. Ballasting where there is shortage of ballast. Heaping up ballast in the tamping zone, to ensure effective packing. Clearing of ballast on sleepers to make them visible to the operator.

iii. Making up of low cess.

iv. Cleaning of pumping joints and providing additional clean ballast, where

necessary.

v. Attention to hogged joints before tamping.

vi. Tightening of all fittings and fastenings like fish bolts and elastic fastenings and replacement of worn-out fittings and renewing broken and damaged sleepers and fastenings.

vii. Squaring of sleepers and spacing adjustment; re-gauging to be done as necessary.

viii. All obstructions such as signal rods, cables, pipes, level crossing check rails, joggled fish plates etc., likely to be damaged by the tampers should be removed. In unavoidable case, these should be clearly marked and made known to the tamping operator before he starts work. Tight overhead clearance should also be brought to his notice; the beginning and end of transitions should be marked.

b) Attention during Tamping:

i. The tamping depth i.e. gap between the top edge of the tamping blade and the bottom edge of the sleeper in closed position of the tamping tool should be adjusted to 15 mm to 20 mm. Care should be taken to ensure that tamping tools are inserted centrally between the sleepers into the ballast to avoid any damage to the sleepers.

ii. The tamping (squeezing) Pressure (110 – 120 Kg/Sq. cm for plain track and 125-135 Kg/Sq.cm for P&C) and squeezing time (0.8 second to 1.2 second) should be adjusted according to the track structure, as per the recommendations of the manufacturer.

iii. Generally, one insertion is adequate. Two insertions may be necessary if the lift is above 30 mm.

iv. The shoulders should be compacted along with tamping, where separate provision for shoulder compaction is available.

v. A run-off ramp of 1 in 1000 should be given before closing the day's work.

c) Post Tamping Attention:

i. Immediately after the tamping work, the track should be checked for quality of work done, in respect of cross levels and alignment, and action taken as considered necessary. Test check of records after passage of one train should be recorded.

ii. As some of the fastenings might become loose, tightening of fittings should be done immediately after tamping.

iii. Any broken fitting/sleeper should be replaced.

iv. The ballast should be dressed neatly and proper filling and consolidation of ballast between the sleepers should be done.

711. Picking up of Slacks: Slacks usually occur on stretches of yielding formation, on high banks and cuttings, on approaches of bridges, SEJs, P & C zones, on badly aligned curves, axle counter locations and other electrical and S & T installations where ballast is poor in quality or quantity or where drainage is defective. Need for attention to slacks is determined by inspections and results of track recording car and OMS car. The locations needing urgent maintenance as detected by TRC/OMS shall be targeted first for restoring normal condition quickly and thereafter the locations identified for Need Based Maintenance as determined by Track recording Car or other inspections shall be attended. Track official after reaching site will verify the results after taking gauge, cross level, unevenness and alignment on 9 m chord of the affected location which can be checked after visual inspection. The values of unevenness and alignment are indicative only as the value of TRC are in loaded condition and values

are being verified in floating conditions. For spot attention/slack picking, multi-purpose Tampers and Off-track handheld tampers/ any other approved equipment shall be used as a regular measure. In very exceptional circumstances where Off-track tampers are not available, packing may be done with the help of Crowbar/Beater after approval of CGM/RMU in charge, duly taking care that concrete sleepers are not damaged. When crowbars are used for slewing, care shall be taken to avoid lifting of track.

712. **Maintenance of yard lines:** - Though movement of trains in yard line takes place at slower speed but it is necessary to maintain it in good health. Normally track recording to these lines is not covered by TRC/OMS. Hence, track parameters on these lines will have to be measured manually or by other suitable methods. The defects noticed during inspection of yard lines shall be attended by deploying the gangs or machine as per the requirement.

713. Observance of attended track under Passage of Traffic after completion of works: - After completion of works the team supervisor and Track Maintainers at the work site should stand on the cess up to one rail-length in addition of stretch of track they are attend, and observe the movement of sleepers under load. Immediately after the passing of train, loose sleepers should be marked, packed uniformly and the packing tested. The post tamping reading should be taken after passage of minimum one goods train.

SLEEPERS AND FASTENING RENEWALS

714. **Laying of PSC Plain track Sleepers:**

a) PSC Sleepers shall be laid and maintained square to the rails on straights and radially on curves. The rail joints should be suspended between the sleepers.

b) Relaying with mechanical equipment should be adopted while carrying out track renewals with concrete sleepers, as the manual handling of concrete sleepers is difficult and may cause damage to the sleepers.

c) The preliminary (preparatory) work prior to relaying at site, the actual relaying process at site and the post relaying operations are described in detail in "IRTMM-2019".

715. **Laying and Casual Renewal of Concrete Sleepers manually**

a) Manual laying will not normally be adopted except under exceptional circumstances when some isolated sleepers' cracks or inserts are broken.

b) PSC Sleepers shall be laid and maintained square to the rails on straights and radially on curves. The rail joints should be suspended between the sleepers.

c) Not more than one sleeper in 30 consecutive sleepers shall be replaced at a time. Should it be necessary to renew two or more consecutive sleepers in the same length, they may be renewed one at a time after packing the sleepers renewed earlier duly observing the specified temperature limits (t_d+10°C and t_d -30°C).

d) If consecutive sleepers are to be renewed suitable caution shall be imposed which shall be lifted after packing and consolidation.

e) Concrete sleepers shall be placed perpendicular to the length of the BFR/RBMV. Manual unloading, if unavoidable, shall be done sleeper by sleeper. Wooden or steel sleepers provided with hooks at the top ends for gripping the side of the BFR shall be used as ramps for sliding the sleepers down to the cess level. Damage by over-running shall be prevented by placing the lower ends of the ramps either inside an old motor truck tyre or between gunny bags filled with

wood shavings and the sleeper allowed to move down the ramp. Two men shall stand on the cess with crowbars planted into the cess and control the downward sliding of the concrete sleepers. After unloading, the sleepers shall be placed on the cess approximately alongside the final position.

f) Just prior to the line block, a speed restriction of 20 KMPH shall be imposed on the portion to be re-laid during the block and rail sleeper fastenings shall be removed from the alternate sleepers. Ballast cribs between sleepers shall be exposed up to bottom level of sleepers. It shall be ensured that the number of sleepers taken up for replacement during the line block period shall not be more than that which can be given at least one mechanical tamping with 'on track' tamper before the first train is allowed after the replacement of the sleepers.

g) After taking the line block, the rails over the length to be dealt with during the line block period shall be disconnected and removed. For isolated casual renewal of sleepers it is not required to remove the rail and the sleeper can be taken out by removing the fittings of three or four adjoining sleepers and lifting the rail slightly. The sleepers shall then be taken out, taking care to disturb the ballast bed only to the minimum extent.

h) The new concrete sleepers shall then be laid in position by means of sleeper slings taking care to ensure the correct longitudinal and lateral alignment. When the sleepers are being placed in position, the prepared ballast bed should be disturbed only as little as possible. Care should be taken not to damage the edges of the sleepers or to chip the concrete. After the sleepers are placed, rubber pads shall be placed at the rail seats. Elastic clips shall be loosely fastened at this stage. If the original rails are to be continued after relaying, the track rails shall be laid and connected on either side.

i) After the sleepers are packed, the rails shall be secured in position by inserting liners and elastic rail clips and firmly fastened.

716. Laying/Renewal of Fan Shaped Turnout Sleeper:

a) Sleepers shall be transported by BFR's or by road from the store to the site and unloaded on the side of the track. The complete turnout will be assembled on a level ground adjacent to the site of laying or on the loop line connected to turnout. The spacing shall be strictly maintained. On DFC, the sleepers sets for left and right hand turnouts are different.

b) Ensure that a clean ballast cushion of 300 mm below the bottom of sleeper is available. The ballast bed must be perfectly level. Enough ballast shall be stacked along the cess to enable the filling of ballast in the cribs on the same day. Remaining 50 mm cushion will be achieved after tamping by UNIMAT.

c) The sleepers in the crossing portion shall be perpendicular to bisector line of crossing angle. Long Sleepers in switch portion meant for providing motor may be placed for housing motor with the extended portion of sleeper in reverse direction only in circumstances where it cannot be avoided.

d) Insertion of pre-assembled turnout – The complete assembled turnout shall be inserted in position by using T-28 machine as one unit or after breaking it into three panels viz. Switch, lead and crossing portions by means of T-28 machine or cranes or rollers.

e) To ensure correct layout, the laying of sleeper falling at transition from switch to lead and lead to crossing portion should be paid special attention.

f) Special care shall be taken to ensure that ATS location, X-ing locations shall remain same as of original design during renewal of Sleepers/Switches/X-ings.

717. Inspection, maintenance and renewals of Sleeper's Fastenings: -

a) Elastic Rail Fastenings inspection: - The clips should be driven/taken out with clip applicator/extractor.

i. The essential feature of the Elastic rail clip is the correct driving of the clip, which should be checked by the Keyman during his patrolling. The clip should be driven so that the leg of the clip is flush with the end face of the insert.

ii. Toe load of elastic rail clip should be measured on 1% of ERCs randomly on every 100 sleepers (all 4 ERCs to be measured on one sleeper). The testing of ERCs is to be done after four years or passage of 200 GMT of traffic, whichever is earlier. In corrosion prone area, the initial testing of ERC is to be done after two years or passage of 100 GMT, whichever is earlier.

iii. However, if 20% or more of sample size records toe load below 900 kg, both frequency of inspection and sample size are to be doubled.

iv. If 20% or more of sample size records toe load below 650 kg, which is to be confirmed by 5% sample size, proposal of through fastening renewal should be initiated.

v. The loss of toe load is reflective of conditions of other elastic fastening components like groove rubber sole plate, liners etc. as well. The field units may also record condition of these components along with measuring toe loads for elastic rail clips.

b) Lubrication of ERCs – Grease Graphite to the specification IS-408-1981 Gr. "O" should be used for this purpose. This work should not be carried out during extreme summer and heavy rainfall. At a time, ERCs should not be removed from more than one sleeper and at least 15 sleepers shall be kept intact between any two sleepers taken up for lubrication of ERCs at the same time. The ERCs should be cleaned by wire brush and emery paper. The eye of the insert shall also be cleaned by a suitable brush. After cleaning, grease graphite shall be applied to the inside surface of eye of insert and leg of ERC. Inside/Outside ERCs should be interchanged and fixed again. The lubrication of ERCs and insert at the time of initial laying should be done and thereafter should be done once in a year in corrosion prone areas and once in two years in other areas or more frequently as decided by CTE/DFC.

c) Composite Groove Rubber Sole Plates inspection– It must be ensured that the CGRSP are in correct position. Whenever it is found that the rubber pads have developed a permanent set, these shall be renewed. The loss of toe load can also be due to ineffective pads. The toe load should be checked regularly, as prescribed, and also if any creep is noticed It shall be ensured that the manufacturer's initials embossed on CGRSP are in contact with the rail bottom.

d) Metal/GFN Liners inspection- The liners should be inspected and fitted in proper position. Corroded/dent marked liners adversely affect the toe load and should be planned for replacement.

e) Plate screws in Turnouts and Bridge concrete sleepers- Only Galvanized plate screws should be provided in track. Wherever the plate screws are not galvanized, it should be opened and refixed at an interval of once a year.

718. Renewal of fastenings: Precaution during renewal of fastenings shall be taken as per the provisions of LWR/CWR. Large scale replacement of fastenings must be done under the supervision of IMSD Sectional. The work of renewal of fastenings shall be carried out when rail temperature is within the specified temperature limits (t_d+10°C and t_d-30°C.) with following additional precautions:

a) Renewal of fastenings not requiring lifting of rail: Fastenings not requiring lifting of rails, shall be renewed on not more than one sleeper at a time. In case

fastenings of more than one sleeper are required to be renewed at a time, then at least 15 sleepers in between shall be kept intact. Work shall be done under supervision of Keyman/MTS.

b) **Renewal of fastenings requiring lifting of rail:** Fastenings requiring lifting of rails i.e., grooved rubber pads, etc. shall be renewed on not more than one sleeper at a time. In case fastenings of more than one sleeper are required to be renewed at a time, then at least 30 sleepers in between shall be kept intact. Work shall be done under supervision of IMSD Sectional. Alternatively, if prevailing rail temperature is lower than t_d-10, fastening up to 5 sleepers on either side may be removed for replacement of rubber pad under the rail.

MAINTENANCE OF TRACK ON BRIDGES AND BRIDGE APPROCHES

719. Inspection and Maintenance of Track on Bridge:-

a) Proper seating of girders should be checked. Shifting of girders laterally or lengthwise create misalignment in track. Sleepers should have correct seating on girders and rails should have correct seating on sleepers for maintaining track geometry.

b) Creep should be measured, and corrective action should be taken accordingly.

c) In case of variation in track level from designed, level of bed blocks should be checked. The adequacy of clearances of running rails over ballast walls or ballasted girders at the abutments should be inspected.

d) Sleepers – The condition of sleepers and fastenings should be checked. The spacing of sleepers should not exceed the limits laid down. Squareness of sleepers shall be ensured. Sleepers requiring renewals should be marked with paint, and renewals carried out.

e) The guardrail arrangements should be checked. The correct distance between the running rail and guardrail should be maintained as per the prescribed dimensions.

f) On girder bridges condition of pathways should be checked by Dy.CPM and repaired if needed.

g) During destressing of rails on ballasted deck bridges, destressing of bearing of bridges are also to be done.

720. Fabrication of Steel sleeper and other components –

a) Fabrication of Steel Sleepers on bridges and its protective coating should be in conformity with BS-45 issued by RDSO.

b) For girder, location of Steel Sleepers should be marked and numbered after detailed survey of the girder. The fabrication of Steel Sleeper should be location specific considering the girder Centre, top flange cover plates, pitch of rivets etc.

c) In the case of bridges on curves, the location of Steel Sleepers should be marked after considering the realigned curve. In case transition curve lies on bridge fully or partially, the thickness of steel pad plate should take care of cant gradient.

721. Laying of Steel sleepers on bridges –

a) The minimum level of supervision while replacing channel sleepers shall be IMSD Sectional.

b) Before laying Steel Sleepers, creep if any, should be pulled back and rail joints should be so located that after laying sleepers, joints should not become supported joints.

c) The top flange of the girder should be cleaned of old paint and then re-painted as specified.
d) Wherever required the existing cross level and misalignment of girder/ track should be corrected in advance of Steel Sleeper laying.
e) Single pad plate below Steel sleeper is preferable. Packing plates can be used along with pad plate to adjust Parameters, wherever required. The pad plates are not required where neoprene pad is provided to cover the rivet head.

722. Maintenance of Steel sleepers and fittings on Bridges:
a) Keyman must check the looseness of fittings on daily basis.
b) Hook Bolts – Hook bolts shall, be galvanised. These should be checked for their firm grip. Position of arrows on top of the bolts should be at right angles to the rails pointing towards the rail.
c) Creep and joint gaps should be checked, and rails pulled back wherever necessary. Defective rails should be replaced. Where switch expansion joints are provided on the girder bridge, it should be ensured that free movement of the switch is not hindered.
d) After laying Steel sleepers, tightening of all fittings including hook bolts should be done once in 15 days and it shall be ensured by IMSD sectional.
e) Guard rail fittings should be tightened once in three months.
f) Replacement of grooved rubber pads & elastomeric pads shall be done on condition basis.
g) In case Galvanized coating is damaged, it should be repaired.

723. Inspection and maintenance of Track on Approaches of Bridges: On all bridge approaches, sleepers with arrangement for fixing guard rails should be provided for provision of guard rails.
a) The rail level of track at approaches of bridges should be maintained as per designed level, versine and cant and dips in rail level immediately after the abutments should be avoided.
b) Rail joints should be avoided within three meters of a bridge abutment.
c) Joggled fish plate with clamps on good AT welds shall be provided on bridges having length of water way of 100 m or more and on approaches up to 100 m length.
d) For maintaining the ballast section, suitable ballast retaining arrangement should also be provided.
e) In addition, for important and major bridge approaches, for a length of about 100 meters, width of cess should be 90 cm clear of full ballast section to maintain ballast profile.

BALLAST RESILIENCE, CLEANING, RENEWALS AND DRAINAGE

724. Maintaining Ballast Profile: Replenishment of ballast shall be completed before onset of summer. Shortage of ballast in the shoulder at isolated places shall be made up by the Executive P-way by taking out minimum quantity of ballast from the centre of the track between the two rails over a width not exceeding 600 mm and a depth not exceeding 100 mm. Enough ballast shall be collected to provide full ballast section before commencing any maintenance operation, specially lifting.

725. Assessment of Ballast Requirements –

a) The requirement of ballast shall be assessed separately for:-
   i. Making good the deficiencies as existing in track,
   ii. Making good deficiencies arising out of overhauling, through packing/tamping and deep screening,
   iii. For providing adequate cushion in the case of mechanical tamping,
   iv. For providing extra cushion/profile or up-gradation of track structure for higher axle load.

b) The ballast required for maintenance purposes shall be estimated by assessing the quantity approximately, if necessary, by a survey, over a rail length in every 1 km. Care should be taken that the cores under the sleepers are not disturbed.

c) In case of deep screening, assessment of ballast required for recoupment and providing standard section should be made by deep screening the ballast section to the full depth in a rail length for two to three sleepers at every 0.5 to 1 km. In this case screening is done under the sleepers as well.

d) The quantities assessed vide Sub-Para above will be the net quantities of ballast required to recoup the deficiencies to provide required profile / sections. The above net quantities may be enhanced suitably (say 8%) to arrive at gross quantities of ballast for the purpose of procurement action in case measurements are proposed to be taken in stacks or in wagons at originating station.

726. Collection and Training out of Ballast – The collection of ballast can either be done-

a) By collecting at depots and training them out by ballast trains. The stacking ground should be levelled and firm with good drainage so that ballast is not submerged.

b) The mode of collection shall be decided considering proximity of quarry, availability of good stone ballast, service roads alongside the line for carrying of ballast, availability of ballast trains, the turn round of ballast trains and availability of block for unloading.

c) Cess supply is banned in DFCCIL except with the permission of Corridor Director.

727. Handing over Charge by IMD In-charge – During transfer the IMD In-charge taking over, should satisfy himself by test checking some of the stacks at each depot to the effect that the quantities of Ballast shown in the registers are correct. He should certify that this has been done by initiating each entry so checked.

728. Unloading Ballast along the Line – When unloading ballast along the line care shall be taken that the heaps at the sides and the center are clear of prescribed running dimensions. Care should be taken to ensure that Ballast shall be cleared from the point rods and no stone is left inadvertently between the stock rail and tongue rail.

729. Surplus Ballast Along the Line – All surplus ballast left alongside the line should be collected and stacked in regular heaps and not left scattered on the slopes to be overgrown by grass and lost.

730. Systematic Overhauling of Ballast: Need based overhauling will be adopted. The overhauling should be done using SBCM for cleaning shoulder ballast. Cess when high, should be cut along with overhauling and when low, should be made up. A template should be used for this purpose. The crib ballast should also be shifted to shoulders for screening by the machine, which should again be put back in crib portion. It should be done when the expected temperature is not likely to go beyond T_d+10.

731. Deep Screening of Ballast: Due to presence of bad formation, ballast attrition, excessive rainfall and dropping of fines and ore, ballast gets choked up and track drainage is impaired. In such situations, there may be need to screen the entire ballast right up to the formation level /sub- ballast level. Such screening is called "Deep screening", as distinguished from shallow screening, which is done, during overhauling. During deep screening, standard ballast section should be provided. Side drains in cuttings, yards etc. should also be restored after deep screening. Deep screening should be done as need based during maintenance period and it is mandatory prior to through Sleeper renewals. All the loop lines should be deep screened when the clean ballast cushion is less than 150 mm.

a) Deep screening should be avoided in case of extreme temperatures.

b) The deep screening is done by BCM machine as detailed in IRTMM. All precautions stipulated for LWR/CWR track shall be strictly followed. The work of deep screening shall be followed by Tamping and Stabilization of Track with TTM (Tie Tamping Machine) and DTS (Dynamic Track Stabilizer) respectively or using dynamic tamper having both provisions. The work is to be carried out in stages on various days after the start of the screening operations and the speed restriction recommended to be imposed are indicated in the schematic representation in Table – I. According to the schedule, normal sectional speed can be resumed on the 8th day.

c) The cutter bar shall be removed after completion of day's work, ballast filled and packed & stabilized by TTM/DTS.

d) Ramp shall not be located in locations like level crossing, Girder Bridge, transition portion of curve etc. It shall be kept away minimum 26m.

e) In case of malfunctioning of TTM and/or DTS, deep screening shall be stopped and track which has not been tamped and stabilized shall be attended manually by ballast ramming and correction of track geometry to ensure safety of running trains. Speed restriction shall be imposed as 20 KMPH till the availability of machine and the speed will be relaxed as per the schedule after machine packing. In case the machine is not repaired for more than 7 days, speed will be relaxed with manual packing as per the provision of IRPWM for the length already screened.

f) When BRM is not deployed, adequate track maintainer shall be deputed to recoup ballast, particularly in shoulder and maintain ballast profile after machine working.

g) Lifting of track shall be resorted to after ensuring adequate availability of ballast for maintaining ballast profile for planned lifting.

h) Ballast Cleaning Machine (BCM), tamping machine and Dynamic Track Stabilizer (DTS) shall, as far as possible, be deployed in one consist.

i) Temperature records of the sections where deep screening is to be undertaken, shall be studied for the previous and the current year. The maximum and minimum rail temperature attainable during the period of deep screening and during the period of consolidation shall be estimated.

j) If range of rail temperature falls within t_d+10°C to t_d-20°C, deep screening may be done without temporary de-stressing.

k) If range of rail temperature falls outside t_d+10°C to t_d-20°C temporary de-stressing shall be carried out 10°C below the maximum rail temperature likely to be attained during the period of work. Constant monitoring of rail temperature

shall be done during the progress of work. Should the temperature go beyond expected temperature 2nd temporary de-stressing should be done before closer of traffic block. Patrolling of the section shall be done till second de-stressing is completed.

l) During the winter period of deep screening, if there is any possibility of minimum temperature falling 20°C below t_d, temporary de-stressing should be done before closer of the block.

m) After deep screening and consolidation, de-stressing of LWR shall be undertaken.

Table-1

SCHEDULE OF SPEED RESTRICTION DURING MECHANIZED DEEP SCREENING

Details of Work	Days of Work	Speed Restriction
Deep screening of track by BCM, ballast equalization followed by initial packing and initial stabilization by DTS in maximum settlement mode.	1st day	40 Kmph
First round of tamping followed by stabilization of track by DTS in maximum settlement mode.	2nd day (1st Tamping)	40Kmph
Ballasting for recoupment of ballast d efficiency if required (boxing of ballast section and tidying	3rd day	40 Kmph
Boxing of ballast section and tidying	4th day	40 Kmph
Second round of Tamping followed by stabilization of track by DTS in maximum settlement mode	5th day	40 Kmph
Survey of track for design tamping mode as per Annexure - 2.16 of IRTMM, boxing of ballast section and tidying.	6th day	75 Kmph
Inspection of Track ,boxing of ballast section and Tidying	7th day	75Kmph
Third round of tamping in design mode followed by two round of stabilization by DTS in controlled settlement mode.	8th day (3rd Tamping)	75 Kmph
Inspection of track, boxing of ballast section and tidying.	8th day	Normal speed of the section

FORMATION AND DRAINAGE MAINTENANCE

732. Nature of Formation Problems: In such stretches, the track levels get disturbed frequently causing problems in track maintenance. These problems are attributable to: -

a) Excessive or uneven settlement of banks affecting track Parameters.
b) Slope failure leads to slips, heaving beyond the toe, creep or bulging of slopes.
c) Ballast penetration and mud pumping of poor Subgrade Material.
d) Swelling and shrinkage of expansive soils in fills such as black cotton soil.
e) Cracks on the cess, affecting track Parameters.
f) Rain cuts

733. Remedial Measures Suggested –Site investigations and soil testing should be done and accordingly relevant remedial measures should be formulated. Some of the remedial measures suggested for the formation troubles generally encountered are listed below for guidance:

Sl. No.	**Nature of Problems**	**Remedial measures***
1	Inadequate drainage due to high cess, fouled ballast	Improve side drainage by lowering the cess and screening of ballast
2	(i) Weak soil at formation top on contact with rainwater resulting into mud pumping under trains, (ii) Fouling of ballast with Subgrade fines, (iii) Impaired drainage	(i) Improve the drainage, (ii) Provision of blanket of suitable thickness. (iii) Laying of Non-woven Geotextile
3	(i) Strength failure below ballast causing heaving up of cess or in between sleepers, (ii) Ballast penetration exceeding 30 cm below formation	(i) Provision of blanket of suitable thickness. (ii) Laying of Non-woven Geotextile below blanket
4	Seasonal variation in moisture in formation top in expansive soils causing alternate heaving, shrinkage of formation.	(i) Blanket of suitable thickness, (ii) Thickness of blanket may be reduced with provision of Geogrid layer, (iii) Laying of Non-woven Geotextile below blanket
5	Gradual consolidation of earth below embankment (Bank settlement & heaving of soil beyond toe).	(i) Provision of Sub-bank (ii) Prefabricated vertical drain along with Sand layer at top/Geo-composite drain (Horizontal) or , (iii) Stone columns in sub soil
6	Creep of formation soil.	Flatting of side slopes with sandwiched construction.

7	(i) Inadequate sides slopes, causing embankment slips after prolonged rains, (ii) Longitudinal cracks on cess/slopes	Flattening slopes or provision of berms as per slopes analyzed with slope stability analysis & with proper drainage system
8	Hydro-static pressure built up under live loads in ballast pockets containing water causing bank slips.	Draining out of ballast pockets by sand or boulder drains
9	Erosion of slope/cess of banks	(i) Repair of slope/cess, (ii) Provision of turfing, mats, etc.
10	Cut slope failure	(i) Adequacy of slope/slope protection measure as required, (ii) Provision of adequate drainage arrangement (Side drain/Pucca catchwater drain etc. and ensure its proper functioning)

Remark: - The above measures suggested are only indicative in nature & final remedial measures shall be decided based on-site investigation, soil testing, past failure history (if any) etc. For details, relevant latest instructions issued through various guidelines/ specifications for earthwork by RDSO, shall also be referred to.

734. Side and Catch Water Drains and Waterways:

a) For efficient drainage of cuttings, side and catch water drains of suitable type and size should be provided. The bottom of side drains should be at least 30 cm below the formation level.

b) Adequate openings to take the full flow of side drains should be provided at the end of the cuttings.

c) In cuttings catch water drain should be provided sufficiently away from the top of the cutting to avoid any danger of a breach occurring between the drain and the cutting itself. The excavated spoil should be used to form a 'bund' between the drain and the top of the cutting.

d) Ballast walls, where provided in cuttings, should be regularly inspected. The efficient maintenance of ballast walls includes regular cleaning of weep holes, the provision of weep holes where none exist and rebuilding where necessary.

e) The cleaning of side and catch water drains, clearing of obstructions from outfalls and cleaning waterways of bridges and culverts shall be completed before the monsoon sets in. The spoil from cleaning drains or cuttings should not be deposited at a place from where it is likely to be washed back into the drains.

f) In the Municipal areas, where the outfall of Railway drains is in the municipal drains, close co-ordination should be maintained with the municipal authorities to ensure free flow from Railway drains.

g) The cross drain to drain out the water collected in between DFC and IR track should be regularly cleaned.

735. Drainage in Station Yards: - The network of cross and longitudinal drains in yards should be so planned that storm water is led away in least possible time. The system

of surface drains of carriage-watering and carriage washing hydrants should be efficiently maintained. Proper yard drainage plan should be prepared and maintained by executive.

UPKEEP OF SPECIAL FEATURES ALONG THE TRACK

736. Maintenance of SEJs:

a) Once in a fortnight SEJs shall be checked, packed and aligned if necessary. Oiling and greasing of tongue and stock rails of SEJ and tightening of fastenings shall be done simultaneously.

b) During his daily patrolling, Keyman shall keep special watch on the SEJs falling in his beat.

c) The gaps between the reference mark and tongue rail tip/stock rail corner, which is attached to the LWR/CWR side at various rail temperatures, shall not differ by more than ±10 mm from the theoretical permitted range.

d) Where fish-plated or SWR track is joined on one side of SEJ, the gap between the reference mark and tongue rail tip/stock rail corner on SWR/Fish plated track side shall not be measured.

737. Section Limit Boards:

a) Boards at jurisdictional limits should be provided thus:

i) End of CGM unit

RMU JAIPUR.	**RMU AJMER.**
Dy.CPM/Tr/(Name of IMD)	DY. CPM/Tr/(Name of IMD)
(name of IMSD)	(Name of IMSD)

ii) End of IMDs

Dy.CPM/Tr/(Name of IMD)	DY. CPM/Tr/(Name of IMD)
(Name of IMSD)	(Name of IMSD)

iii) End of IMSDs

(Name of IMSD)	(Name of IMSD)

b) Suitable boards should also be provided indicating the state and district boundaries.

c) When a board must be located at an exact kilometer, it should be fixed by the side of the kilometer post.

d) The boards, which may be of RCC should be fixed on the cess on the same side of the line. The letters and figures should be painted black on white background.

738. Kilometer and Gradient Posts: -These may preferably be of RCC of suitable dimensions and fixed at right angles to the track on the cess to be distinctly visible. The figures, arrows and letters should be painted black on a white background.

739. OHE Mast/ Numbers: -

a) Kilometrage should be indicated on OHE Mast/ either by painting or providing number plates (Retroreflective boards) thereon as per the provisions of Traction Manual. Either the plate can be provided on both sides of OHE masts or in the

direction of traffic. The number plate may be provided and on opposite side it can be painted. It is to be provided by the Electrical department. In bottom the opposite site the OHE Pole, chainage of the center of OHE Mast shall be painted at suitable place by Pway officials.

b) In deep-cuttings or tunnels, OHE Mast/ numbers should be repeated at cess level.

c) On double line section where one line is located away from the line along which the OHE Mast/ numbers are provided and from where the figures on the Mast/ Hectometer cannot be easily read, additional rail posts should be provided along the other line, which should indicate the corresponding OHE Mast/ numbers.

740. Protection of Land Boundaries: - The IMSD in charge is responsible for maintaining the railway land boundaries on DFCC side where DFCC track is parallel and both side when it is on the detour. The IMSD in charge shall submit, by the prescribed date every year, a certificate to the IMD In-charge regarding no encroachment in DFCCIL land boundary, during his inspection IMD IN-charge shall ensure that railway boundaries are demarcated correctly and that there are no encroachments. In cases where he cannot prevail on the parties to remove the encroachments, he must report the facts with particulars to the Dy CPM and CGM unit/RMU Officers who will take up the matter with the Local Authorities.

741. Standard Schedule of Dimension (SSOD): - Machine based checking shall be done for Standard Schedule of Dimension over the sections and shall be verified personally by the IMSD In-charge and submit no infringement certificate to IMD In-charge by the end of March. IMD In-charge after scrutiny should forward these to Dy.CPM. Works involving infringement should be referred to the Competent Authority for sanction prior to execution.

742. Reference Marks: Reference marks are needed for various maintenance operations like measurement of creep, maintenance of turnouts and SEJs, destressing etc. Following should be observed while fixing reference marks:

a) Reference marks shall be fixed reference pillars erected for this purpose.

b) While the reference marks on the reference pillars shall be saw marks, corresponding marks on the running rails shall be paint marks on the non-gauge face of the rail.

c) In no case, a saw mark shall be made on the running rail. Reference marks are required to be fixed immediately after de-stressing of LWR/CWR and shall not be shifted or tampered with thereafter.

d) Additional reference marks in breathing length may be provided to know the behaviour of LWR/CWR.

e) For measuring CWR creep in every KM the 1st OHE mast of KM shall be used as reference pillar. For accurate measurement of creep T may be used for reference line. The Delhi Facing surface of OHE mast shall be used for reference purpose on EDFC and WDFC both.

f) A Reference pillar shall be erected for measuring creep of Stock rail at ACD/ATS location on Right and Left handrail of all Turnout.

g) A Reference pillar shall be erected for measuring creep of X-ing at ANC of all Turnout.

743. Felling of Trees Obstructing View: - Trees and bushes that interfere or tend to interfere with the view from a train or trolley, or signals or level crossings or along the inside of curves, shall be cut. When cut, it should be ensured that they do not foul the track. When trees and bushes require to be cut in terms of Sub-Para above, on private lands, action should be taken as laid down in Section 14 of the Railways Act 1989 (24 of 1989) reproduced below:

"14. (1) Where in the opinion of a railway administration –

a) there is imminent danger that any tree, post or structure may fall on the railway so as to obstruct the movement of rolling stock; or

b) any tree, post, structure or light obstructs the view of any signal provided for movement of rolling stock; or

c) any tree, post or structure obstructs any telephone or line maintained by it, it may take such steps as may be necessary to avert such danger or remove such obstruction and submit a report thereof to the central government in such manner and within such time as may be prescribed."

744. Fouling Mark

a) The fouling marks should consist of a stone/ cement concrete block about 1500 mm in length, 250 mm wide and 125 mm thick, with the top edge rounded off and the top surface whitewashed. These should be laid level with the top line of the ballast section. Fouling marks should be distinctly visible and difficult to remove.

b) These should be fixed at the point at which the spacing between the tracks, begin to reduce to less than the minimum as laid down in the schedule of dimensions, i.e. not less than 6.0 meters

c) The CSL (Clear Standing Length) of loop and number of wagons, which can be accommodated in a siding or a loop, should be marked on each fouling mark.

ACTION IN CASE OF EMERGENCY

745. Action in case of Derailments:

a) When the damage is extensive and track is distorted in such a way that it is not possible to pass traffic even at a restricted speed, the affected portion should be isolated by introducing buffer rails (as an emergency restoration measure) / on either end of the affected portion. The distorted track should be removed and replaced by track laid with available rails and sleepers. The traffic should be restored at a restricted speed. The affected portion should then be converted to long welded rails by taking usual precautions for LWR.

b) When the damage is not extensive and it is possible to pass traffic at a restricted speed, suitable speed restriction should be imposed after assessing the damage to track, sleepers should be replaced as in the case of casual renewals taking precautions as laid down for LWR/CWR. After all the damaged sleepers are replaced, the affected portion and 100 meters on either side should be de-stressed after consolidation, and normal speed should be restored thereafter.

c) In the case of manual working IRPWM may be referred.

746. Breaches, Temporary Girders and Diversions:

a) The affected portion shall be isolated by insertion of SEJs preferably within the temperature range specified for td.

b) The track thus isolated shall be replaced by fish plated / SWR track, which shall be box anchored, if necessary.

c) In the breached sections where the new banks are constructed, the formation shall be fully consolidated before laying LWR/CWR again.

d) In case of diversions and insertion of temporary girders, SEJ shall be inserted to isolate the portion where such work is required to be done.

e) The LWR panels in the affected portion shall be de-stressed immediately after the LWR are restored.

747. Manual Through Packing, Deep Screening, Over Hauling, Lifting and lowering of tracks and formation failures & soil investigation etc. have not been included in this manual. In case of need, relevant paras of IRPWM are to be referred to and action to be taken after approval of CTE/DFC.

CHAPTER – 8

RAIL MANAGEMENT

RAIL INSPECTIONS

801. RAIL TEMPERATURE: The first thing that is to be measured in CWR track before undertaking any activity is measurement of Rail Temperature. The maximum daily variation of rail temperature and the mean rail temperature (tm) for the section shall be ascertained from the temperature records available with the IMSD In-charge. If the rail temperature records of preceding five years are not available, the mean and range of rail temperatures from adjoining railway PWI offices should be taken or the mean and range of rail temperatures shown in the 'Map of India showing Rail Temperature in Para 405 shall be adopted in corresponding geographical jurisdiction in DFC after approval of competent authority of DFCCIL corporate office till DFC's own data is collected adequately.

a) The following are the types of approved thermometers for measuring rail temperature:

i. Embedded type: This is an ordinary thermometer inserted in a cavity formed in a piece of railhead, the cavity filled with mercury and sealed. The rail piece is exposed to the same conditions as the rail inside the track. This type of thermometer takes 25 to 30 minutes for attaining temperature of the rail.

ii. Dial type: This is a bi-metallic type thermometer, which is provided with magnet for attaching it to the rail. The thermometer is attached on the shady side of the web. A steady recording of the rail temperature is reached within 8 minutes.

iii. Continuous recording type: It consists of a graduated chart mounted on a disc, which gets rotated by a winding mechanism at a constant speed to complete one revolution in 24 hours or 7 days as applicable giving a continuous record of rail temperature. The sensing element is attached to the web of the rail and connected to the recording pen, through a capillary tube, which is filled with mercury.

iv. Any other type of thermometer approved by RDSO/ CTE.

b) The measurements of Rail temperature are to be done as follows:

i. The rail temperature shall be recorded using preferably a well-calibrated continuous recording type thermometer and data to be updated in TMS.

ii. The maximum and minimum rail temperature for a continuous period of at least 5 years shall be ascertained and the mean rail temperature (t_m) shall be decided accordingly.

iii. These temperature records shall be analysed to assess the probable availability of time periods during different seasons of the year for track maintenance, de-stressing operations and requirements of hot/cold weather patrolling etc.

iv. The rail thermometer shall also be available with each Gang and IMSD Sectional to enable the Gangs to work within the prescribed temperature ranges.

802. Rail longitudinal stress measurement in floating condition: The temperature at which the rails experience zero stress is called the Stress-Free Temperature (SFT). The two most important parameters affecting the stability of rails in CWR are rail stress and the lateral resistance of the track. It is well established that the SFT at which the track has been originally laid, changes with time, due to factors such as braking or acceleration of trains (which move the rail ahead /behind thereby increasing tension),

gradients, curves, bridges, mechanized track maintenance, degradation of fastenings (toe load), degrading ballast condition, extreme weather conditions, rail/weld repairs etc. Therefore, the primary strategy of maintenance is to keep the track close to SFT so that rail stresses are within limits. Installing CWR at a "safe" region at SFT does not guarantee that SFT will not change in future. Hence, to prevent the rails from buckling or fracture, SFT needs to be identified on a timely basis. The procedure defined by OEM of SFT measuring equipment's has to be followed properly and in case rail is to be lifted it should be done in proper traffic block.

803. Rails corrosion- In corrosion prone areas, measurement of depth of corrosion both vertically and laterally (reduction in bottom flange width of rail), shall be done using straight edge and feeler gauge or any other suitable device at a fixed periodicity of once in a year on every 100 sleepers by removing Elastic Rail Clips and liners and such measurements shall be recorded in TMS. The Corrosion prone area shall be decided by CTE/DFC.

804. WEAR:

a) **Wear on Rail Table** – The wear of top table increases with higher traffic density. Generally it shall be measured by TRC/RIV/Mechanized means.

b) **Flattening of rail table** —This mostly occurs on the inner rail of a curve because of higher contact stresses due to heavy axle loads, large un-sprung mass or under equilibrium speed on canted track, which causes slipping of wheel sets. Flattening of rail table is an indication of overloading on inner rail; and this tendency can be reduced, if appropriate cant is provided.

c) **Wear on Gauge Face** – The outer rail of a curve must withstand heavy pressure from the wheels, which results in the running edge becoming worn or 'side-cut'.

d) **Wear of sharp curves-** The wear of rails of curves having radius of 600 m or less shall be recorded periodically. The lateral wear, vertical wear and total loss of section should be recorded, and proper record of measurements maintained.

805. USFD Testing: USFD testing of rails is to be done by SRT having features of B scan and A scan both. With B scan, suspects will be identified and by A scan, the same will be verified and categorized as per USFD manual. In SRT, the machine is available immediately after finding the flaw, but in case of vehicular USFD like Spurt car either vehicle is brought back on the spot or a separate team shall be required to verify those suspects. Following are the methods adopted for USFD testing: -

a) B-Scan 9 Channel Single Rail and AT Welding testers.

b) Phased Array Ultrasonic Testing of FB Welds (PAUT)-PAUT is an advanced non-destructive ultrasonic technique that permits the shaping and steering of the ultrasonic beam angles and enhanced beam coverage. The Phased Array beam sweeps across the entire section of the rail/weld, resulting in a recordable image that reveals defects hidden inside a rail or weld. Phased Array has advantages over conventional ultrasonic, since it shows defect representation in A Scan, B-Scan, C-Scan and S-Scan that can produce more accurate results and provide a higher level of reproducible results which minimizes human error. PAUT technology as approved by RDSO may be used for testing rails/welds. If more than one FBW fracture in a km the Phased Array Testing of all The FBW of that km or similarly suspected should be done.

c) Vehicular USFD Testing.

806. Rail Profile measurement: Rail profile must be measured by DFC Rail inspection Vehicle (RIV) before and after rail grinding.

a) Rail Inspection Vehicle(RIV):- RIV is a self-propelled vehicle borne Rail Head inspection and Analysis System for use on the tracks. The self-propelled Rail Inspection Vehicle (RIV) can be installed with Rail Head Profile Inspection & Analysis System to facilitate advance digital inspection of rails for selection of an optimum rail grinding program.

b) Rail profile shall be measured after Rail grinding to assess the quality of rail grinding. There are handheld instruments which can measure the rail profile accurately. The rail profile of test sites should be measured by handheld profile instrument in the presence of track officials.

807. Corrugation – In certain locations, rail table develops ridges and hollows called corrugation and when vehicles pass over these rails, a roaring sound ensues. Such rails are called "roaring rails". In such locations, excessive vibrations are caused, due to which fastenings and packing tend to get loose and track needs frequent attention. These shall be attended by rail grinding.

RAIL MAINTENANCE WITHOUT INVOLVING RAIL CUT

808. RAIL GRINDING: Rail Grinding is an important technological solution to reduce damage to the rails and wheels by re-profiling railhead so that rail wheel interaction is favorable. Rail Grinding results in an increase in the life of rails and wheels, reduction in rail/weld failures, enhancing reliability and safety, reduction in fuel consumption.

a) DFC has 72 Stones machine with Grinding Stone of 250mm Dia and it can work on angles toward gauge face side from vertical +70 degree and towards field side from vertical -30 degree. The RGM can travel/ grind in both directions with working Speed from 2.4 to 24 kmph (normally 8-20). The annual grinding program based on last year GMT must be issued by the Head Quarter and it can only be changed/altered by CTE/DFC.

b) The machine is having two laser-based rail profile measurement systems to measure the railhead profile before and after the grinding. The after-ground profile is compared with the target rail profile by a machine software and an index known as GQI (Grind Quality Index) is displayed during the run. GQI gives an indication as to how close or away we are from the target rail profile. GQI value of 100 means that we have achieved the target profile within the specified tolerances. A lower value indicates the deviation. GQI value of 80 or above can be considered as satisfactory. However, we may achieve the target GQI after 2 or 3 cycles of rail grinding only. The grinding stones are positioned differently (at different angles) across the rail head. Arrangement of the stones is known as "Pattern". The Patterns are different for straight track, mild curves track (<1.25 degree) and sharp curves (≥1.25 degree).

c. Switch Rail Grinding Machine (SRGM) can be used to ensure grinding of turnouts, level Crossings, curves with check rails and other stretches where it is not possible to use main line RGM due to track structure or geometry constraints.

d. Rail Milling Machine:- Rail milling machines are meant to improve the worn profile of rail head to remove fatigued material having micro cracks of more than 0.3 mm size & other surface defects on the rail head.

809. Rail Lubrication: Track mounted automatic Gauge Face Lubricators should be provided on curves of radius 1400 meters and less to avoid Rail face wear. There are two types of lubricators, Electronic & Hydraulic. The Basic dispensing system of lubricant is almost similar for both Electronic and Hydraulic types of lubricating systems. It is located on tangent track at the beginning of transition curve where wheel flanging is about to occur. On single lines, the lubricator shall be in the direction of heaviest traffic. Lubricators to be provided at gauge side of outer rail. Lubricators should be located away from switches, crossings and other areas where discontinuity in LWR/ CWR track may exist.

810. Painting for Corrosion: Life of 880/R-260 grade rails is 1000 GMT with the use of Rail Grinding. The Life of 1080 HH/1175HT rails is not prescribed by rail manufacturers, but it is likely to be 1000 GMT to 2500 GMT. Rails may be on track for 20-40 years based on the GMT of the section. If corrosion is not prevented, the expected life of rail may not be fully utilized. Corrosion is generally noticed on the web, at the foot of the rail and liner seat area. Corrosion is generally heavy in areas near the seacoast, sidings where saline or corrosive goods are dealt with, tunnels and deep cuttings, industrial belts. Areas prone to corrosion of rails shall be identified by the Chief Track Engineer of DFCCIL based on reports sent by field units. Following points should be considered for painting:

a) For new rails Zinc metallization shall be done in rail manufacturing plant or FB Plant as per procedure laid down in Technical Specification for Zinc Aluminium metallization of Rails (IRS: T-51).

b) For in service rails anti-corrosive bituminous or Zinc Chromate coating should be done for corrosion prone areas. Procedure is as following

i. Wherever possible, surface preparation of rails shall be done, with the help of hand operated or power operated tools i.e. scrappers, wire brushes, sandpaper, pumice stones etc. Wire brushing shall invariably be done at the end to obtain uniform rubbed surface.

ii. The surface prepared shall be checked visually for uniformity of surface. Special care should be taken in surface preparation at weld collars and liner contact areas. Surface preparation should not be done when ambient temperature is below 10° C or above 50° C, in rainy season, during night, in winter before 8AM, in summer between 11AM to 3PM and in extremely windy/misty/dusty conditions. Chemicals should not be used for surface preparation. Painting should be done in two coats of thickness of 100 microns each by anti-corrosive bituminous black paint conforming to IS: 9862 after an interval of 8 hours between two coats. All the metal liners and Elastic Rail Clips shall also be painted with anti-corrosive black bituminous paint after duly cleaning the surface.

iii. Greasing and sealing of liner contact area –On DFC track in identified corrosion prone areas, the rail liner seat should be greased using graphite grease IS-408-1981 Gr. “O” specification after proper cleaning along with the greasing of ERCs at prescribed frequency. Greasing and sealing of liners contact area shall be done once in year for gauge face side and once in two years on non-gauge face side of rail.

811. Frequency of Painting on rails: In identified corrosion prone areas, bituminous painting (Preferably Zinc Chromate Painting) of rails shall be done once in a year on inside & outside of gauge face including web for normal rails and HH rails and in other areas where bituminous painting (Preferably Zinc Chromate Painting) shall

be done once in three years. After new rails are laid in an identified corrosion prone area, regular watch on the effect of corrosion shall be kept by taking measurement of depth of pits. Rail flange/web should be kept free of the muck specially in loading unloading yards.

812. Repair of Wheel burns by Reconditioning: Wheel slipping occurs usually on adverse gradients or long rising grades or during rainy season when friction is less or while starting on rising grades, during which considerable heat is generated and top of the rail is chipped in patches, causing depressions known as wheel burns, from which cracks may develop. This also occurs when train brakes are applied suddenly and wheels lock slide, or due to the underpowering of trains. Wheel burns cause the wheels to hammer the rails and lead to difficulties in keeping the sleepers packed firmly and fastenings tight or in extreme cases rail breakage may take place. Such rail can be repaired with in situ robotic welding through RDSO approved sources if the damage is in limited length. It should be kept under observation and changed in case repair by welding is not feasible.

813. Handling and Stacking of Rails: Rails used on WDFC is 110 UTS HH rails and on EDFC 90 UTS rails which are comparatively brittle and sensitive to mis handling. Hence, during loading and unloading, ramps of un-serviceable rails should be made, and the rails shall slide over them, intermediate support being given to prevent excessive sagging. For handling of rails RDSO's Guidelines for Handling and Stacking of Rails (No. CT-35) shall be followed. Preferably, cranes may be used for loading/unloading of rails. For handling rails, slings or tongs should be used. When hauled into position, prior to linking or otherwise, rails should be so spread as to rest evenly along their entire length or on supports closely spaced and should lie on the foot. During any operation requiring marking of rails such as yard surveys, curve adjustments, and realigning operations etc., the marking on rail shall be done by paint mark only and any chisel or punch marking is not permitted. The gas cutting of rails and making of holes using gas is prohibited except in case of emergency. While stacking rails, care shall be taken that the ground is levelled and well drained. Free rails are supported at least at four points evenly along their length. Welded rail panels shall be spread on cess as to rest evenly along their entire length on supports spaced at 4 meter center to center to prevent formation of kinks.

814. Lubrication of Rail Joints: - The track on DFC is generally CWR, except for a few isolated locations having rail joints which require regular lubrication. All rail joints should normally be lubricated once a year on a programmed basis during the cold weather months after the monsoon, preferably from September to November. The work should be carried out under a block with supervision of IMSD Sectional. In this procedure the nuts are unscrewed, and the fish bolts and fishplates are removed. For removing a fishplate, which has seized to the rails, the fishplate may be tamped gently by a wooden piece. The fishing surfaces of the fishplates and rail are then cleaned with a wire brush. The rail ends are inspected for cracks and the fishing surfaces of rails and fishplates are checked for wear. A magnifying glass and a mirror should be used for detecting cracks in rail ends and fishplates. The fishing surfaces of the rails and fishplates are then lubricated. A stiff paste of plumbago (Graphite) and kerosene oil, made in the proportion of 3 kg of plumbago to 2 kg of kerosene oil may be used as lubricant. Black oil or reclaimed oil may be used for fish bolts and nuts. The fish bolts

are then put back in reverse position and tightened using a standard fish bolt spanner, the inner two bolts being tightened first, while tightening overstraining of bolts shall be avoided. Chamfering of all bolt holes, bond holes should be done. Drilling of holes except for few isolated locations as approved by CTE/DFC is prohibited. Fish bolts must be kept tight but not so tight as to prevent expansion or contraction of rails. Record should be maintained.

MAINTENANCE OF RAILS INVOLVING CUT OF RAILS

815. RAIL CUTS: In case of Rail cuts, a speed restriction of 30 kmph is imposed with posting of watchman on the location after temporary repairs, if same is not attended permanently in block time. Generally, replacement of rail fracture, defective rail, buckled rail, rails involved in accidents and breaches creates a situation when rail cutting is required.

816. RAIL FRACTURES: Repairs shall be carried out in four stages as Emergency repairs, Temporary repairs, Permanent repairs, De-stressing as mentioned in Para 817.

a) SCHEDULE OF SPEED RESTRICTIONS AFTER CUT/FRACTURE: After maintenance of rail, speed restrictions mentioned in Table below are to be imposed as per the condition of track.

S No	Conditions of track	Restriction imposed in Km/h
1 a	When 1 meter long slotted fishplates with screw clamps, M.S. clamp or joggled fishplates with bolted clamps are used at a temporary rail joint and there is 24 hrs. watch. However, if the above arrangement is not under round the clock watch, speed restriction of 20 Kmph should be imposed	30
1 b	Approved high Performance Rail Clamps should be used progressively for improved safety. When approved High Performance Rail Clamps are used at a temporary rail joint and there is 24 hrs. watch, a speed restriction of 50 kmph shall be imposed. However, if the above arrangement is not under round the clock watch, speed restriction of 30 kmph, should be imposed	50
2	When sleeper fastenings on alternate sleepers are loosened before de-stressing	30
3	At fracture after emergency repairs are completed with approved high performance rail clamp and there is 24 hours watch	
i	First train	STOP DEAD & 10
ii	Subsequent trains	50
4	After emergency repairs to track after buckling	
i	First train	STOP DEAD & 10

ii	Subsequent trains	20
5	Speed restriction during consolidation period of track, after regular track maintenance operations when rail temperature exceeds t_d + 20°C:	
i	When shoulder and crib compaction has been done	50
ii	When shoulder and crib compaction has not been done	30

b) Equipment required for fracture repair:

i. Special 1 m long fishplates with screw clamps and joggled fishplates with bolted clamps (for fractures at welded joints).
ii. Steel tape capable of reading up to one mm.
iii. Alumino-thermic welding and finishing equipment /FB plant with Super puller
iv. Equipment for de-stressing/Tensor
v. 6.5 metre or longer sawn rail cut piece of the same section as LWR duly tested by USFD
vi. Rail closures of suitable lengths
vii. Equipment for protection of track

817. RAIL FRACTURE REPAIR STAGES:

a) Emergency repairs of rail fracture: The key man/ Patrol man, as soon as he notices the rail fracture/weld failure should first protect the track and inform to the IMSD sectional/IMSD In-charge and the Station Master.

i. If the fracture is with a gap of less than 30 mm, the fractured rail ends should be joined with fish plates and clamps.
ii. When the fracture gap is more than 30 mm, a rail closure of appropriate length should be used, and fish plated with clamps.
iii. In cases where a small portion or piece of rail has come off or in the case of multiple fractures, the rail must be changed before allowing traffic.
iv. In the case of weld failure, joggled fishplates and clamps should be used.
v. After carrying out the emergency repairs the trains may be passed only by regular MTS or above of DFCCIL at speed prescribed in para 816 (a), until the Permanent Way Official replaces the rail.

The fractured rails shall be joined with or without insertion of closure rail piece as per site conditions and feasibility. The traffic may then be resumed at a speed as mentioned in Para 816 (a).

b) Temporary repairs of fractured rails: If a welding party is not readily available, the fracture shall be repaired by using a cut rail (6.5 m or longer) and clamped/bolted.

i. A traffic block shall be taken as soon as possible preferably when the rail temperature is within the range specified for t_d or as near as possible to t_d. Two points on either side of the fracture shall be marked on the rail such that the length of closure rail to be inserted is equal to the total length of the rail pieces removed from the track minus allowances for two welds and saw cut (normally 51 mm). Alternately, two points on either side of the fracture shall be marked on the rail at a distance equal to the length of the available closure rail. The length of closure rail should not become less than 6.5 m at the time of permanent repairs.

ii. The rails shall then be cut through at these points simultaneously, if possible. The closure rail shall then be inserted and joined. After joining, the traffic shall then be resumed at restricted speed in accordance with Para 816 (a).
iii. In case closure rail is inserted, one of the joints may have to be provided with closure piece of adequate width and joined by one metre fishplate and clamps.

c) Permanent Repairs of rail fracture by FB Welds by Super Puller: Repair by FB Plant with super puller should be done wherever possible. The procedure is as following.

i. One end of the rail piece is welded as it is done in normal case. Temperature is measured.
ii. ERC is opened for 500m to 1500m length depending on rail temperature. Rollers are placed under rail @ 1 roller per 13-15 sleepers.
iii. Rail temperature is measured.
iv. A gap is created duly reducing 37 mm which is the length of rail consumed in flash Butt Welding.
v. Super Puller is used to pull the rail and then it is locked.
vi. Flash-Butt Head is lowered, and rails are held tightly by Welding Head
vii. Alignment is checked and corrected.
viii. FB Welding done and Weld is hold for 8 minutes.
ix. Controlled cooling of weld/ Air quenching needs to be ensured in HH rails.
x. Rail is lowered, rollers are removed, and ERC is fitted.
xi. Equalisation of stressed done by opening the fitting of minimum 250 m on each side of weld location.

d) Permanent Repairs of rail fracture by AT Welds: All efforts should be done to repair fracture with help of FB Plant with super puller along with destressing as per Para 823. If super puller is not available, the permanent repair can be done by AT Welds. It can be done with or without rail tensors, in case of tensors the process as per Para 824 and in case of without rail tensors the process as per Para 825 is to be followed.

818. Rail Fracture reporting and investigation: IMSD In-charge will prepare a 'Rail failure' Report as per proforma in TMS and forward it to the IMD in-charge, who will transmit with his remarks to the Dy. CPM, for onward transmission to the Chief Track Engineer in TMS.

a) Sketches and photographs illustrating the fractures should also be submitted with the failure reports in each case duly indicating the running/gauge face of the rail.
b) It is particularly essential to record the type of failure in the failure reports as per RDSO monograph "Rail Failures - Description, Classification and Reporting".
c) Where rail/ weld failure is prima facie cause of train accident and where failure occurs before 200GMT and it is not possible to determine the cause of the failure by visual examination/ultrasonic detection report, it is obligatory to take up full metallurgical examination by the Chemist and Metallurgist with a view to ascertain the exact cause of failure,
d) In case of fractured rail, both the pieces of approximately 500 mm long each i.e. total 1 m long containing fractured faces/flaw should be sent to the Chemist and Metallurgist for investigation.
e) In case of failures of imported rails within the guarantee period, attributable

to manufacturing defects as revealed by metallurgical investigation, the RMU In-charge should immediately lodge a provisional claim with the manufacturer pending report from M&C under information to corporate office.

BUCKLING OF TRACK

819. Buckling of Track: Buckling or a tendency towards buckling may occur, among others, in the following circumstances:

a) Failure to adhere to the temperature ranges specified for various laying and maintenance activities on LWR/CWR.

b) Inadequate resistance to longitudinal, lateral and vertical movement of track due to deficiencies in ballast section or/and inadequate ballast consolidation.

c) Use of ineffective fastenings or missing fastenings resulting in loss of creep resistance and torsional resistance.

d) Excessive settlement of formation.

e) Repair to fractures or replacement of defective rails not as per procedure prescribed, which can lead to the disturbance to the force diagram in the LWR/CWR as explained below (Fig. 8.1 (a), (b) (c)).

i. Normal Force diagram in a good LWR:

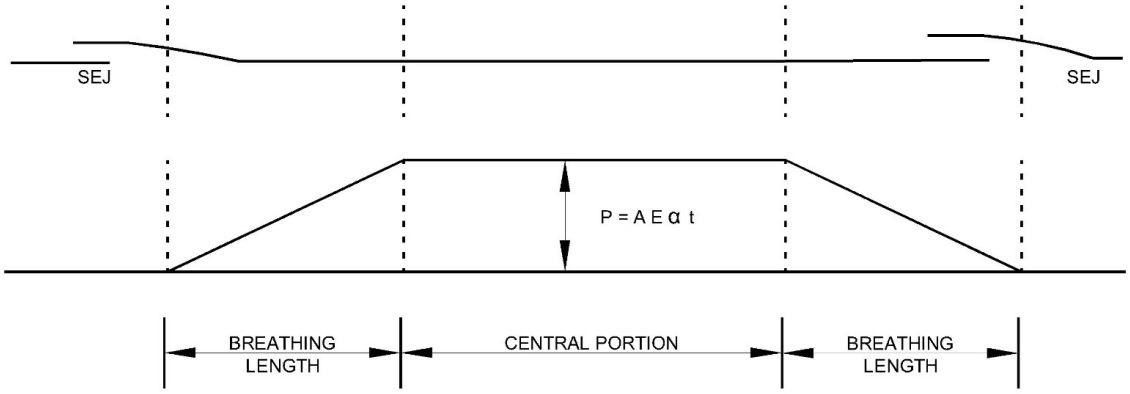


Fig. 8.1(a)

ii. In case rail fracture occurs, the force diagram gets altered instantaneously as under:

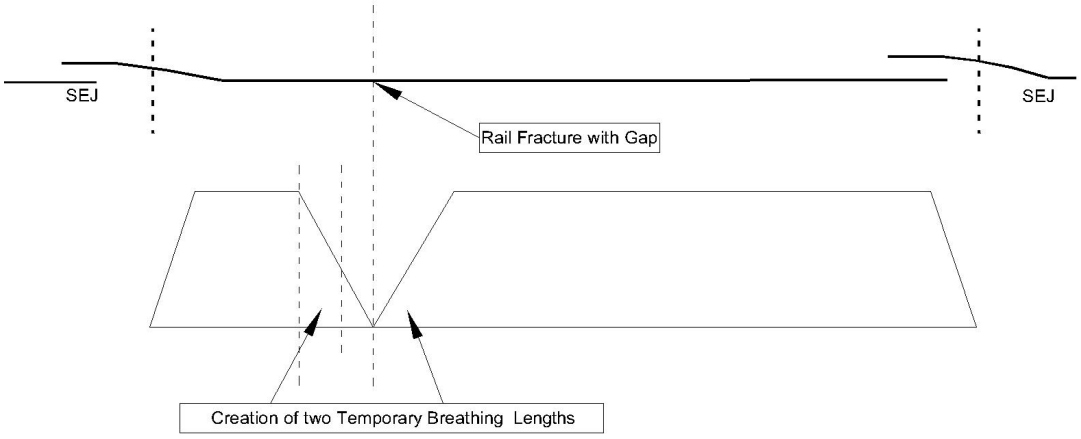


Fig 8.1(b)

iii. If rail introduced during repairs to rail fracture is not as per the provisions of Para 824 the force diagram is altered as under:

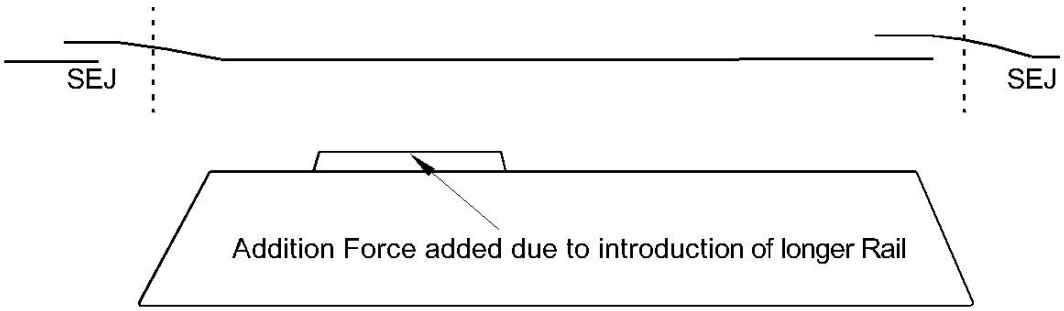


Fig 8.1(c)

820. Buckling and its investigation:

a) Tendency towards buckling will usually manifest itself through kinks in track. Kinks may also arise from incorrect slewing or lifting operations. By tapping sleepers for hollowness, it may be possible to notice if there is any tendency towards vertical buckling.

b) As soon as the tendency for buckling is detected, the traffic shall be suspended, and the track protected. The track shall then be stabilized by heaping ballast on the shoulders up to the top of the web of the rail obtaining the ballast from inter-sleeper spaces between the rails. Thereafter full investigation shall be made to find out the cause of the tendency for buckling.

c) Each case or buckling shall be investigated by IMSD In-charge and IMD In-charge soon after its occurrence and a detailed report submitted to Dy.CPM.

821. Repairs to buckled track: When the track buckles, the traffic shall be suspended and the cause of buckling ascertained. The rectification shall normally be carried out in the following stages under the supervision of designated IMSD Sectional:

a) Emergency repairs: The buckled rails shall preferably be gas cut adequately apart not less than 6.5 m. The track shall then be slewed to the correct alignment and cut rails of the required lengths shall be inserted to close the gaps making do provision for welding of joints on both sides. The cut rails shall then be connected by use of special fishplates and screw clamps and the line opened to traffic with speed restriction as indicated in Para 816 (a).

b) Permanent repairs: As soon as possible, the clamped joints shall be welded adopting the same procedure. Additional pair of cut rails and rail cutting equipment shall also be required to adjust the gaps in case they have been disturbed in the intervening period. The speed restriction shall be removed after welding. The first train shall be passed after 30 min of welding.

c) The length of track of minimum 500 m on either side of the location of buckling of the affected LWR/CWR shall be de-stressed as soon as possible and complete LWR/CWR shall be inspected by IMSD Sectional/IMSD In-charge and further action as deemed necessary shall be taken.

DESTRESSING OF LWR/CWRs

822. Need of Destressing: Destressing of LWR/CWR may be necessary immediately after initial laying of LWR/CWR and during maintenance. During maintenance creep is measured at every km in DFC to assess the length of disturbance. Distressing shall be done in case of excessive creep at each KM of LWR is noticed. De-stressing should be done at a little lower temperature than the targeted stress-free temperature with the use of rail tensors and super puller. Emergency/Temporary de-stressing can be done when rail temperature falls between the range provided for t_d. Such LWRs should be inspected by IMD In-charge of the section. Abnormal behaviour of LWR/CWR can be inferred by observing one or more of the following:

a) When the gap observed at SEJ differs beyond limits specified or exceeds the maximum designed gap of SEJ or when tip of tongue rail/corner of Stock Rail crosses the reference line

b) When SFT measured by VERSE, or any other non-destructive approved method is not within range of t_d.

c) Creep is to be measured in every Km of CWR/LWR of both rails. In case of excessive creep of more than 20 mm at any creep measuring point of LWR/CWR is noticed.

In such cases LWR/CWR shall be inspected by IMD In-charge for:-

i. Deficiency of ballast,
ii. Poor consolidation of ballast,
iii. Deficiency of fittings/Poor toe load of ERC
iv. Formation trouble if any,
v. Whether procedures for repairs of rail fractures as per Para 821 were followed during permanent repairs after earlier rail fracture(s),
vi. The possibility of defective thermometers being used by the staff.

d) After the above inspection, the deficiency shall be made good at the earliest by suitable corrective action, to improve the track resistance. Thereafter, the designated IMSD Sectional shall keep the locations under close observation. If LWR/CWR still behaves abnormally, a decision shall be taken by IMD In-charge for de-stressing of LWR/CWR. Destressing to be done after following maintenance operations:

i. After special maintenance operations such as Through fittings renewal, Deep screening, Major Lowering/Lifting of track, Major realignment of curves, Major Sleeper renewal, Rehabilitation of bridges and formation etc., de-stressing shall be undertaken.
ii. After restoration of track following unusual occurrence which has caused major disturbance to track such as rail fractures or replacement of defective weld, damage to SEJ/Turnouts, buckling or tendency towards buckling, accidents, breaches etc., de-stressing shall be undertaken.
iii. If number of locations, where repairs have been done by replacement of rails/ weld, exceed three per km, de-stressing of affected portion of LWR/CWR shall be done.

823. De-stressing with Super Puller along with FB Welding: Destressing can be carried when prevailing rail temperature is less than stress free temperature. This procedure is done with mobile flash butt welding (FBW). Since super-puller works on one rail, destressing of one rail will be done at a time. For de-stressing of LWR/CWR with the use of rail super-puller, the following procedure shall be adopted:

a) Anchor length is the length of the CWR track that is left clipped down during the destressing operation to ensure that no movement occurs at the fixed ends

of the length being destressed. Where all fastenings are new Mark V and all present, installed with the correct tools and in good condition with all pads and insulators in place and good consolidated ballast conditions.

b) Rollers are devices used to support CWR clear of the sleepers so as to allow its free longitudinal movement during destressing. Rollers are to be provided at every 10 sleepers on curves and every 15 sleepers in straight track.

c) Side rollers (support arms) are devices used to prevent lateral movement of CWR during Destressing in curves. Their design varies to suit the sleeper, fastening type and curvature of track. Side rollers shall be placed on every 10 sleepers on one degree and below curve, 8 sleepers on 2 degree and below and 6 sleepers on 2.5 degree and below.

d) Decide manageable length L1 (500m to 1500m) and mark anchor length A1- A2 equal to la at one end of the length L1. The anchor length [la= 2.5 x (t_0- t_p) or 2.5 x (t_d- t_p)]. Anchor length shall be increased suitably based on the condition of the fastenings, rubber pads, liners or ballast. In case of already linked track A1 may be far away and may be distantly available. Place the FB Plant near the rail cut away from the destressing length.

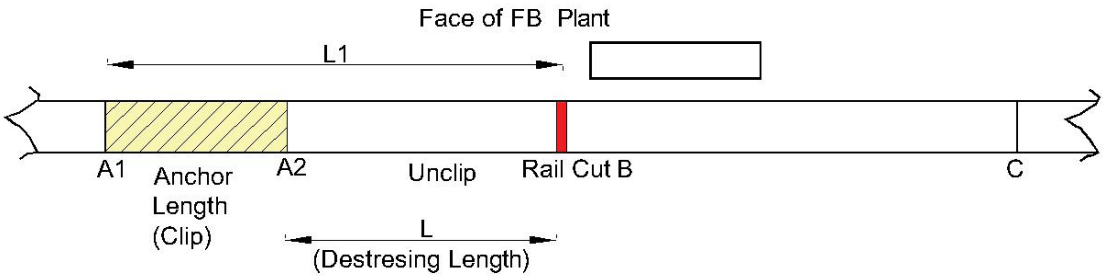


Fig.8.2 Destressing with super puller

e) Erect marker pillars W0, W1... WB on each of the length A2 B. Transfer the marks W0 onto the rail foot. The distances W0 W1, W1 W2 etc. shall be marked at about 100 m intervals, the distance from the previous pillar and the last pillar WB may be less than 100 metre.

f) Remove impediments to free movement of one rail such as rail anchors, guard rails, check rails etc.

g) During the traffic block, temperature to be noted and a cut is made at location 'B' i.e. at end of the segment of the LWR/CWR to be destressed. If cut is already bigger, then a rail piece shall be welded before starting destressing. Gap shall be made by calculating the required movement at WB = Y_o + elongation of length W0 WB (L) due to temperature difference (t_o - t_p) = Y_0+ Lα (t_o - t_p) and the rail length consumed in weld.

h) Unfasten ERCs and mount on rollers the portion from A2 B.

i) Side rollers on the inside of curve shall also be used while undertaking de-stressing on curved track these should be spaced at every nth sleeper,

$$\text{Where, } n = \frac{\text{Radius of curve (R) x No. of sleepers per rail length}}{50 \times (t_o - t_p)}$$

j) Outside supports shall be used in addition at the rate of one for every three inside supports.

k) Stable the super-puller behind the gap 'B' and apply tension and do Flash Butt welding of gap 'B'.

l) For continuous destressing the FB plant should be placed behind C and cut should be made at C and destressing shall be continued.

m) The Destressing temperature of the two rails of the track should not differ by more than 6 ^{0}C. If only one rail is being replaced the other rail shall therefore be destressed at the same time, unless the SFT of the other rail can be measured and shown to be not more than 6 ^{0}C different from the relevant SFT values.

Note- Sub para of "e" above has been provided to measure the elongation of various parts of track. In case of straight track, if length to be destressed is less than 500 m this may not be required.

824. Destressing with Rail Tensors with AT Welding: Second alternative of destressing is by use of tensors. In this case AT welding will be required. Destressing shall be carried when prevailing rail temperature is less than stress free temperature. For this following procedure shall be adopted:

The maximum pull to be applied shall not exceed the lesser of 60 tonnes or 10 tonnes less than the maximum capacity of the tensors. When this maximum pull is insufficient to achieve the full rail extension, an extension equivalent to the maximum pull shall be calculated and applied. In such cases the required SFT will not be obtained, and it may be necessary for the CWR length to be destressed.

a) Decide manageable length L1 (500m to 1500m) and mark anchor length A1- A2 and C1- C2.

b) Measure the temperature and if temperature is less than T , remove impediments to free movement of rail such as rail anchors, guard rails, check rails etc.

c) During the traffic block, create a gap of 1 m at location 'B' i.e. centre of the first segment of the LWR/CWR to be destressed (Fig. 8.3).

d) Divide the length to be destressed into segment of 100meters. Last segment may be less than 100m. Provide marker pillars at all locations name it W0, W1... from the fixed point. Calculate the required movement at W0=0, W1 = 1.15t and W2 = 2x1.15xt ....Wn= nx1.15t where t is difference between intended destressing temperature – current rail temperature. Mark the above calculated extensions with respect to the transferred marks referred above on the rail foot on the side away from the tensor.

e) Unfasten ERCs and mount on rollers the portion from A2 C2.

f) Side rollers on the inside of curve shall also be used while undertaking de-stressing on curved track these should be spaced at every nth sleeper,

$$\text{Where, } n = \frac{\text{Radius of curve (R) x No. of sleepers per rail length}}{50 \times (t_o - t_p)}$$

g) Outside supports shall be used in addition at the rate of one for every three inside supports.

h) Fix the rail tensor across the gap at 'B' and apply tension to release the tension if any and note the movement if any to correct the movement at marker pillar.

i) Apply the tension by means of rail tensor till the mark of required extension comes opposite to the mark on the marker pillar W1. Fasten down the segment W0W1

j) Then check at W2, bring the mark of required extension at this location opposite to the mark on the marker pillar W2, by adjusting the tensor either by reducing or increasing tension and fasten down the segment W1W2. Similarly, check the remaining marks, adjust the tension as required and fasten down each segment

before proceeding to the next segment.

k) The variation of temperature, if any during the de-stressing operation shall automatically be taken care of by reducing or increasing the tensile force from the tensor, while coinciding the reference mark on rail with the corresponding mark on pillars.

l) After the fastening down, a rail of X meter which should be above 6.5 m shall be placed near the cut the rail from the other end shall be cut X metre +2 x 25 - 1 mm.

m) When the required total extension in each rail has been obtained, at least 40m of rail on each side of the tensors shall be fastened down. The welder shall check that the welding gap is correct and re-cut the gap if necessary. Once a weld is started there shall be no disturbance to that rail or the opposite rail until the weld is completed and the cooling period has been achieved. On sharp curves fastening down shall follow within 10 sleepers of the removal of each side roller, in order to minimize the tendency of the destressed rail to leave the rail seating. The tensors shall remain in position for the minimum cooling period after the weld has been made, in order to avoid hot tears.

n) During the same or separate block, equalize the forces in the rail by releasing the fastenings over a length of minimum 125 m on either side of location 'B' and tapping with wooden mallets etc. Fasten down the rail and allow traffic.

o) In case further length beyond C2 is to be destressed, mark anchor length such a way that the anchor length C1- C2 of previous segment is covered in the segment "L2".

825. Destressing without Rail Tensors/Super Pullar: This shall be done when it is not possible to do destressing by rail tensors or FB Plant with super pullers. In this case rail temperature at the time of de-stressing should between t_m+5° to t_m+10. Detailed procedure as given below may be adopted:

a) 1 KM Segment: Long CWR can be destressed segment by segment. Generally, up to 1 KM length should be taken for destressing between the creep measurement posts on OHEs. It shall be continued till we fine Zero creep. Shorter length say 600 m shall be adopted if it involves curves. Mark the anchor length A1-A2 and C1-C2 each equal to la at either end of the length L1.

b) Free movement: Remove impediments to free movement of rail such as rail anchors, guard rails, check rails etc (unclip).

c) Gap creation: During the traffic block, create a gap of 1 m at location 'B' i.e. centre of the segment of the length L1 to be destressed. A traffic block of adequate duration should be arranged at such a time that the rail temperature is within range specified for t_d [between t_m+5° to t_m+10] during the fastening down operations of fittings.

d) Speed Restriction: Before the traffic block is taken, a speed restriction of 30 Kmph should be imposed and fastenings on alternate sleepers loosened.

e) Unfastening of Fittings: Unfasten the rail starting from ends towards centre i.e from A2 to B and C2 to B simultaneously. The segment of rails from A2 to C2 shall now be lifted and placed on rollers at every 15th sleeper to permit the rails to move freely. Mount on rollers. Side rollers (n = R/50) should be used on curves if any. Outside supports shall be used on curves in addition at the rate of one for every three inside supports.

f) Tapping by wooden mallet: The rails shall be struck horizontally with wooden mallets to assist in their longitudinal movement.

g) Removal of rollers: The rollers shall then be removed, the rails lowered to correct alignment and fastenings tightened, starting from the middle of segment (point B) and proceeding towards both ends simultaneously (B to A2 and B to C2 simultaneously). The tightening of fastenings shall be completed within the temperature range for t_d. The actual range of temperature during the period of tightening shall be recorded by the IMSD Sectional along with the time and date.

p) Temporary/Permanent repair: After the fastening down, a rail of X meter which should be above 6.5 m shall be placed near the cut the rail from the other end shall be cut X metre + 2 x 25 mm -1 mm. The rail shall be placed and Welded

h) Equalize the forces: After this equalize the forces in the rail by releasing the fastenings over a length of minimum 125 m on either side of location 'B' and tapping with wooden mallets etc. Fasten down the rail and allow traffic.

i) In case further length L2 beyond C2 is to be destressed, mark anchor length such a way that the anchor length C1-C2 of previous segment is covered in the segment "L2" as shown in –

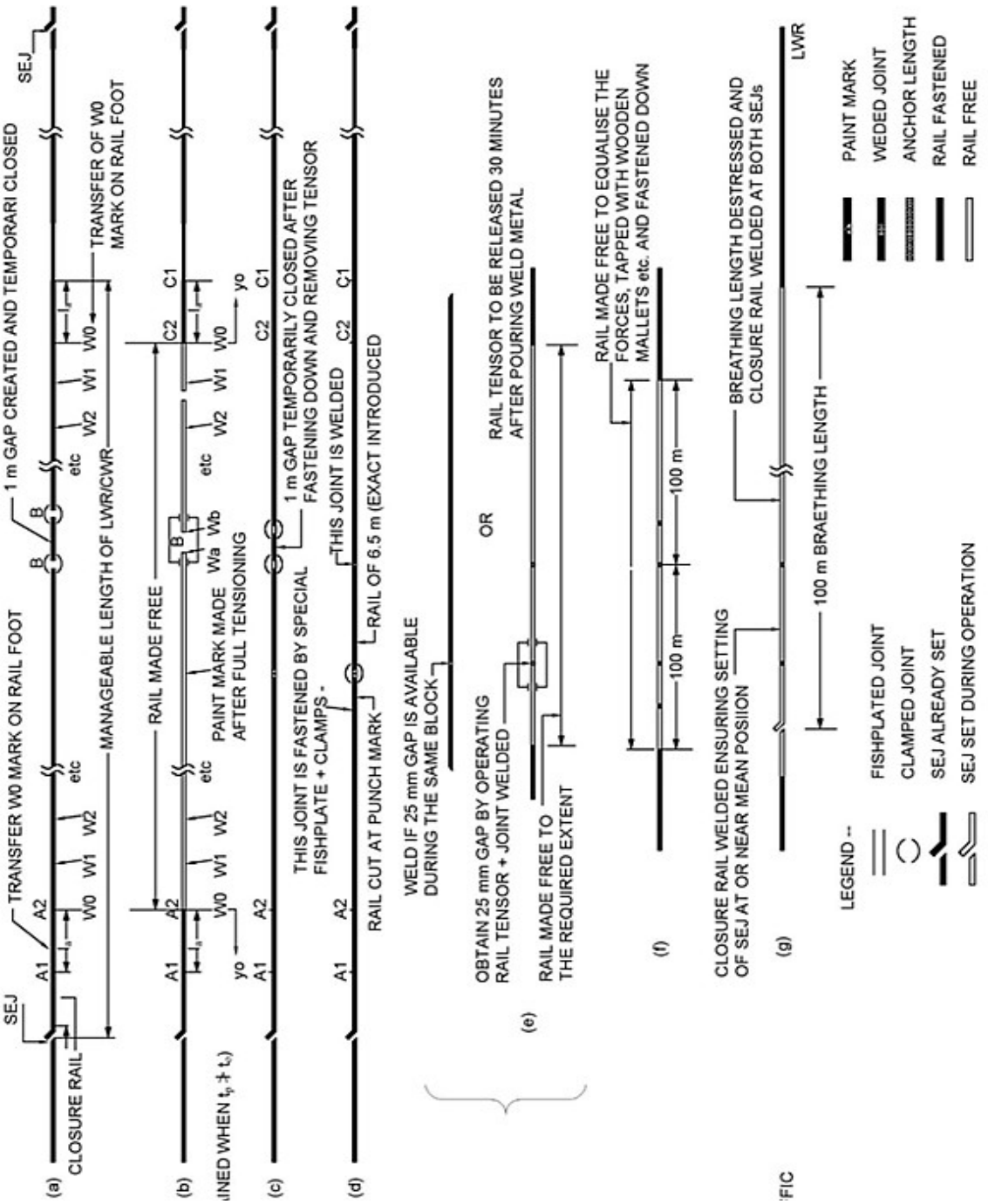


Fig. 8.3 Destressing of LWR using Rail Tensor

826. Equalization of Stresses after Permanent Repair in LWR/CWR: If there is a fracture or rail replacement on any account, two breathing lengths will be created. This will alter the stress-free temperature (SFT) of rail in the affected portion of track.

a) If repairs are done in such a manner that the length of rail removed from track is exactly same as the length of rail inserted (including welding) then SFT of that location will change, but if the equalisation of stresses is done for a length of at least two temporary BLs then the concentration of forces will be distributed, and we can achieve the t_d very close to SFT.

b) If during rail replacement the length of rail inserted in track is different from the length of rail removed the pattern of thermal stresses in the affected portion of LWR will change altering the SFT in the affected portion. The magnitude of change in SFT can be calculated as below. If length of rail inserted in track varies by δL from the length of rail removed from track, and equalization of stresses is done, say over 250 meters (125 metres on either side), then the force change in LWR would be
$F = (\delta L / 250) * EA$ and this is equal to $AE\alpha\ \delta t$.
Thus, δt can be calculated as under,
$\delta t = \delta L / (250 * \alpha)$ This is closer to SFT.

c) If equalisation of stresses is not done (over 125 m on either side) then the SFT at the location of rail replacement will get altered to the temperature at which repairs are completed. This makes track much more vulnerable for buckling or fractures depending upon whether the repairs are done at rail temperature lower than t_d or higher than t_d.

827. Replacement of Switch Expansion Joint

a) Modified & Switch type SEJ has been provided in DFC. Life of modified SEJ is 400 GMT & Life of Switch type SEJ is on condition basis as per para 835(j). The damaged/broken SEJ(modified) shall be replaced with a Switch type SEJ. In case of renewals modified SEJ shall also be replaced with Switch type SEJ. The gap at the new SEJ shall be adjusted to the mean gap as provided in table below, depending on the rail temperature prevailing at the time of replacement.

b) If another SEJ is not available for replacement, both the damaged SEJ and the undamaged SEJ on the opposite rail at the same location, shall be replaced by a closure rail and connected to LWR/CWR with special clamps and fishplates.

c) The traffic over the clamped joints may be permitted at a restricted speed as per Para 816(a). The restriction may be relaxed only after the new SEJ has been inserted in the correct position and the clamped joint has been replaced with in-situ weld.

Sl.No	Difference from mean temperature	Width of expansion Gap in mm
1	+30	12
2	+24	22
3	+18	30
4	+12	36
5	+6	39
6	0 (Mean)	40 (mean expansion Gap)

7	-6	41
8	-12	44
9	-18	50
10	-24	58
11	-30	68
12	-36	80

828. Maintenance of Insulated Joints

a) Insulated joints provided shall be laid as square joints. Where staggering cannot be avoided, the distance between staggered joints should not exceed the minimum wheelbase of the vehicles.

b) The rail ends of the insulated joints shall be square.

c) All rough edges and burrs should be removed from bolt-holes.

d) Battered ends must be put right and the gap between the rails should be equal to the thickness of the end post.

RAIL MAINTENANCE SHORT WELDED PANELS.

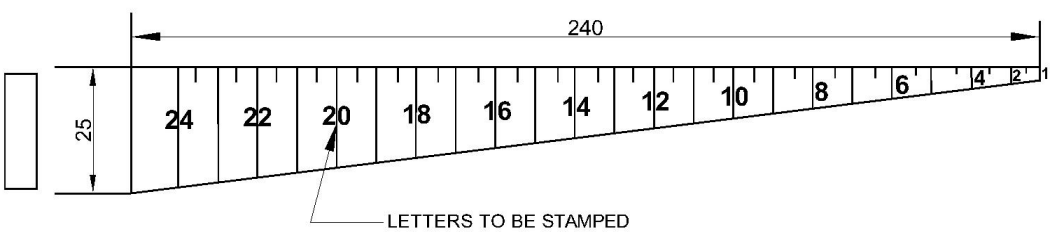
829. Regular maintenance operations of Short Welded Rails: Adequate number of joggled fishplates with special clamps shall be provided to the gangs for use in emergencies. In the case of any fracture in the weld or in the rail, the portion of rail with fracture is cut, and removed for a length of not less than 6.5 m to carry out the re-welding duly introducing a rail piece of equivalent length.

830. Gap Survey and Adjustment of Gap: Gap survey and rectification of gaps is to be carried out, in stretches where track develops excessive creep, jammed joints, sun kinks, misalignment, wide gaps, battered and hogged joints, fractures at joints and bending of bolts etc. In SWR, the gap survey and adjustment should normally be done before the end of February once a year (i.e. before onset of summer).

a) The gap survey shall be conducted on a clear and sunny day in the cool hours of the day in rising rail temperature trend.

b) The length over which gap survey is to be done should, wherever possible, be divided into suitable sub-sections, each bounded by fixed points such as level crossings, points and crossings etc. The survey should be completed during as short a time as possible, by employing adequate number of parties so that the rail temperature is not likely to vary appreciably.

c) The joint gaps shall be measured by taper gauge in mm (shown below) Fig. 8.4



TAPER GAUGE

Fig. 8.4

d) Recommended range of value of gaps – The recommended range of value of gaps (in mm) during service for various ranges of rail temperature is indicated in the table-II given below:

Table – II

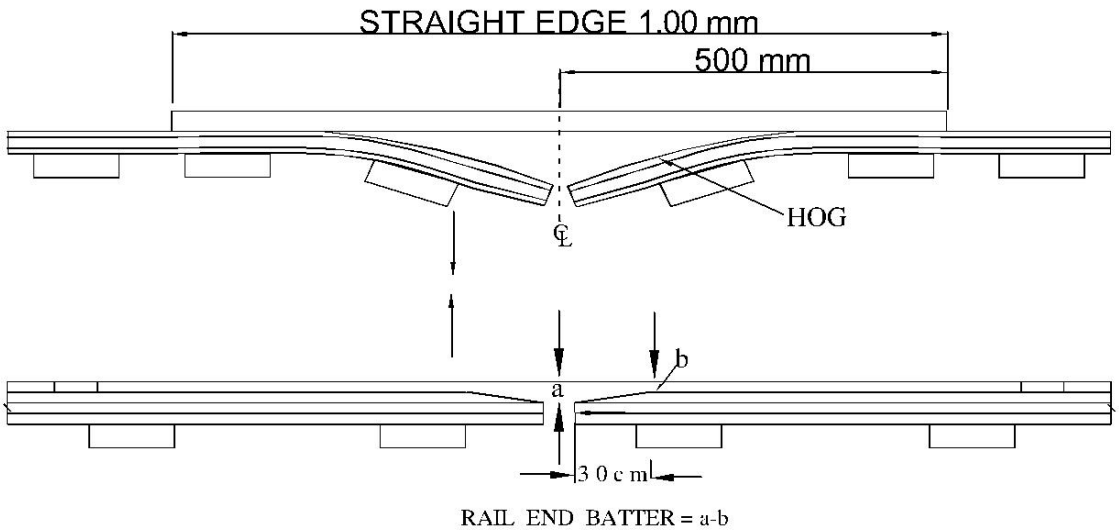
Rail Temperature During Gap Survey	**Permissible Values of gaps (in mm)**
	For 26/25 m rolled rails
t_m - 17.5°C to t_m - 12.6°C	8-13
t_m - 12.5°C to t_m - 7.6°C	6-11
t_m - 7.5°C to t_m - 2.5°C	5-10
t_m - 2.4°C to t_m + 2.5°C	3-8
t_m + 2.6°C to t_m + 7.5°C	2-7
t_m + 7.6°C to t_m + 12.5°C	1-5

e) Calculations for adjustment– The average of the measured gaps is worked out as shown in the proforma for gap survey Table II. A comparison of the results of the gap measurements recorded and the permissible values of gap will lead to one of the following cases:
Case 1 – Average gap is within the recommended range, but some of the individual gaps fall outside the range.
Case 2– Average gap falls outside the recommended range.

f) Action to be taken– The action to be taken is as follows–
Case 1– Rectification work should be restricted to correcting the individual gaps, which falls outside the recommended range. Under no circumstances, adjustment shall be done by cutting a rail or introducing a longer rail.
Case 2– The joint gaps shall be systematically adjusted from one end to the other end of the sub-section. The rails shall be unfastened over convenient length, the gaps adjusted to the initial laying gaps as per Para 406 and rails fastened. In this case, introduction of a longer or shorter rail might be required.

831. End Cropping of Battered and Hogged rail joints: Rail end batter occurs where the joint gaps are excessive. It is caused by the impact of wheels on the end of a rail particularly if the fishplates do not fit snugly. Rail end batter is measured as the difference in heights of the rail at its end and at a point 30 cm away from the rail end as shown in the sketch below. A hogged rail is one with its end or ends bent in vertical direction. A hogged rail end in the track is ascertained by un-fishing the joints, removing the fastenings and then measuring the extent of hog at the rail end by placing a 1-meter-long straight edge over the rail table, centrally over the joint as shown in the sketch below:

Hogged Joints



Battered Joints

Fig. 8.5

832. Counteraction and Adjustment of creep: Rails have a tendency to move gradually in the direction of the dominant traffic. It is believed to be caused by the 'ironing out' of yielding track by the moving load, augmented by braking loads, and by the impact of the wheels on the running-on ends of the rails, particularly at times when they are in a state of expansion or contraction. 1st OHE Post of UP and DN line of every km will be used as Creep post for recording Creep in CWR. Arrow mark on OHE posts will be marked and point of arrow should be 25 mm above rail level and "CREEP MARK" will be written. Corresponding creep marks on web of the rail on non- gauge face. Creep records should be maintained in the proforma given in TMS. The frequency of recording creep shall be every six months or more frequently in case the section has been identified as creep prone. Creep over 20 mm shall not be permitted.

In CWR section Creep posts will also be erected at Turnouts location at location of:

a) Actual Toe Switch/ACD location,
b) Actual Nose of Crossing (ANC)

833. Adjustment of creep– Adjustments of creep should be carried out in the following manner:

a) It is a good practice to adjust creep before the commencement of summer. It is desirable to pull back the rails during the cool hours of the day.
b) Careful measurement of expansion gaps, as existing, should be done and appropriate length, which can be dealt with in one operation should be chosen. The total amount of gap in the length should be equal to the standard expansion gap required for the temperature at the time, multiplied by the number of joints in the length.
c) Work should start at the running-on end of the length, commonly just beyond the points and crossings or level crossings. The work of creep adjustments

should be carried out under the protection of engineering signals by the IMSD Sectional as envisaged in Para 1113 under traffic block.

d) When the value of total gap existing is more than the standard expansion gap required for the temperature at the time of adjustment multiplied by the number of joints, it is necessary to provide closure rails. When closure rails are put in, a speed restriction of 30 Kmph should be imposed, which should be removed, when closure rail is changed.

834. Buckling of Track (other than LWR)– Buckling of track occurs when high compressive forces are created in the rails associated with inadequacy of lateral resistance in the track at the place. A special watch should be kept on the junction of two stretches of track, one liable to creep and the other held against creep. As one side of such a junction point is held firmly against creep, the movement of rails due to creep from the other side is resisted resulting in heavy compressive force being exerted, which will tend to buckle the track. Jammed rail joints at such junctions are therefore an indication of the track being subjected to undue strain.

a) Conditions, which induce Buckling– The following conditions create high compressive forces in the rail:

i. Inadequate expansion gaps,
ii. Failure to counteract creep in time.
iii. Non-lubrication of rail joints,
iv. The lateral resistance gets impaired due to inadequacy of ballast and due to carrying out of operations such as deep screening, lifting of track and slewing of track, without adequate precautions.

b) Precautions against Buckling– It should be seen that

i. Operations, which impair the lateral resistance of track, are not carried out when rail temperatures are high.
ii. The greasing of fishplates is done before the hot weather sets in.
iii. The joint gap survey is done in the case of SWR and adjusted before the onset of hot weather. Similarly, in case of free rail track, joint gaps should be adjusted wherever necessary.
iv. Adequate precautions are taken to reduce creep as detailed.
v. Over tightening of fish bolts is avoided, but they should be reasonably tight.
vi. Particular attention is also paid to stretches of track, one liable to creep and the other held against creep. Jammed joints at such junctions call for remedial measures.
vii. Adequate shoulder ballast should be provided at all places.

c) Action on buckling of track– If a buckling does occur or appears imminent, the track should be protected immediately with hand signal flags and detonators as per the protection rules laid down. The buckled rails shall preferably be cut adequately apart not less than 6.5 metres. The track shall then be slewed to the correct alignment and cut rails of the required length shall be inserted to close the gaps making do provision for welding of joints on both rails. The cut rails shall then be connected by use of special fishplates and screw clamps and the line opened to traffic with speed restriction. It may not be possible to do any more until the temperature drops when the joints must be adjusted. Particular care must be taken to see that the factors, which contributed to the buckling i.e. jammed joints, seized fishplates or shortage of ballast, receive appropriate attention without delay.

INSPECTION AND MAINTENANCE OF TURN-OUTS

835. Inspection of Points and crossings:

a) Measuring gauge of having stopper with uniform Dia/width shall only be used for measurement of gauge in Turnout portion.

Fit for use

Fit for use

Not fit for use

Fig. 8.6

b) The design gauge up to distance mentioned in column 4 of table at sub para (m), shall be as per para 127.

c) Design gauge beyond distance mentioned in column 4 of table at sub para (m) shall be 1676 mm.

d) Gauge tolerance in TO zone is -3 mm to +3 mm.

e) The Twist on 3 m chord length in Turnout shall not exceed 3.5 mm/m.

f) The check rail clearance opposite to nose of crossing shall be within 44 – 48 mm. This clearance must be measured at locations mentioned in column No.8 of Sub Para (k) of this clause. Checkrail clearance in flared portion is to be measured at 100 mm from end of check rails and should lie between 66 mm and 76 mm.

g) The Wing rail/Nose wear of X-ing measurement locations and values to be deducted for different Turnout used in DFC are detailed in sub para (l) of this para.

h) The clarence at JOH (location where Head width of Tongue rail reaches 72 mm) shall be 60 mm or more.

i) The Design throw of switch at ATS shall be 160 mm. The tolerance allowed in throw of switch shall be within -3 mm + 3mm.

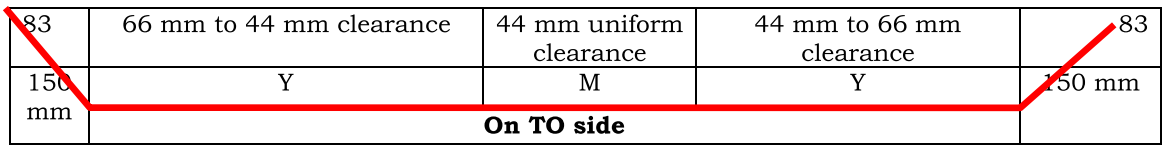
j) The wear permitted in wing rail/ Nose of X-ing of various turnouts are as under:

Wear values	**Reconditioning/Condemnation limit (in case of passing of upper limit the reconditioning can be done with the approval of CTE)**	**Wear based Condemnation limit after two round of reconditioning (The reconditioning may be increased beyond two rounds with the approval of CTE)**
Wing rail	6 - 8 mm	> 8 mm
Nose	3 – 4 mm	> 4 mm
Switch (Vertical)	6 - 8 mm	>8 mm
Switch (Lateral)	4 - 6 mm	>6 mm

Note:- In order to reduce manual measurement system for Point & Crossing, Portable track geometry measurement system for Point & Crossing can be used. It will progressively replace the existing system of manual measurement. After introduction of this system, magnitude of errors in parameters measured manually will be reduced. This will also result in time saving in measurement & reduction in manpower deployed in the work.

k) Details of Check Rail length and Clearances of TO

TO Angle	Switch Radius	Length of Check rail of ML side in mm	Length of Check rail of TO side in mm	Length on ML side X in mm	Length on TO side Y in mm	Length of uniform Check rail Clarence M in mm	Stretch of 44-48 MM uniform Clearance
1	2	3	4	5	6	7	8
1 in 12	555 m	6100	4700	1950 (Flaring of 1 in 100)	1450 (Flaring of 1 in 100)	1700	After SL No 70 to before SL No 75
1 in 12	460 m	6100	4700	2200 (Flaring of 1 in 100)	1500 (Flaring of 1 in 100)	1400	After SL No 62 to before SL No 65
1 in 12	441 m	4500	4500	1400	1400	1700	C/L of SL No 69 toC/L SL No 72
1 in 8.5	216 m	5800	4600	2200 (Flaring of 1 in 100)	1600 (Flaring of 1 in 100)	1100	Before SL No 43 to After SL No 44



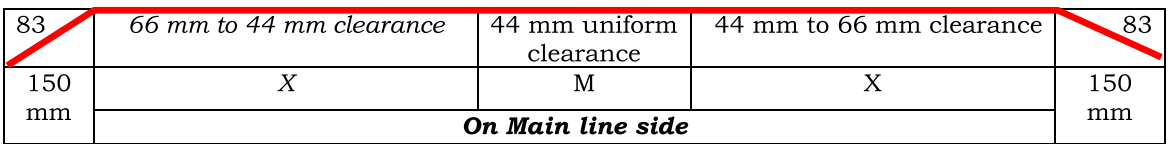


Fig 8.7: Details of Check rail clearance for 1 in 12 with R = 555 and 460 m and 1 in 8.5 with 218 m

71 mm to 44 mm clearance	44 mm uniform clearance	44 mm to 71 mm clearance
Y	M	Y
On TO as well as ML side		

Fig 8.8: Details of Check rail clearance for 1 in 12 with R = 441

l) Location of measuring wear in Crossing

TO Angle	Switch Radius	Distance/depth in mm					Actual wear of crossing be calculated by deducting following values from measured values		Actual wear is measured values minus following value measured at wear of wing rails due to 1 in 20 conicity of wing rail
		TNC to ANC	Depth wrt rail level at TNC	Depth wrt rail level at ANC where nose Thickness is 6 mm	Distance from ANC to Location where nose Thickness is 30 mm (location at which X-ing wear is to be measured in mm)	Depth wrt rail level where nose Thickness is 30 mm			
							at ANC	at NOSE TH. of 30mm	
1 in 12	555 m	116	60	8	269	4	10.6	6.6	2.6
1 in 12	460 m	108	60	8	252	4	10.6	6.6	2.6
1 in 12	441 m	198	60	6	162	4.5	7.8	6.3	1.8
1 in 8.5	218 m	71	60	8	179	4	10.6	6.6	2.6

m) Location and length of SR Machining after which uniform design gauge is 1676 mm for different radius of Turnouts and Angle.

TO Angle	Switch Radius	Start of 1:3 Machining of SR from SRJ	End of 1:3 Machining of SR from SRJ mm	Machining upto sleeper No and gauge between running TR & SR	
				Location upto Sleeper no.	Gauge in mm
1	2	3	4	5	6
1 in 12	555 m	693.5	8945	15 (upto 2nd station)	1678
1 in 12	460 m	1090	7490	13 (upto 2 nd station)	1678
1 in 12	441 m	1400	8626	14 (upto 2nd station)	1676
1 in 8.5	218 m	1448	5298	8 (upto 1st station)	1678

836. Maintenance of Points and Crossing

a) General Maintenance

i. Correct spacing of sleepers should be ensured according to the standard layout drawings.

ii. The track geometry at the turnout should not be inferior to that applicable for the route.

iii. The clearance, at the toe, at the JOH and at checkrail must be maintained within the tolerances as prescribed.

iv. The chairs and fastenings and all other fittings must be properly secured.

v. Packing under the sleepers must not be loose/ defective especially under crossing and the thick web switch.

vi. Cess should be low enough to permit efficient drainage and adequate depth of ballast cushion should be provided.

vii. In case creep is observed at such layouts, the condition of elastic fastenings may be examined, and suitable action be taken.

viii. Where large number of Points and Crossings are being maintained within a specific area such as marshalling yards, large layouts of sidings, terminal stations etc., regular cycle of maintenance covering all Points and Crossings should be organized.

ix. Cleaning and Lubrication of points– At all interlocked and partially interlocked stations, the Signal staff will be responsible for the periodical cleaning and lubrication of all slide chairs in all points interlocked with signals or provided with locks.

x. Alterations of Points– The position of points and crossings should not be changed without approval of CTE/DFC.

b) Maintenance of Switch assembly

i. The condition of stock & tongue rails should be carefully examined, and badly worn and damaged stock and tongue rails should be replaced. A tongue rail may be classified as worn/ damaged when-

1. It is chipped/cracked over small lengths aggregating to 200 mm within a distance of 1000 mm from its toe. Chipped length will be the portion where tongue rail has worn out for a depth of more than 8 mm over a continuous

length of 10 mm.

2. It is badly twisted or bent and does not house properly against the stock rail causing a gap of 5 mm or more at the toe, the limit described in the IRSEM.

ii. Wear on stock rail shall not exceed the limits laid down in Para 1203. However, proper housing of tongue rails is to be ensured.

iii. Rail Gauge ties, rodding etc. hinder proper packing and hence at the time of packing point and crossing the signal staff should take out the rods and stretcher bars etc.to facilitate proper tamping.

iv. Checking of the housing of the tongue rail and also the throw of the thick web switch shall be done when traffic permits doing so.

v. If the tongue rail is found to be not housing properly against the stock rail, the defect must be rectified jointly with signal staff.

vi. Tongue rail should, preferably rest evenly on all the slide chairs.

vii. When the tongue rail is in closed position, it must rest evenly against slide blocks.

viii. The Motor point rodding assembly for pulling the tongue rails shall be maintained by Signal staff.

ix. Wear on thick web switches can be reduced by lubrication of the gauge face of tongue rail.

x. Burrs Removal of Stock rail: Burrs larger than 1 mm in the area of the running edge to be ground, whereby the shape of the rail head should not change massively (running behaviour and derailment safety).

xi. Burrs Removal of tongue Rail: Burrs larger than 1mm in the area of the running edge and the contact to the stock rail head to be ground, whereby the shape of the rail head should not change massively.

Fig. 8.9

c) Maintenance of checkrails: Checkrail clearance in flared portion is to be measured at 100 mm from end of check rails and should lie between 66 mm and 76 mm and also check rail clarence in central portion and it should lie between 44 – 48 mm. In case the check rail clearances are beyond permitted limits, then following procedure to be adopted for correcting the check rail clearances:

i. Remove or add spacer shims in the checkrail flange way until the correct flange way clearance/check rail clearances is obtained.

ii. If the flange way is WIDE make sure that the correct check rail bearing plates are fitted. If not, replace them with the correct bearing plates at time of replacement of checkrail. Otherwise replace the checkrail.

iii. If the flange way is TIGHT replace the worn check rail bearing plates or grind

checkrail carrier rail overflow.

iv. If after doing above activities, the check rail clearances are not coming in permissible rage then replace the complete checkrail assembly.

d) Maintenance of X-ing assembly:

i. The marking of all measuring stations in X-ing portion for checking wear, Gauge and X-level to be done confirming to design.

ii. All fittings in X-ing portion needs to be ensured on regular basis.

iii. The reconditing of wing rail/nose to be done before actual wear reaches the reconditing threshold value.

iv. The Rubber pad between X-ing and sleepers shall be regularly checked for their effectiveness.

v. Date of Laying Points and Crossings– The month and year of laying a new or second-hand points and crossings should be painted in white block letters on the webs of thick web switches about 500 mm from the heel joint and the webs of crossings about 500 mm from the joint connected to the lead rails.

837. Maintenance of Torsional Type Back Drive: Measure the gap 60 mm (±3 mm) at JOH, if the parameter is not observing as per the given value then kindly follow the process given below: -

a) The smooth movement of switch blade with respect to the slide chair will check visually, if the smooth movement is not observed then clean the slide chairs & use and check the position of roller and re-adjust.

b) Set the point in Normal condition/reverse condition as per requirement of the situation for the gap adjustment at JOH.

c) Open the protection cap with the help of crowbar & also counter nut with the help of spanner key 65 mm.

d) Adjust the adjusting piece with the help of spanner key 41 mm as per requirement: by Rotating clockwise to increase the gap at JOH (60 ±3 mm) and by rotating anti-clockwise to increase the gap at JOH (60 ±3 mm).

e) After adjustment, check once again the parameter if the parameter has found as per given value, then tight counter nut & protection cap.

f) Provide oiling/greasing for the smooth movement of L.M. Stretcher Bar.

g) Check, whether all the chuck nuts are tightened or not.

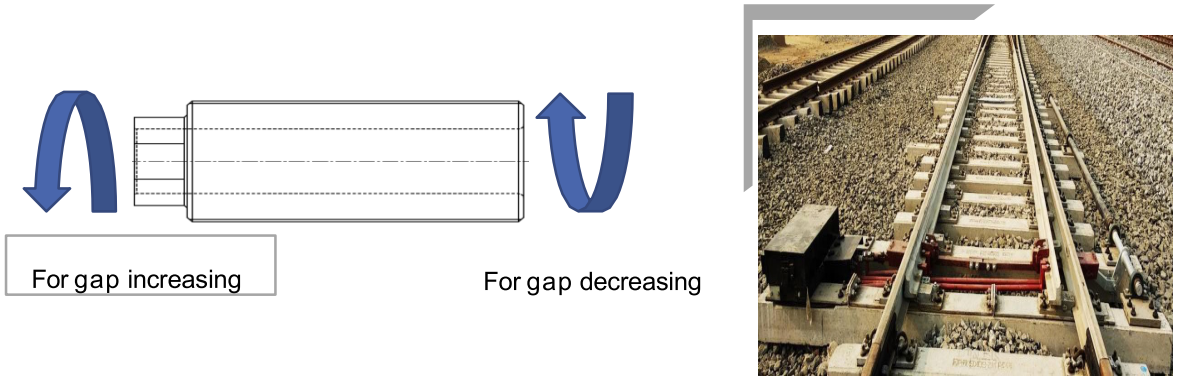


Fig. 8.10

838. MAINTENANCE of BACK DRIVE (non-torsion): Back Drive System for 1 in 12 turn-

out DFCC to be installed on the opposite side of the point machine. It is a mechanism connected with electric point machine used to maintain the Gap at JOH of Switch Assembly by providing adequate force to the rails at JOH through driving shafts linked with the idle stroke assembly. The Back Drive couples to the Drive Rod of the point machine of turnout and through a system of bell cranks and shafts transmits a force to one of the rear switch rod in the turnout assuring that the switch vertical face butts fully against the stock rail in desired length. Lost motion adjustment at the rear rod is obtained by using a very simple arrangement of a threaded rod, jam nuts assuring simple adjustment and long life. Following maintenance procedure is to be carried out:

a) Maintenance Preparation:-

i. First study drawings of turnout, rodding and BACKDRIVE unit.
ii. Measure stroke of switchblades at the BACKDRIVE position. Determine the clearance.
iii. Measure the gap between closed switchblade and the stock rail. Determine the stock rail distance and the gauge according to layout plan, if necessary, readjust.
iv. Determine the stroke of the rodding and the stroke of the blades at the first setting level, if necessary, readjust.
v. Gap in both claw locks, Gap in the first and second claw locks position, locking to be measured.
vi. Check that the sliding plates are properly clean.
vii. Check that the distance between the sleepers where the clamp locks are located is in accordance with the design.
viii. Check that the distance between the locking box axis and the locking rod axis is correct
ix. Check that the distance between the locking rod center in the first clamp lock and the locking rod center in the second clamp lock is right according to the design.
x. Sliding are enabled by the locking rod and the locking strip, for this reason, an outage is admitted according to the design.

b) ASSEMBLY STEPS: Back drive (Non-Torsional) assembly composed of various elements, all of them conjugated with each other. Following abnormality must be attended before start of assembling back drive components. If the actual distance between the sleeper and the edge of the locking drive rod is not in accordance with the design, may be caused by either the distance between sleepers is not correct, or there is an outage in the turnout.

i. Engine-frame support assembly for the switch blade electric drive and the squad base plate: To assemble the frame support, this will be pre-installed over the squads base plates according to the designed dimensions.

ii. Assembling of Tongue rail electric drive system, including locking devices:
The following steps to be followed and dimensions indicated in drawing should be considered.

- Pre-install the drive system with its screws.
- Install the point operating rod into the clamp lock.
- Tighten the driving system bolts with an indicated tensile force.
- Tighten the split pins and open its side pieces.

c) Assembly of the mechanical back drive system: Following steps to be followed and dimensions indicated in drawing should be considered.

i. The squads base plate is screwed to the drive frame, so when the frame is installed according to the design, squads will be also installed in the correct position, as you can see in the next picture.
ii. Once attached to the drive frame support, screwed to it will be the squads base plates, and in this way, attaching the frame support following the design instructions you would also have correctly connected the squads of the driving system.
iii. Once attached the two frame supports with the squads following the design instructions, the two squads connecting rods and the pulley protection box must be connected through rock bolts. The squads connecting rods have a threaded area that allows to get shorter/longer depending on the motor stroke.
iv. When the connecting rods are attached to the squads and lying on the pulleys, it must be verified that they are not blocked, and the movement is smooth when you pull/push on.
v. Once the correct movement of the connecting rods has been checked, the squads must be hooked up to the clamp locks. Squads are attached to the clamp locks by a bracket which allows lengthening or shortening, depending on what the clamp lock needs. Once the bracket is adjusted, the rock bolt that joins it to the clamp lock must be placed. Both the squads and the clamp locks have two holes to fit when the regulation time.

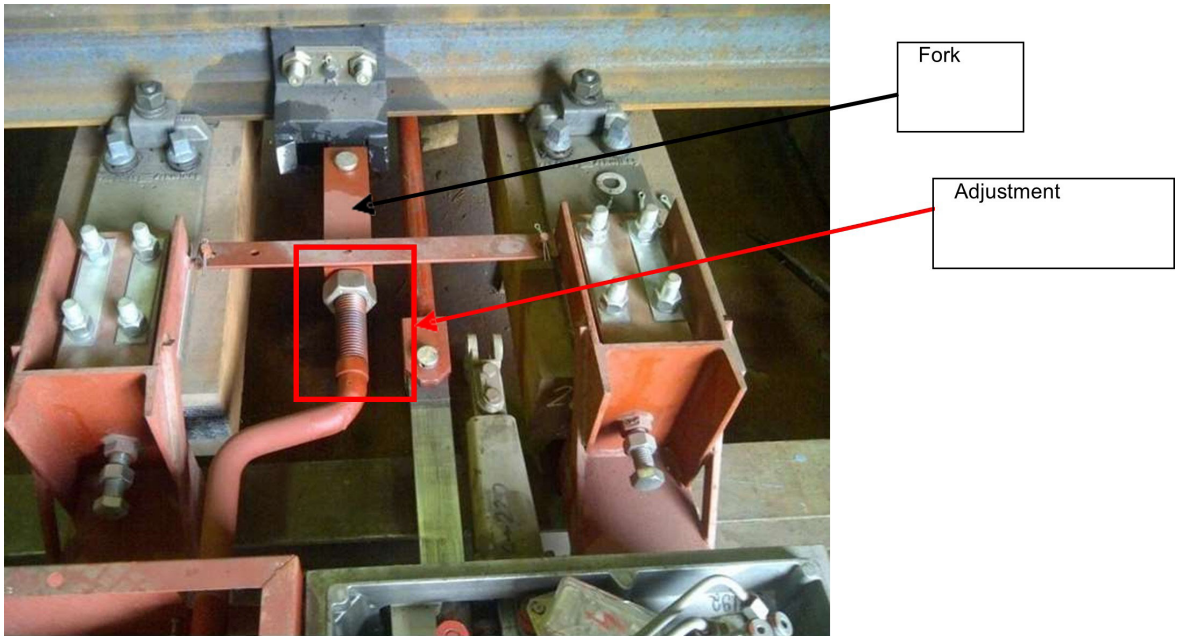


Fig. 8.11

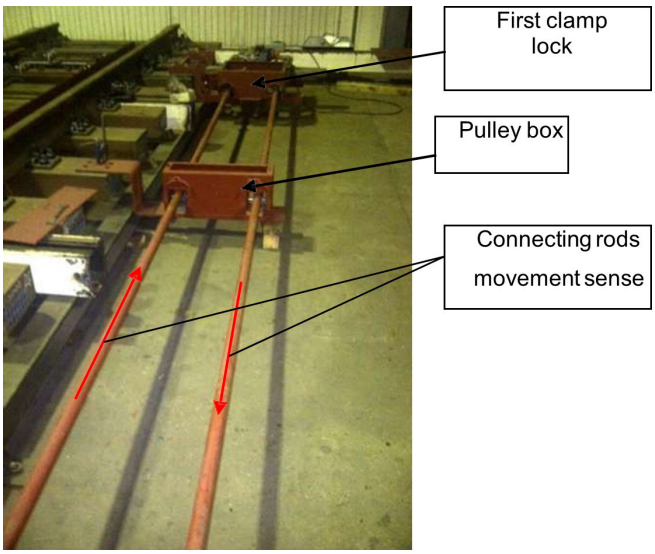


Fig. 8.12

d) Adjustment after assembly:-

i. The back drive operating rods have a threaded area to be lengthened/shorten depending on the motor stroke.

ii. The bracket and the bar that joins the two squads to the clamp locks can be adjusted through the brackets threaded area. On this way, the gap between tongue rail and stock rail, and the clamp locks locking can be adjusted. It must be considered that if the gap is modified in one of the two clamp locks, it will be modified in the other, because this, it will be necessary to calculate the average of the measurements in both sides.

iii. When the back drive System assembly and regulation works are over, the lids with their pins will be placed and the connecting rods protective covers, following the design instructions.

839. Maintenance of Spring Setting Device:

a) Check the symmetrical slewing movement of the levers. The permissible maximum difference between dimension "a" and "b" for turnouts with symmetrical switch throats or not super-elevated turnouts is 2 mm. Elongating a connecting rod reduces the dimension "a" and vice versa. Tightening the stop screws will increase the dimension "b" and vice versa. To keep the clearance, it is necessary

to alter the dimensions "a" and "b" jointly, e.g. shortening of "a" and elongating of "b" or vice versa.

b) Check the clearance between switch rails and stock rails after several settings of the switch.

Fig. 8.13

c) Check the clearance between switch rails and stock rails after several settings of the switch.

d) After completion of the functional test, the locknuts of connecting rods and the stop screws must be tightened and split pins must secure all Rail pins & bolts.

e) The ends of the split pins at Rail Pin on the switch rail foot must lay on the steel washer.

f) Metallic sliding surfaces and threads must be lubricated. Excess lubricant must be removed.

g) Close cover and secure with spring plug.

h) Prior the opening to traffic or first passage over the turnout, the guaranteed fail-safeness of the turnout as well as the clearance of the kinematic envelope must be checked.

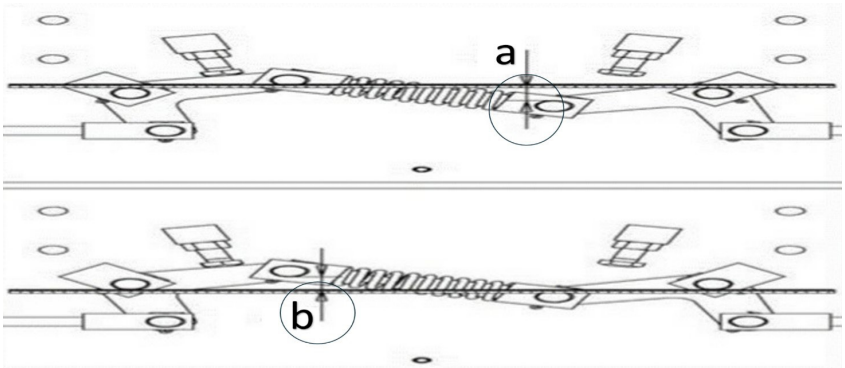


Fig. 8.14

840. Creep Monitoring Valve: Also known as Anti Creep Device. Creep more than design gives indication that rails in Lead portions are not properly laid/destressed. The clearance at ACD tongue on both sides shall be 7 mm at t_d. The Creep Monitoring Valve has eccentric hole in Pin as well as in fork w.r.t C/L of ACD. The hole in ACD pin and fork w.r.t centerline are at 113 mm and 117 mm. This eccentricity in the hole of Pin & Fork is provided for adjustment inside clearance of ACD up to 4 mm for which the pin/fork of ACD is to be reversed and upside down. If ACD is butting, then there is possibility of kink formation in TR just beyond ACD. Then immediately remove the ACD. On breakage of ACD there may be the possibilities of creep in the tip of TR and

in case the resultant creep is not giving any trouble during Motor Point operation, in that case ACD may be removed. The following Procedure should be adopted before providing new ACD: -

a) Observe the Gap of ACD at SFT (during rising and falling rail temp).
b) Under no circumstances the Stock rail/tongue rail shall be cut to adjust ACD gap.
c) If clearance on any side of pin is equal to or more than 3 mm, then reverse (upside down) the ACD pin/fork part depending on which side gap has been reduced the ACD when rail temperature is very near to t_d.
d) And in case clarence is less than 3 mm at t_d, then customize the ACD assembly from OEM and fit the ACD in Turnout when rail temperature is very near to t_d.
e) Regular tightening of bolts of ACD with torque wrench shall be done at a maximum torque of 900 N-m.

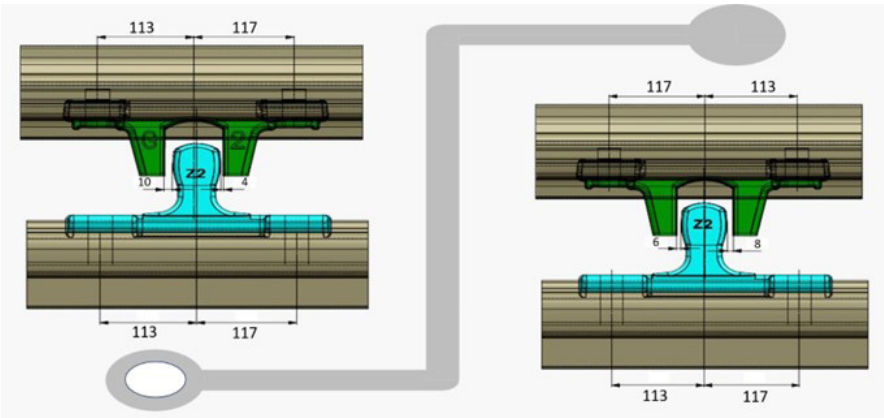


Fig. 8.15

841. Whenever any replacement of tongue rail or stock rail, on account of fracture, is required, the same shall never be replaced individually.

a) Stock Rail & Tongue Rail shall always be replaced together, to achieve proper housing.
b) If Stock Rail is defective or broken, keeping emergency traffic conditions in mind, emergency repair of Stock rail alone may be taken up in rare cases and trains at 20 km/h can be permitted.
c) If one side tongue rail is fractured, the traffic on other side tongue rail route, which is intact, can be permitted, if it is main line, at a speed of 50 km/h and if it is diverging line at 20 km/h.
d) Traffic on routes where the tongue rail is broken shall be permitted only after its replacement.
e) The speed can be relaxed to normal after permanent repair only.

842. **Replacement of Defective/worn-out X-ing in CWR territory:** It is to be done only when the rail temperature is nearly equal to destressing temperature (between +/- 2 Degree). After taking traffic block the defective/worn-out X-ing shall be replaced after cutting the rails on 4 sides of T/O in such a way that 25 mm clear gap shall be available at the time of welding of all 4 rails ends with X-ing ends. Following sequence shall be followed for welding of X-ing for all 4 joints. The steps can be summarised as under:

a) Isolate the CMS Crossing by cutting all four sides of it including heat affected zone after providing Creep Anchors just beyond planned rail cut locations on at

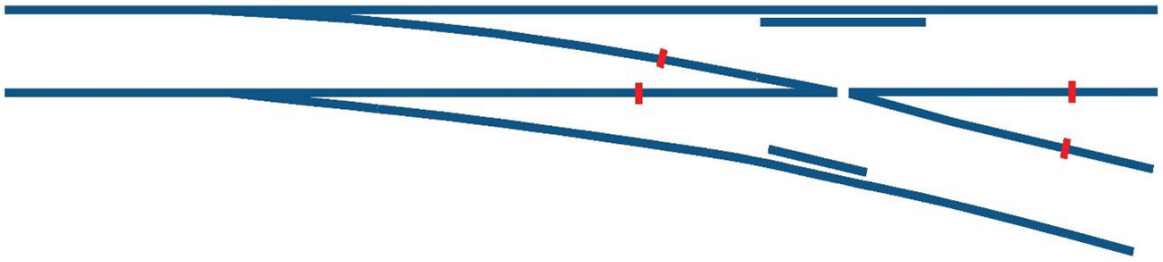


Fig. 8.16

b) Replace the defective X-ing with new X-ing and fix all fitting of X-ing portion.
c) Before placing the new crossing over sleepers all the rubber pads shall be replaced, if required.
d) During replacement of CMS Crossing, it must be ensured that TNC/ANC positions should not be disturbed & all one-meter fish plated & clamped joints shall be supported with wooden blocks.
e) After tightening all four joints of CMS Crossing, traffic shall be allowed at speed of 20 km/h for temporary repairs.
f) For permanent repair, cut the free end of rails 4 rails coming towards the X-ing in such a way to get a gap of 25 mm for doing AT welds between rail and X-ing legs and complete the AT welding activity.

843. Replacement of Defective/worn-out Tongue/Stock Rail in CWR Territory: Whenever on account of fracture or Defective/Worn-out Tongue/Stock Rail is required to be replaced in CWR territory whole Switch means Tongue and stock rail of same side should be replaced. It is to be done only when the rail temperature is nearly equal destressing (between +/- 2 Degree). Procedure is as follows:

a) All fixtures like S&T gears & SSD (If any) shall be disconnected
b) For replacement of Stock rail, after taking traffic block two cuts on Stock Rail, (one at SRJ & another at junction of lead rail) and one cut at Junctions of Switch

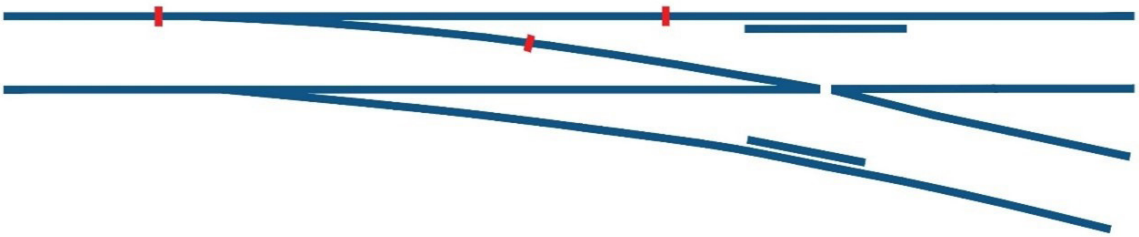


Fig. 8.17

c) All fixtures and fasteners are then removed from Stock and Switch Rail.
d) Replace the fractured / defective Tongue and Switch Rail dully adjusting the side clearance of ACD @ 7 mm on both side of ACD and some hard material shall be fitted in adjusted Gap of ACD.

e) In case adequate welding parties are available (three welding parties needed) and adequate block is also available permanent repairs should be carried out similar to repairs of rail fracture at all three cuts.

f) After 3 AT welds are done, hard material fixed in ACD gap should be removed after ensuring all fitting of Stock Rail portion of turnout.

g) In case welding parties are not available first temporary repairs shall be carried out similar to rail fracture at all three cuts by inserting rail closures (not less than 6.5m length) at each cut and traffic is passed at restricted speed after fish-plating and clamping and inserting all fixtures and fittings. When welding parties are available permanent repairs should be carried out like repairs of rail fracture at all four closure rails.

h) FB Plant with Super puller shall be placed 150 m away and excess/short length of rails to be adjusted if required.

i) Equalization of stress over 250 meters on either side of Turnout shall be done similar to permanent repairs of rail fracture.

j) Check for proper Switch housing, ACD gaps, S&T installations. After jointly certifying by S&T and Engineering supervisors, Traffic block is cancelled, and train is allowed at normal speed.

Note:

i. In order to avoid additional AT welds in Turnout Zones, during first replacement of Tongue rail, total length to be ordered for tongue rails should be 600 mm more than its designed length. Similarly, for first replacement of Crossing and stock rail, 600 mm extra length should be available on both sides for stock rail and on all four sides in case of crossing.

ii. All activities of replacement of Switch Rail/Tongue rail shall be done in presence of S&T staff.

iii. In case of fracture, if the fractured location on Switch Rail is between ATS and ACD, Gap at fractured location shall not be considered during repair work. If a fracture is between ACD & Junction of lead rail, gap at fractured location must be considered while repair is going on.

iv. Before carrying out welding of another end of lead rail which is welded the tongue rail the position of anti-creep device must be ensured for matching with initial laying position.

v. If adequate block and welding teams are available, temporary repairs can be skipped and straight away permanent repairs should be done after emergency repairs. (preferable).

844. Replacement of check rail:

a) Under traffic block, remove defective/worn out Check rail and replace it with a new one. When the check rail is properly secured, place the bolt from inside of the check rail and fix it with a double spring washer and a nut. Repeat for the rest of the check rail chairs.

b) Measure the check rail clearance and gauge and compare with values given on the layout drawing.

c) If the check rail clearance is going beyond limits, it can be adjusted by placing shims between chairs and check rail.

d) Check the relative position of the check rail to the crossing according layout plan. If necessary, readjust by shifting sleepers respectively the rail seats.

e) Tighten the bolts with the torque given on the drawing.

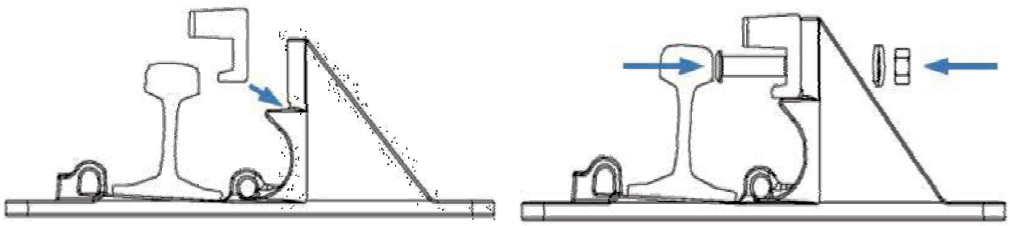


Fig. 8.18

845. Maintenance of lead portion and turn-in curve:-

a) At the time of laying, the correct sleeper spacing should be ensured to achieve correct alignment of the lead curve. During maintenance, stations at 3.0 m intervals should be marked, versines checked, and track attended as necessary. The versine at each station in lead curve and turn in curve should not be beyond 3 mm, from its design value, as a good maintenance practice.

b) The versines of turn-in curves on loops should be recorded at stations at 3.0 m intervals on 6.0 m chord length during the inspection of points and crossings to check the sharpness of the curve and rectified as necessary.

c) The turn-in curve should also be checked for condition of sleepers and fastenings.

846. Robotic Reconditioning of CMS Crossing: - Robotic Welding Technology is to be used for in-situ reconditioning of Weldable CMS crossing on all running lines including loop lines. The Robotic Welding technique uses a computer-controlled arc-welder that utilizes a coated wire without gas to eliminate operator exposure to weld fumes. The records of all welding parameters and events are stored in memory for later reference. OEM shall guarantee minimum 80 GMT life after reconditioning. For detailed welding process the manufacturer's manual may be referred to. The life of CMS crossing, based on wear is 250 GMT with three rounds of reconditioning. Reconditioning activity after three rounds of reconditioning shall be decided by CTE/DFC. Selection of Points and Crossings for Reconditioning is as following:

a) CMS crossings to be reconditioned by robotic welding should be in good condition and certified by the Sectional IMSD for their suitability for reconditioning and should normally not have exceeded specified limit of wear as given in para 835(j).

b) Crossings containing cracks on the worn-out portion having depth more than 3 mm (as determined by gouging) beyond the condemning size shall not be selected for further reconditioning.

c) The Crossings having internal defects should not be reconditioned.

847. Competency of reconditioning welder: It is essential to maintain the horizontal and vertical slopes of CMS crossing as per the drawing. The OEM shall issue the competency certificate of the welder for the type of CMS Crossing from the circulated list of RDSO. A copy of competency certificate with identity card should be available with welder at the site of reconditioning.

848. Periodical Inspection of Reconditioned Crossing: - After reconditioning crossing shall be inspected quarterly in addition of scheduled inspections for the structural soundness, presence of disintegration or any other defects.

849. Destressing of Turnout Zone of CWR at destressing temprature: The destressing of

turnout zone of CWR is to be done at when rail temperature is within T_d–2˚C to T_d+2ºC. Following procedure is to be adopted for destressing of Turnout:

a) Impose Speed restriction of 30 Kmph on Main line as well as loop line.

b) The complete crossover shall be isolated from running rails of Main line and loop line by cutting the rails at 150 m ahead of SRJ (in case permanent welding of main line rail end and Turnout side rail by FBW plant) otherwise at 30 m (when AT welding is planned) and at 150 m after back leg of X-ing (in case permanent welding of main line rail end and Turnout side rail by FBW plant) otherwise at 30 m (when AT welding is planned) on main line as well on loop line also and fix joggled plates with 4 clamps before allowing the traffic under SR of 30 Kmph.

c) After ensuring adequate availability of labor avail traffic block for natural distressing of complete crossover when rail temperature is T_d–2ºC (on rising temperature trend)/ T_d+2ºC (of falling temperature trend).

d) In traffic block 100% fittings of cross over portion of track as well as plain tracks up to the point where the running rails are cut are to be removed without disturbing the X-ing locations. With the wooden mallet the rails are to be tamped to release any locked-up stresses in rail.

e) Then the ACD side clearances at all 4 ACDs are to be made 7 mm and some hard materials shall be fixed inside gaps (to avoid any change in fixed side clearances of ACDs). Fix back 100% fitting of entire opened track including 150/30 m plain track on all 4 ends of cross overs.

f) Insert the required thickness rail closers and fix the JFP at all 8 joints and cancel the traffic block with SR of 30 Kmph.

g) Take suitable block and to AT/FBW by using Tensor/super puller for welding of 8 JFP joints.

CHAPTER – 9

MAINTENANCE OF TRACK IN ELECTRIFIED AREAS

901. General Instructions and general knowledge of Staff:

a) Staff working in electrical traction area shall be in possession of a copy of rules framed for the purpose of the operation of the Traction Power Distribution system pertaining to Engineering Department and ensure that staff working under him are also acquainted with the rules. He will ensure that rules pertaining to carrying out engineering works are strictly observed.

b) All electrical equipment, every power line or cable shall be considered as always being 'live'. No work shall be commenced adjacent to any electrical equipment except on authority issued in writing by a competent official of the Electrical Department to the effect that the equipment has been made dead and earthed.

c) **Defects in Overhead Equipment** – Defects or breakdowns in the overhead equipment including track and structure bonds noticed by the Engineering staff shall be reported immediately to the Traction Power Controller. When defects in the overhead equipment, that are likely to cause damage to pantographs or trains, are noticed and it is not possible to convey information to Station Masters or TPC to enable them to issue caution orders, the line shall be protected by the staff noticing such defects according to G&SR (DFC).

d) **Traction Bonds** – In DFC ariel and buried Earth Conductors have been provided for carrying the return current in electrified areas. In addition, traction bonds have also been provided as a second line of defense and the return current fully or partially flows through the rail. To ensure reliable electrical circuit continuity and to ensure proper earthing in case of leakage of current, traction bonds are provided at suitable places and maintained by the Electrical Traction Department.

e) Other steel structures such as foot-over bridges, sheds, etc. in the vicinity of O.H.E. lines are also provided with separate earthing and connected to rails through similar structure bonds.

f) No hole shall be drilled in the rail for providing Traction bonds. It should be provided with proper clamps. In case it is essential to drill a hole it can be done only with the approval of CTE/DFC and must be at neutral axis and properly chamfered.

g) While carrying out the track maintenance, various OHE gears should be removed, wherever they interfere with the maintenance activities so as not to cause any damage to such fixtures.

902. Special Instructions to Staff Working in Traction Area: - Precautions are required to be taken on account of following-

a) Proximity of a Live Conductor – The risk of direct contact with live O.H.E. is ever present while working in electrified sections such as for painting of steel work of through spans of bridges and platform cover.

b) Buildup of potential due to return current in rails – The return current in the rails may cause a potential difference –

i. Between rail and the surrounding mass of earth.

ii. Between two ends of a fractured rail.
iii. Between earth and any other metallic mass.

903. The following precautions should be taken while working in traction areas-

a) No work shall be done within two meters from the live parts of the O.H.E. without a 'permit-to-work'.

b) For work adjacent to overhead equipment the Engineering Inspector shall apply to the proper authority sufficiently in advance to sanction the traffic and power block required.

c) The Traction Power Controller through Traction Foreman will arrange to isolate and earth the section concerned on the date and at the time specified in consultation with the Traffic Controller. He shall then issue 'permit-to-work' to the IMSD sectional. On completion of the work the 'Permit-to-work' should be cancelled, and Traction Power Controller advised, who will then arrange to remove the earth and restore power supply.

d) No part of the tree shall be nearer than 4 m from the nearest live conductor. Any tree or branches likely to fall on the live conductor should be cut or trimmed periodically to maintain the safety clearances. The responsibility for wholesale cutting of the trees, i.e. cutting of tree trunks, will rest with the Engineering Department. In the electrified territories, however, the cutting of the trees shall be done by the Engineering Department in the presence of authorized TRD staff to ensure safety and satisfactory completion of the work. The day to day trimming of the tree branches, wherever required, to maintain the 4 m safety clearances from OHE shall be done by the authorized TRD staff and Supervisors.

e) In case of dispute, the decision whether to cut or trim a tree shall be taken through a joint inspection of Engineering and Electrical officials. The decision of CGM/RMU is final.

f) The modalities to be adopted for cutting/ trimming of the trees, i.e. contractually or departmentally, may be decided by the respective departments based on local conditions. Accountal and disposal of trees cut will be done by the Engineering Department. While the disposal of the trimmed tree branches will be the responsibility of the TRD Department. No fallen wire or wires shall be touched unless power is switched off and the wire or wires suitably earthed.

g) **Earth Work** – For excavation work adjacent to tracks, the following action is taken :-

i. Intimation should be given to the concerned officers of the Electrical and S&T Department, since all the S&T and Electrical lines are cabled on account of Electrical Induction.

ii. Cable markers showing the location of cables are provided by the Traction Department. In addition, the cables are protected by tiles and bricks, and during excavation if workmen come across such tiles or bricks in an arranged manner, they should at once report the matter to the higher officials. Any further excavation should be carried out only in the presence of the authorized staff of Electrical Traction and or S&T Department as the case may be.

h) **Alteration to Tracks** – The relative alignments of the centerline of the track with respect to the alignment of the contact wire must be maintained within the specified tolerances. This applies to both horizontal and vertical clearances. Slewing or lifting of track must not be done outside the agreed maintenance

limits, unless the position of the contact wire is altered at the same time. Adjustment of cant has a magnified effect of the horizontal displacement of the centerline of the track with respect to the alignment of the contact wire.

i) Horizontal clearances to structures within the limits laid down in the Schedule of Dimensions must be maintained. For Slewing or alterations to track involving adjustment of contact wire (outside the agreed maintenance limits) sufficient notice should be given to the traction staff so that they arrange to adjust the overhead equipment.

j) **Alterations to Track bonding** – All bonds removed by the staff of the Engineering Department shall be replaced by the staff of the Engineering Department and all such removals and replacements shall be reported to the Electrical Engineers, Traction Distribution in-charge, concerned without delay.

k) **Working of Cranes** – No crane shall be worked except on the authorized 'permit-to-work'. In every case of working a crane, arrangements should be made for the presence of authorized overhead equipment staff to ensure that all safety precautions are taken.

l) **Inspection of Tunnels** – For inspection of roofs and sides of a tunnel, the overhead equipment shall be rendered 'dead'. Special insulated apparatus should be used if sounding the unlined portions to locate loose rock in the roof and sides, is required to be carried out, when the overhead equipment is 'live'.

m) As far as possible closed wagons shall be used for Material trains. In case open or hopper wagons are used, loading and unloading of such wagons in electrified tracks shall be done under the supervision of an Engineering Official not below the rank of an Executive/P- Way, who shall personally ensure that no tool or any part of body of the workers comes within the 'danger zone' i.e., within 2 m of O.H.E.

n) Steel tapes or metallic tapes with woven metal reinforcement or metallic staff should not be used in electrified tracks. Linen tapes are safer and, therefore, should be used even though they are not accurate.

o) The top foundation blocks in electrified structures should be kept clear of all materials.

904. Maintaining Continuity of Track: -

a) During maintenance or renewal of track, continuity of the rails serving electrified tracks shall invariably be maintained. For bridging gaps which may be caused during removal of fishplates or rails, temporary metallic jumpers of approved design shall be provided as below. The necessary jumper will be provided by the Electrical Department on requisition.

b) In case of rail fracture, the two ends of the fractured rail shall be first temporarily connected by a temporary metallic jumper of approved design (as shown in the sketch below). In all cases of discontinuity of rails, the two parts of the rail shall not be touched with bare hands; Gloves of approved quality shall be used.

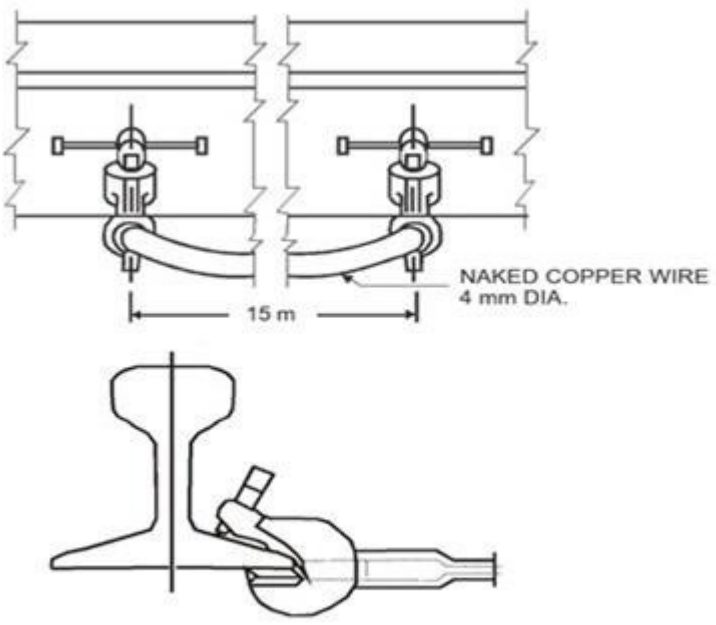


Fig. 9.1

c) In the case of track renewals temporary connection shall be made as shown in Annexure 9/1.

d) In the case of defective or broken rail bond, a temporary connection shall be made as shown in point (b) above.

e) Before fishplates are loosened or removed temporary connection shall be made as in sub-Para (c) above.

f) Additional precautions in A.C. Traction Area: -The following additional precautions are required to be taken in A.C. traction areas: -

i. Build-up of potential due to induction in metallic bodies situated close to O.H.E. – It is important to note that dangerous voltages may be induced in metallic masses such as fencing posts in the vicinity of traction conductors. To avoid possibility of shock due to such voltages, the metallic structures are bonded together and earthed.

ii. Unloading of rails – When unloading rails along tracks, care shall be taken to ensure that rails do not touch each other to form a continuous metallic mass of length greater than 300 meters.

iii. Permanent way staff are advised to keep clear of the tracks and avoid contact with the rails when an electrically hauled train is within 250 m.

905. Fire in Electrified Areas: -The Permanent Way Officials noticing a fire likely to result in loss of life or cause damage to property shall take all possible steps to prevent it from spreading and to extinguish it. In case the fire is adjacent to any electrified equipment, the Permanent Way Official shall make no attempt to extinguish the fire but shall report the occurrence of fire to the nearest Station Master by most expeditious means.

906. Permanent Way Tools: -Permanent Way tools (insulated and un-insulated) along with gloves shall be used in a manner as approved by the Chief Track Engineer/DFC.

907. Treatment of Persons Suffering from Electric Shock: -When persons receive electric shock, practically in every case they can be revived with prompt application of First Aid. The method of resuscitation resorted to should be that known as artificial respiration. The efforts to restore breathing must be continued regularly and with perseverance and must not be discontinued until a doctor has taken charge of the case.

908. Accident to Power Lines of outside Bodies: -The Engineering officials shall be in possession of the name and address of the officer-in-charge of each power line across DFC land to enable an immediate report of any defect or accident appertaining thereto being made, under advice to the IMD In-charge and Dy.CPM.

MAINTENANCE OF TRACK WITH AXLE COUNTER

909. Provision and Maintenance of Signaling Fixtures in Track:

a) No signal fixtures/installation, which interferes with maintenance of track should be provided on track unless the approval for same is available from Chief Track Engineer/DFC.

b) Precautions to be taken while working in axle counter area– As a policy, axle counters have been provided in DFC in lieu of Track circuit. As such, no special precautions are required. However, the Executive/P. Way should instruct the P-way staff to work carefully while working near MSDAC and other S&T gears.

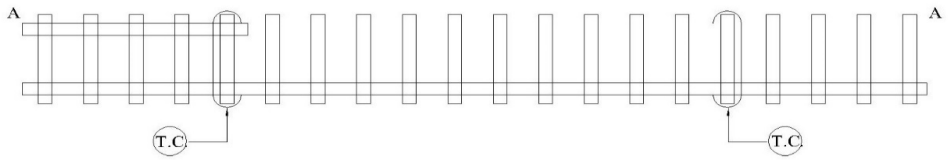
c) S&T Department shall make arrangements for the opening of signal rod, signal gears, other installations etc. to facilitate mechanized track maintenance.

d) No hole shall be drilled in the rail for providing S&T fixtures. It should be with proper clamps. The decision of CTE/DFC is final.

e) During machine tamping, staff of the signal department shall assist in removing axle counters for effective machine packing.

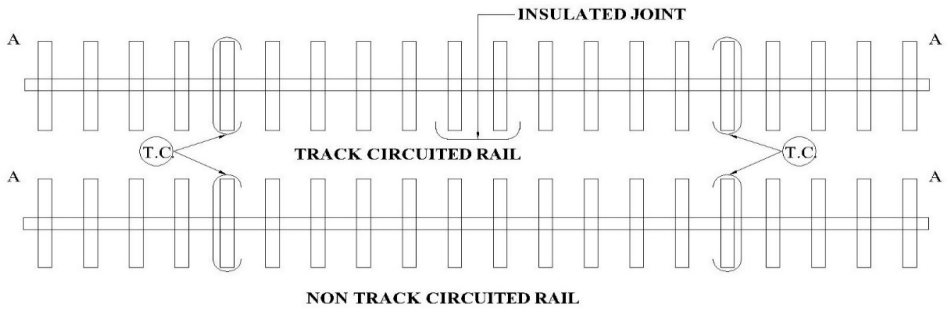
Annexure-9/1

TEMPORARY CONNECTION DURING RELAYING OPERATION

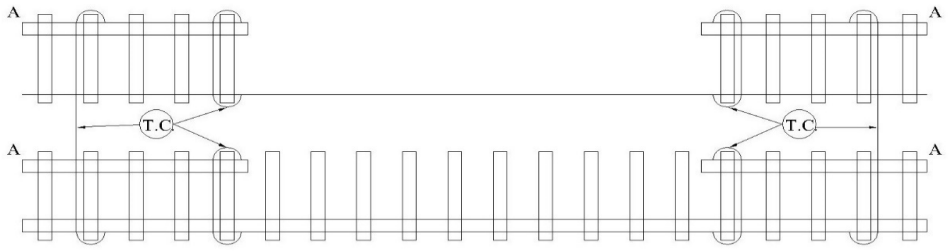


1) REMOVING OF ONE RAIL
(BOTH THE RAILS INSULATED FOR TRACK CIRCUITING)

2) REMOVING BOTH THE RAILS,SIMULTANEOUSLY OF ONE LINE
(BOTH THE RAILS INSULATED FOR TRACK CIRCUITING)



3) REMOVING OF ONE RAIL
(ONE RAILS ONLY INSULATED FOR TRACK CIRCUITING)



4) REMOVING BOTH THE RAILS SIMULTANEOUSLY OF ONE LINE
(ALTERNATIVE TO NO.2 ABOVE)

(T.C) TEMPORARY CONNECTION

Fig. 9.2

Chapter – 10

TRANSPORTATION OF MAN AND MATERIAL ON TRACK

WORKING OF TROLLIES, MOTOR TROLLIES AND LORRIES

1001. The Rules for working trollies, motor trollies and lorries are contained in Para 250 to 260 of DFC General & Subsidiary Rules. The instructions contained in this chapter are in amplification of these rules and will not supersede the General and Subsidiary rules of DFC. In DFC inspection by Push trolley shall progressively be replaced with Rail-cum-Road Inspection Vehicle (RCRIV). Inspection by RCRIV would be done under block protection. It is capable of facilitating safe travel on electrified/non-electrified section.

1002. Distinction between Trolley, Motor Trolley and Lorry:

a) A vehicle which can be lifted bodily off the line by four men shall be deemed to be a trolley. Any similar but heavier vehicle (which includes Dip Lorry) shall be deemed to be a lorry.

b) Any trolley which is self-propelled, by means of a motor, is a motor trolley.

c) A trolley shall not, except in cases of emergency, be used for the carriage of permanent way or other heavy material, and when a trolley is so loaded, it shall be deemed, to be a lorry.

1003. Certificate of Competency:

a) No trolley, motor trolley or lorry shall be placed on the line except by a qualified person with valid Competency Certificate.

b) Such qualified person shall accompany the trolley, motor trolley or lorry and shall be responsible for its proper protection and for its being used in accordance with special instructions.

c) Staff in whose favour a certificate is issued should be literate, having knowledge of Hindi or other local languages, should have passed the prescribed medical test and should be conversant with the rules for working of trollies, motor trollies and lorries, as the case may be. The certificate of competency will be issued for a specified period by an officer authorised to do so and renewed periodically.

1004. Officials Permitted to use Trollies, Motor Trollies and Lorries– Subject to their being certified competent, the following officials of the Engineering Department are permitted to use Trollies/Lorries:

a) Trollies/Lorries–

i. All officers and IMSD In charge/IMSD Sectional of Engineering Department.

ii. MTS/Junior Executive, Head Trolley men as may be authorised.

b) Motor Trollies– All officers of Engineering Department, motor trolley Drivers and such IMSD In charge/IMSD Sectional as may be authorised.

1005. Responsibility for Safe Working:

a) The official-in-charge of Trolley/Motor Trolley/ Lorry is always responsible for its safe working. When more than one person holding competency certificate travels in a trolley, the official-in-charge of the trolley is responsible for its safe working.

b) It shall be clearly understood by officers and staff that they are to take every

possible precaution and protection against accidents.

c) Motor trolley should be used under block protection.

1006. Efficient Brakes– No Lorry, Trolley or Motor Trolley shall be placed on the line unless, it is fitted with efficient brakes. The brakes should be tested before the commencement of each journey. It will be the responsibility of the official-in-charge to ensure the adequacy of braking.

1007. Attachment to Trains Prohibited– No Trolley/Motor Trolley/Lorry shall be attached to a train.

1008. Working on Track Circuited Sections and Sections Provided with Axle counters: As per DFC joint circular for the working of Motor Trollies in Block sections.

1009. Numbering of Trollies/Motor Trollies/ Lorries– Each Trolley/Motor Trolley and Lorry shall be marked with its number, code, initials of the department, the designation and headquarter of the official-in-charge.

1010. Conveyance of Trollies/Motor Trollies/ Lorries by Trains–

When loading a motor trolley with petrol in the tank, it shall be ensured that :-

a) The flow of petrol in the carburettor has been cut off.

b) Any pressure has been released from the tanks.

c) The tank is in sound condition and closed by a well fitted cap.

d) The engine has been run by the official- in-charge until the carburettor has become exhausted and the engine stops automatically.

1011. Trollies, Motor Trollies and Lorries not in use: A trolley, motor trolley or lorry, when not in use shall be placed clear off the line, and wheels thereof secured with a chain and padlock whenever kept parallel to the track. Whenever possible, motor trollies, should be placed in a shed, the key of which, shall be in the possession of the official-in-charge.

1012. Conveyance of Non-DFC Officials– Trollies shall not be used for the conveyance of persons other than DFC officials. In special cases, Magistrates, Police, Civil, Military, Medical and Forest Department Personnel or a person requiring medical aid, may be conveyed by trolley by order of the competent authority (IMD IN-CHARGE or above), after a bond on form in Annexure – 10/1 is signed indemnifying the DFC against all liabilities and risks. Contractors and their Agents may be conveyed on trolley in connection with works, provided they have executed a general indemnity bond like Form in Annexure -10/1.

1013. Equipment for Trolley / Motor Trolley / Lorry – Each trolley/motor trolley/lorry shall have the following equipment:

a) Two hand signal lamps/Tri colour LED Flashing hand signal lamp.

b) Two red and two green hand signal flags.

c) Detonators 10 Nos.

d) A chain and a padlock.

e) A motor horn and a search light (for motor trolley only).

f) Two banner flags and additional detonators (for lorry only); and

g) Such other articles as may be prescribed by the DFCCIL Administration in this behalf.

h) The official-in-charge of the trolley/motor trolley/lorry shall also be in possession

of a watch.

1014. Signals for Motor Trolley / Lorry–

a) Day Signal– Every trolley, Motor trolley or Lorry when on the line shall show a red flag by day, fixed to a staff which will be placed on a socket and conspicuously visible in both directions.

b) Night Signal– On a double line the night signal shall be red light in the direction from which trains are expected and white in the other direction and on a single line, red in both directions. Where on double line, single line working is introduced, the night signal should be as per a single line. When working within the station limits, the light displayed at night shall be red in both directions.

c) Signals within long tunnels– On sections where there are long and dark tunnels, the night signals prescribed must be displayed during the day in addition to the red flag, in the case of Trollies, Motor trollies and Lorries. In the case of thick foggy or tempestuous weather impairing visibility, light signals must be displayed in addition to the red flag.

1015. Working of Motor Trollies/Moped Trollies:

a) A motor trolley shall work under block protection, as prescribed by the DFCCIL Administration.

b) Working under block protection–

i. A motor trolley should be run only under block protection.

ii. When a motor trolley that is worked under block protection breaks down in the block section, the official-in-charge should remove it clear off the line and send a written/DFIS advice to the nearest Station Master returning the line clear ticket or token or in the case of a motor trolley when the token has been clamped for a preceding train the key of the padlock. He should not replace the motor trolley on the line without the written/DFIS permission of Station Master at the end of the block section concerned. On arrival at the other end, the official- in-charge will deliver the authority to the Station Master after the trolley has arrived complete.

c) Following a Motor Trolley– Motor trolley may follow another motor trolley in the same block section during day light hours and in clear weather under special instructions issued by the DFCCIL Administration.

1016. Working of Lorries:

a) Mode of working of lorry– Lorries should be worked only under block protection. Lorries in all cases should be pushed and never pulled. Riding of persons on the same is prohibited.

b) Manning of Lorries– Lorry must be accompanied on foot by not less than four men in addition to the number of men required for expeditiously loading and unloading materials being conveyed on the lorry.

c) Actual working of lorry–

i. It will work under traffic block.

ii. After completion of the work, the lorry shall be removed of the track and the traffic block shall be cleared. In case the lorry is off loaded in the mid-section and the section is clear, the traffic block may be cancelled on DFIS.

iii. Working in Station limits- This must be done under traffic block.

1017. Rail Dolleys:

a) Rail Dolley's should work under traffic block protection.

b) Rail Dolley is a device with two or more wheels, which in balanced condition, can be moved manually on one rail of track and can carry one rail/sleeper in suspended condition. When necessary, the suspended material can be dropped and rail Dolley cleared off the track.

c) Every rail Dolley shall be manned by not less than 2 able bodied persons. The person- in-charge for the working of rail dolley's shall be a DFC official not lower in rank than a MTS. The official in-charge should have passed in medical category A-3 and must hold a valid certificate of competency for working rail dolleys. Certificate of competency shall be issued by IMSD In-charge of the section who must satisfy himself that the person to whom competency certificate is being issued is fully aware of the rules for the working of rail dolleys and is also well acquainted with the concerned section.

d) Working of Rail Dolley's:

i. The DFCCIL official in-charge of rail Dolley's must inspect the section in advance particularly in reference to heaping of ballast, girder bridges and any other special features which make it difficult to drop the material.

ii. Not more than 6 rail Dolley's should be worked in a group in any one block section.

iii. Every rail Dolley/group of rails Dolley when on track shall exhibit a red flag.

iv. The rail Dolley shall be protected by a flagman at 1200 metre from the rail Dolley, on a double line in the direction from which trains may approach, and by two flagmen one on either direction on single line. The flagmen shall also carry three detonators for use in any emergency.

v. Where necessary, intermediate Flagman should be posted to relay signals.

vi. The official in-charge shall be fully responsible for the safe working of rail Dolley.

WORKING OF MATERIAL TRAINS AND TRACK MACHINES

1018. The rules for the working of material trains are outlined in Para 199 to 204 of General Rules of DFCCIL.

1019. Material Train – Material Train means a train intended solely or mainly for carriage of DFC material when picked or put down for execution of works, either between stations or within station limits. The DFC material may include stone boulders, ballast, sand, cinder, Moorum, rails, sleepers and fittings etc.

1020. Economical Working – Material train should be expeditiously and economically worked. The IMD In-charge should arrange to form a train of maximum capacity consistent with the haulage capacity of the engine and tonnage approved for the section. In consultation with the Operating Department, the running of goods trains should be suitably regulated to provide as long a working time for material train as possible. Delays in working should be traced to their source and remedies applied as circumstances demand.

1021. Restrictions in Running –

a) Except with the permission of the IMD In-charge/Dy CPM, a Material Train should not be permitted to work during periods of poor visibility due to fog,

storm or any other cause.

b) Except in an emergency such as, an accident or breach of the DFC line, working of material trains carrying labour should not be permitted between sunset and sunrise. If due to certain circumstances it is necessary to work Material Trains during night, permission to do so should be obtained from the CGM/RMU In-charge.

1022. Brake-vans and Shelter Wagons– A Material train must be equipped with at least one brake-van in the rear. When running through between stations the engine should be marshalled at one end of the train, and the brake-van at the other end. Covered wagons to afford shelter to the labour may be coupled to the material train as required.

1023. Ordering of Material Trains– Operating Department is the authority for ordering a material train. On receipt of requisition from the IMD in-charge, the OCC in-charge shall advise the staff concerned by letter, detailing the composition of train, the loading kilometrages, the sections over which the train will work, the date of commencement of work, the station at which the rake will be stabled and the engineering official who will be deputed to be in-charge of the train.

1024. Issue of "Fit-to-Run" Certificate – Before a material train is allowed to work, the complete rake should have a "fit-to-run" certificate issued to the Guard. The rake may also be examined by the carriage and wagon staff each time it arrives at the train examining station and whenever possible.

1025. Official–in–charge of Material Train – Whenever a material train is worked, it shall be accompanied by a Guard or a competent official as decided by DFC. As the Guard is not qualified to carry out such duties as working of hoppers, distribution of ballast/ materials, supervising loading and unloading, maintaining muster rolls and daily reports of labour and preparation of daily reports on material train working, a qualified engineering official (not below the rank of IMSD Sectional) should be deputed on the train to ensure working of material train to the programme specified by IMD in- charge.

1026. Equipment – Every material train Guard must have with him while on duty:

a) A copy of General and Subsidiary Rules or such of them as related to his duties.
b) A watch.
c) Hand signal lamps/ Tri colour LED Flashing hand signal Lamp.
d) Two red flags and a green flag.
e) A whistle.
f) Not less than 10 detonators in a tin case.
g) A carriage key.
h) Padlocks as prescribed by special instructions.
i) A set of clamp for point locking and/or other locking devices.
j) A spare pair of glasses if he is required to wear glasses.
k) First aid box.
l) Wedge/Skid and chains.
m) A tail lamp/L.V. Board.
n) Mobile phone with DFIS app.

1027. Testing of Brake Power: Before starting from a station, the Guard should ensure that the train is equipped with requisite brake power prescribed for the load. Each vehicle

of material train whether provided with vacuum brake, must be provided with an efficient hand brake capable of being fastened down.

1028. Working in Block Section:

a) A material train shall be worked with the written/DFIS permission of the Station Master on either side and in accordance with the provisions and system of working in force on the section. Before a Material Train enters a block section for work, the Station Master should advise the Driver and the Guard in writing of the time by which the train must clear the block and whether it is to proceed to the block station in advance or return to the same station.

b) On double line, a material train must not push back to the Station in rear but should run through to the station in advance and return on proper running line except when otherwise directed. Where provided, lever collars or other visual indicators must be used to remind Station Master that the material train is working in the block section.

c) The Guard/Engineering official-in-charge shall ensure efficient and proper working and adhere to sanctioned time and occupation of block section. Materials should not be left fouling the track, signal wires and interlocking gears. If it is necessary for the train to leave the site of work before this is done, it should be ensured that sufficient labour is left to do so, in-charge of a competent DFC official and that the site is protected until the work is completed.

d) When a material train enters a block section to work under instructions of other than under the normal system of working, the Guard and the Driver of the train shall ensure that the train is protected from the direction a train is approaching on double line and in both directions on a single line in accordance with General Rules.

e) If for any reason, it becomes necessary to detach the engine of a material train in the block section to run to the station in advance, the Guard should ensure that the train is protected both in front and rear.

f) A material train should not be divided outside station limits except in an emergency. Before the train is divided the Guard should put the hand brake in the brake-van hard on, and pin down the hand brakes of sufficient number of vehicles and if necessary, lock by means of safety chains or sprags enough wheels, in each portion of the train. He should further ensure that the workers/ labour are detrained before dividing the train. Vehicles should not be detached from a material train on a grade of 1 in 100 and steeper. The engine itself may be detached with the Guard's permission after he has ensured that hand brakes on each vehicle are properly applied and the wheels spragged against any movement.

1029. Procedure to be Followed while Pushing Back – When it is necessary for a material train to push back into the station from which it started to work in the block section, the following procedure should be observed–

a) No train must be allowed to push back without a written/DFIS authority from the Station Master of the station from which it entered the section. Where line clear tickets are in use, the Station Master shall endorse the line clear as follows "to push back to this station".

b) The Station Master of a station where the train starts from and pushes back to, must advise the station in advance on the telephone and also the Controller on controlled sections that the train will push back to the station. He will then obtain

the acceptance of the "Is line clear for a train stopping in the section" signal on the block instruments or on the Morse instrument, where block instruments are not provided from the station in advance and then give the "train entering section" signal in the usual way.

c) On the return of the train, the Guard will intimate that the whole of the train has returned to the station complete, from the section and sign in the trains register book to the effect and return the "authority to push back" to the Station Master which must be cancelled by the latter. The Station Master will then give "cancel last signal" signal on the block or on the Morse instrument, as the case may be, and endorse the remarks that "train pushed back" in the trains register book or the line clear enquiry book against the entry of the train.

d) When it has been arranged for a train to push back from the section, it must always do so and not go through to the station in advance.

e) Before starting, a green flag must be tied to a convenient fixture in front of the engine and at the back of the rear brake-van to indicate to men working on the line that the train will push back.

f) On the double line, when the train is required to be pushed back into a station, the train must come to a stand outside the advance starting signal and the Driver shall whistle, when, if a line is clear for its reception, it must be piloted into the station. If there is no advance starting signal, the train must be brought to a stand opposite the outer signal pertaining to the opposite direction and then be piloted into the station.

g) On the single line, when a train is required to be pushed back into an interlocked station, it must come to a stand outside the outer signal and whistle, when, if a line is clear, the home and the outer signals may be taken "off" for its reception. At a non-interlocked station, the train must also come to a stand outside the outer signal whence it must be piloted into the station on signals being lowered.

h) Except in an emergency, material trains may push back during daylight only. If in case of an accident or for any other unavoidable reason, a train must push back during the night, it must do so at a walking pace and the Guard or a competent DFC official must walk at least 600 metres in advance, exhibiting a danger signal until the train comes to a stand as detailed in Sub-Para (f) & (g) above.

1030. Passage over Points– The Driver of a material train should stop the train short of all points which are facing for his train, and which are not protected by signals. The Guard should ensure that these are correctly set and locked & then hand signal the Driver past the points.

1031. Speed of Material Trains: When running between block stations with the engine leading, the speed of material train shall not exceed that prescribed for a goods train with a similar load. When the engine is pushing the train and when as in the case of emergencies the brake-van is not leading:

a) The speed must not exceed 10 Kmph.

b) The Guard must travel on the leading vehicle and exhibit hand signals to the Driver.

1032. Stabling of a Material Train

a) Material train shall not be stabled on running lines at a station, except in unavoidable circumstances.

b) When a material train is stabled at a station, it shall be protected in the following manner and Station Master shall ensure that–

i. The vehicles of the material train have been properly secured and are not fouling any points and crossings,

ii. All necessary points have been set against the line on which the material train is stabled and such points have been secured with clamps or bolts and cotters and padlocks.

iii. The keys of such padlocks are kept in his personal custody until the material train is ready to leave the siding or line.

c) The Guard shall not relinquish charge until he has satisfied himself that the material train has been protected as prescribed in this rule.

d) When the train is ready to leave, the Guard must advise the Station master in writing. The Station Master must then arrange for correct setting of the points.

e) When a material train is stabled in an outlying siding, the Guard must ensure that it is inside the trap, clear of fouling marks and clear of running line. He must pin down sufficient number of brakes and if necessary, lock by means of safety chains or sprag the wheels.

1033. Reporting Deficiencies and Damages– The Guard of the material train should at once bring to the notice of the Train Examiner under advice to the IMD In-charge/ Dy.CPM, any deficiency or damage which may have escaped the attention of the train examining staff. The Guard will also keep a record of all damages caused to the vehicles during the work and report to the IMD In-charge/Dy.CPM the circumstances in which they occurred. In every case, the IMD In-charge/Dy.CPM on receipt of such reports should arrange for the train-examining staff to attend to the damages and deficiencies expeditiously.

1034. Warning to Workers on Material Trains:

a) The Guard of a material train shall, before giving the signal to start, see that all the workers are on the train, and warn them to sit down.

b) Before moving his trains, the Driver must sound the whistle, according to the prescribed code, as a warning to the labourers that the train is about to move.

c) Before commencing any shunting with his train, the Guard must ensure personally that all labourers have been de-trained.

d) In the event of it being necessary to part a material train, the Guard must ensure personally that all labourers have been detrained before doing so.

1035. Engine Crew's Hours of Duty– Drivers, Assistant Drivers employed on material train should be relieved according to their duty rosters. Only in exceptional and emergent cases such as breaches on the line, may the engine crew be kept on duty, for long hours, in which case, a special certificate should be given to the Engine Crew by the Engineering Official-in-charge.

LOADING AND UNLOADING FROM HOPPER BALLAST WAGONS

1036. Staff Responsible - The Executive/P-way deputed at the ballast depots are responsible to ensure that the wagons are loaded to the correct level.

1037. Working Trip:

a) The train Guard or Engineering official-in- charge shall be responsible for

working the train to the instructions issued by the IMD IN-CHARGE. The IMSD IN-CHARGE or Sectional shall arrange for the inspection and clearing of track behind the train.

b) A "Working Trip" is a trip when one or more wagons are to be unloaded between two stations. A "Running Trip" is a trip from one station to the other when no wagons must be unloaded on the way. Before departing on a 'Working Trip' the IMSD In-charge or Sectional shall supply the Material Train Guard/Official-in-charge with a memo furnishing the kilometrages at which the wagons shall be unloaded and the quantity to be unloaded.

1038. Operation of Hoppers - The hopper valves shall be operated according to the prescribed instructions under the direct supervision of the train guard or official-in-charge. As far as possible one hopper may be unloaded at a time moving at walking speed. The official-in-charge should walk on the side and instruct the labor as to when to open or close the hopper valves. The train should not be stopped, while ballast is being discharged; labor should not be moved from the platform without first stopping the train. For better control of operation of hopper valves remote operated Electro-Mechanical gates should be used.

1039. Training out Material and Daily Reports of Working:

a) Training out of material and ballast should be done as per programme sanctioned by the Dy.CPM or IMD in-charge.

b) The Guard/Engineering official-in-charge should adhere to the sanctioned programme and submit daily report to the IMD IN-CHARGE through the concerned IMSD Sectional/IMSD In-charge. Where the contract for the working of the material train provides for the employment of a minimum number of labourers and the contractor is paid for the actual labour so supplied for loading and unloading of ballast, permanent way or other materials the daily report should show the correct number of labourers of each class employed and the nature and approximate quantity of work done. Muster rolls should be maintained by the Guard or Engineering Official-in-charge and checked frequently by the IMSD In-charge concerned when the training out is done by departmental labour.

c) In cases where the material is not loaded in bulk, the actual weight and number loaded should be given in the daily report.

d) Enough copies of daily reports should be prepared by the Guard/ Engineering Official-in-charge and submitted to CGM office (RMU).

e) The number of wagons on the train with their capacity and painted numbers should be indicated on the form of daily report. The particulars of detention to the train other than for Engineering work should also be indicated.

f) Before forwarding the daily reports of material train working to the IMD In-charge, the IMSD In-charge/Sectional may add relevant remarks as considered necessary. The IMD In-charge should scrutinise the daily reports and take such action as considered necessary to avoid or minimise detentions in the working of the material train, before forwarding the same to the Dy.CPM for allocation, initials, and record.

g) It must be ensured that Hoppers do not pass through Turnouts with one sided loading.

1040. Charges for Material Train Working:- For purposes of debiting the charges on account

of Material train working to the heads of revenue working expenses concerned a monthly or fortnightly "Material Train Return" in standard proforma will be prepared by Operating Department and sent to the Dy.CPM for completion and submission to the Accounts Department, for necessary action. On this return, the hire charges for wagons and engine will be separately shown.

1041. Register of Engineering Vehicles:

a) When Engineering wagons are not in use, these should be stabled in the siding allotted for this purpose in specific station yards.

b) The Dy.CPM and IMD in-charge should maintain Depot-wise a complete inventory in the form of a register of all closed wagons, open wagons, hoppers, etc., on the RMU. The register should contain Vehicle numbers, Type of vehicle, Capacity, Condition of vehicle. Locations and particulars of periodical overhaul, when carried out and due. The register should be kept current to facilitate issue of instructions when ordering a material train.

c) A monthly return of engineering vehicles on the Integrated Mantainence Depot should be submitted by the IMD Incharge to the Dy.CPM with complete particulars of each vehicle for record in his office. It should be the IMD incharge's responsibility to keep track of all Engineering vehicles allotted to his Integrated Mantainance Depot and see that those that are sent to workshops for periodical overhaul are returned expeditiously.

1042. Working of Track Maintenance Machines:

a) All 'On Track' machines shall be worked only under traffic block with the permission of the concerned Station Masters and in accordance with the special instructions issued in this regard.

i. Each machine shall be in direct charge of a nominated track machine operator. The operator (Outsourced) shall be responsible for the working of the machine under his charge. He shall be fully conversant with the rules of working of trains and of protection in case of emergency. He shall also ensure that the other staff deployed on the machine are fully conversant with the protection rules. He shall hold a valid certificate of competency for driving and working of the machine issued by the agency

ii. The track machine shall work under the direct supervision of an engineering official not below the rank of IMSD In-charge/IMSD Sectional who will be responsible for taking the traffic block, for protection of the line while the work is in progress and clearing of the block after completion of the work when the last machine clears the block section and certifying that the track is fit for train movement.

iii. When the track machine is required to move from one block station to another block station, the operator (Outsourced) along with DFC official not below Executive shall run the machine with the proper authority to proceed.

b) Each unit shall carry all safety equipment as specified under IRTMM.

c) When more than one track machine is running in a block section, there should be a minimum distance of 200 metres between two units.

d) While working on double/multiple lines, the track officials supervising the work of track machine shall ensure that no part of the machine fouls the adjacent track. In case infringement to adjacent track is inherent to the machine working which can be cleared at a short notice, the work should be carried out by protecting the infringed line by Engineering signals by IMSD In-charge/IMSD Sectional as envisaged in Para 1107.

e) Each unit will run within the maximum permissible speed sanctioned for that type of machine on that section.

f) All track machines shall work as per provision given in Para 200 to 204 of DFCCIL General Rules. For detailed working of track machines provisions in IRTMM may be referred.

Annexure – 10/1 Para 1012

Indemnity Bond in Connection with the Permission Granted to Travel on a DFCCIL

.....Trolley/Motor Trolley

In consideration of my being granted permission to travel between .... and ..... on ..... DFCCIL..... Trolley/Motor Trolley, I ..... hereby undertake and agree that the DFCCIL shall be free from all responsibility or liability for any delay or detention or for any injury or loss to me or to any property of whatsoever kind accompanying me occasioned during the journey for which the permission is granted or whilst I am or the said property is within DFCCIL limits.

I further undertake that I shall not interfere with or obstruct .... on his duties and shall obey all reasonable directions he shall give me to be subject to the bye-laws and other general regulations of the DFCCIL.

I further undertake to indemnify and keep indemnified and save harm less the DFCCIL Administration for and against any loss or damage done to the property of the DFCCIL through any act or omission on my part or on the part of my agent or servants while so travelling on the Trolley/Motor Trolley.

Dated .... Name .....

Witness – Designation..... .....

1. ..... Address .....

2. ....

(To be executed on stamp paper)

CHAPTER – 11

SAFETY PROTOCOL

ENGINEERING INDICATORS

1101. Work Involving Danger to Train or Traffic – An Outsourced/ contractual maintenance team shall not commence or carry on any work which will involve danger to trains or to traffic without the presence of the IMSD In-charge or Sectional or of some competent DFC official appointed on this behalf by special instructions.

1102. Carrying Out of Works, in case of Emergency – In the case of emergency, when the requirements of safety warrant the commencement of the work by the DFC official at site, he shall himself ensure that Engineering signals are exhibited at specified distances according to rules and flagmen are posted with necessary equipment to man them, before commencing the work.

1103. Trains shall be permitted over the track under repair at such restricted speed as is specified, only after the track is rendered safe for the traffic.

1104. Works, which Obstruct the Line:

a) Precautions before commencing operations, which would obstruct the line– No person employed on the P. way shall, cause discontinuity in track, disconnect points or signals or commence any other operation which would obstruct the line without obtaining the written/DFIS permission of the Station Master who shall ensure that all necessary signals have been placed at 'ON'. In addition, the employee mentioned above shall also ensure that the necessary stop signals like banner flags, detonators and hand signal flags have also been placed/exhibited at the prescribed locations.

b) Provided further that in emergent cases the persons undertaking such operations shall first bring the train to stop as stipulated in Para 1113 and advice the driver of the train about the need to stop the train through a written/DFIS memo. The DFC official shall send DFIS message to the Station Master for the need to block the track as per Para 1111 and obtain written/DFIS confirmation of the same. The work which may lead to obstruction to the track shall be done only during the traffic block, the written/DFIS confirmation for which shall be obtained from the concerned Station Master.

1105. Works requiring complete block protection– The following category of works will necessarily require complete block protection:

a) Category of works where track is required to be occupied:

i. Working of on-track machines
ii. Working of material trains or girder specials
iii. Working of dip-lorries, Material motor trolleys
iv. Working of motor trollies

b) Works where discontinuity in track is created or such conditions are created which may result in discontinuity or obstruction to running track:

i. Insertion or Replacement of rail/SEJs/Glued Joint/Guard rail.
ii. Temporary/Permanent repairs of rail fractures/rail buckling.

iii. Replacement of switch/crossing or any part of turnouts.
iv. De-stressing of LWRs.
v. In-situ welding of rails.
vi. Through renewal of bridge sleeper.
vii. Removal of rail from track for any purpose.
viii. Renewal of sleeper.
ix. Changing of guardrails on important and major bridges.
x. Picking up of slacks by OFF TRACK TAMPERS.

1106. Categories of Engineering Works: Engineering works can be broadly divided into three categories:

a) Works of routine maintenance, requiring no speed restriction, not necessitating exhibition of hand signals and involving no danger to trains or traffic. These include tightening of bolts, fixing of ERCs, painting on rails or bridges etc

b) Works in corridor blocks: Most of the track maintenance works like machine packing, picking up of slacks, Rail grinding, casual replacement of rail and sleepers shall be done under corridor blocks.

i. Works such as casual renewals of rails and sleepers, adjustment of creep which are completed by sunset of the day of commencement and no restriction of speed thereafter is required, are termed "works of short duration".
ii. Hand-signal, banner flags and fog-signals shall be used at specified distances to protect the trains.

c) **Works of short duration**– Efforts shall be made to complete the works in 4 hours corridor block without speed restrictions. However, in some cases of works of short duration, SR may be required.

d) **Works of Long Duration**–

i. Works such as relaying and deep screening of track, bridge construction, diversions which extend over a few days or weeks during which period a continuous restriction of speed is to be in force, are termed as "works of long duration".
ii. Temporary Engineering fixed signals shall be used at specified distances to protect the trains. These works should be carried out to a programme, about which all concerned will be advised in advance.

1107. Works of Short Duration: Before commencing any work of such category the IMSD In-charge/IMSD Sectional or authorised DFC official should issue a notice to the Station Master at each end of the Block section and obtain their acknowledgment on DFIS. Depending as to whether the train is to be passed through the work site after stopping or at a restricted speed, the line should be protected in the following manner–

a) When the train is required to stop at the site of work (in Block section)–

i. Post a flagman with hand signals at a distance of 30 metres in rear of the place of obstruction, to show stop hand signals.
ii. Post a flagman with hand signals and place a banner flag across the track at a distance of 600 metres in rear of the work. The flagman will show stop hand signals.
iii. Post a flagman with hand signals and detonators at a distance of 1200 metres in rear of the work. The flagman shall fix three detonators on the line 10 metres apart and stand at a place not less than 45 metres from the three detonators, from where he can obtain a clear view of the approaching train. He will show

stop hand signals.

iv. The man at the site of obstruction shall give proceed hand signal to indicate to the driver, when he may resume normal speed after the train has been hand signalled past the obstruction (Annexure -11/1).

b) When the train can pass over the work spot at restricted speed in Block section. The following protections should be adopted in the above cases–

i. Post a flagman exhibiting caution hand signals at a distance of 30 metres from the place of obstruction.

ii. Post a flagman exhibiting caution hand signals at a distance of 1200 metres from the place of obstruction.

iii. Post an intermediate flagman with hand signals at a distance of 600 metres from the place of obstruction. He will also place a banner flag across the track. The intermediate banner flag must be kept across the line until the speed of the train has been reduced, after which the banner flag shall be removed, and the train hand signalled forward.

iv. The DFC official at the site of work should give proceed hand signals to indicate to the Driver, that he may resume normal speed after the train has been hand signalled past the site of work- (Annexure – 11/2).

c) The following points should be kept in view, while protecting the track in the cases mentioned in sub-Para (a) and (b) above:

i. On single line, the line must be so protected on both sides of the work.

ii. At places where there are curves or falling gradients and at times of poor visibility the distances laid down in Sub-Para (a) and (b) above may be suitably increased wherever necessary and intermediate flagman posted to relay hand signals.

iii. If in an emergency, it becomes necessary to carry out such works at night, the provisions for protection of line as detailed in Sub-Para (a) and (b) must be complied with except that red light must be exhibited in the direction of approaching trains in place of red hand signalling flags and banner flags.

iv. In an Emergency, when it is necessary on considerations of safety, the IMSD In charge/IMSD Sectional, or authorised DFC official may commence such work after protecting the line as per GR 15.08 and 15.09, before issuing notice to the Station Master. If the work is likely to be prolonged, he should notify the Station Master as soon as possible.

d) Works to be carried out in station limits–

i. No work should be commenced on running line at a station limit without the written/DFIS permission of the Station Master and until the relevant signals have been placed at 'ON'.

ii. Before commencing a work on a line which can be isolated from the other running lines, the IMSD In-charge/IMSD Sectional should ensure that the line has been isolated and retain the keys of locking device in his possession. Where isolation is affected by the setting of points, they must be locked by means of clamps or bolts and cotters.

iii. Before commencing work on a line which cannot be isolated from other running lines as provided for above, the IMSD In-charge/IMSD Sectional should provide the prescribed hand signals, detonators and banner flags as detailed in Para 1107 (a) &(b).

e) Works in Automatic Territory, Chapter VI of General and subsidiary Rules of

DFCCIL–In automatic territory, if the distance from the place of works/obstruction to the automatic signal controlling entry of a train into the signalling section is less than 1200 metres and the automatic signal is secured at 'ON' the banner flag and three detonators may be provided at 90 and 180 metres respectively.

1108. Works of Long Duration:

a) Preliminary arrangements–

i. For doing such works the Engineering Department will arrange with the Operating Department for the issue of the circular/ notice as per extant instructions.

ii. The concerned Dy.CPM will be responsible for obtaining the sanction of MD/ DFCCIL wherever necessary and sending Safety Certificate on completion of such works.

iii. The IMSD in charge should obtain permission to commence of work from IMD In-charge and should arrange to block the line when work is proposed to be done under block with the permission of the Controller/Chief Controller on the day of block and issue a notice to the Station Master on either side.

iv. Caution orders will be issued by the Station Masters concerned as necessary.

v. The necessary temporary Engineering fixed signals as prescribed should be provided.

vi. In an emergency, when it is necessary on considerations of safety, the IMSD In charge/IMSD Sectional or authorised DFC official may commence such work before issuing the notice, under the protection of hand signals and banner flags. As soon as possible, he should issue the notice and replace the hand signals and banner flags by temporary engineering fixed signals.

b) **Protection of line in block section**–In case where stop dead restriction is to be imposed when restriction is to last for more than a day, the following temporary Engineering indicators should be exhibited at the appropriate distance–

i. Caution indicator.

ii. Stop indicator.

iii. Termination indicators.

c) In case where the train is not required to stop (non-stop restriction) and the restriction is likely to last for more than a day, the following temporary Engineering indicators should be exhibited at the appropriate distances–

i. Caution indicator.

ii. Speed indicator.

iii. Termination indicators.

Note–

(i) Annexure – 11/3 and 11/3 A indicate the distances at which these are to be fixed.

(ii) When during the work, on consideration of safety it is not desirable to pass trains over the site of work for the time being, the track should be further protected by hand signals and banner flags, by the authorised DFC official.

d) **Protection of line in station limits:** Protection of the line as prescribed for block section may be dispensed with if the affected line has been isolated by

setting and securing of points or by securing at "ON" the necessary manually controlled signal or signals and approach signal shall not be taken 'OFF' for a train unless the train has been brought to a stop at the first stop signal, except in cases where the loco pilot has been issued with caution order at the station in rear, informing him of the obstruction and the details thereof.

1109. Temporary Engineering Fixed Signals– Location and Details –

a) These consists of:
   i. Caution indicator.
   ii. Speed indicator.
   iii. Stop indicator.
   iv. Termination indicators (T/750Meters and T/1500Meters).

b) Multi Speed Restriction i.e. existence of two or more than two speed restrictions in continuation– When work of deep screening or sleeper renewal is in progress, there is situation of having two or more than two speed restrictions in continuation. In such situation, placement of speed boards for following speed restriction shall be as under:
   i. In case of following speed restriction being more restrictive, a minimum of 200 m track should be under earlier speed restriction zone. If not, then only one SR board should be provided, considering that the previous speed restriction is at par with the following SR, which is more restrictive.
   ii. In case of following speed restriction being less restrictive, corresponding speed indicator board for following speed restriction shall be placed at a distance equal to the length of the longest goods train operating on the section after termination point of previous speed restriction zone.
   iii. The details and position of fixing each indicator are detailed in Annexure – 11/3, 11/3A and 11/4.

c) For intermediate tracks on triple or multiple lines, Engineering indicators should be fixed between tracks to within 300 mm from rail-level, to avoid infringements of standard dimensions.

d) All indicators shou ld be placed on the left-hand side.

e) One termination indicator bearing letters T/1500 Meters should be located at a distance equal to the length of the longest goods trains operating on the section from the place of work. In the case of light-engines or single unit rail cars, the Drivers will resume normal speed after clearing the restricted length.

1110. Procedure for Passing Trains at Stop Dead Restrictions – The flagman at the stop indicators shall present his restriction book to the Driver who should stop in the rear of the stop indicator. The "Restriction Book" should be to the following form:
Engineering indicator at km.....

Date	Train No.	Time	Signature of the Driver

After the flagman has obtained the signature of the Driver at the indicator, he should exhibit proceed with caution signal to the Driver. The Driver will then be authorised to pass the stop indicator and continue at this speed until his train has cleared the restricted length, after which he will resume normal speed.

1111. Procedure for Blocking Line for Engineering Purposes:

a) Arrangements for block–

i. Except in very urgent cases, arrangements for blocking the lines between stations shall be made by the Dy.CPM in consultation with the OCC in-charge.

ii. The OCC in charge will issue instructions to the Station Masters on either side of the section to be blocked and Station Masters of train ordering stations concerned about the last train to pass over the section before the block is imposed, the trains to be cancelled because of the block and any other particulars and will conclude by stating which official of the Engineering Department will impose and remove the block. The instructions will be acknowledged by those to whom issued.

iii. In an emergency, when there is no time to refer to OCC in-charge or where block will not interfere appreciably with the traffic, the Station Master may arrange block directly.

b) Imposition of Engineering Block–

i. The IMSD In-charge/IMSD Sectional or authorised DFC official who wishes to block the line should transmit a message to the nearest Station Master on section to be blocked, copy to the IMD In-charge/Dy.CPM, Controller of controlled sections and OCC, advising them the time from which the block is to be imposed and the kilometrage and asking for acknowledgement from the concerned Station Masters.

ii. The Station Master receiving the message for transmission will sign for it, noting the time of receipt and shall transmit the message to the Station Master on the other side of the block section, which is to be blocked, and to the Controller. The Station Master on the other side will acknowledge receipt by a message addressed to IMSD In-charge/IMSD Sectional or authorised DFC official and the Station Master of the transmitting station.

iii. On receipt of this message the Station Master of the station from which the message was transmitted will block the line in the manner prescribed and hand over a signed copy to the IMSD In-charge/IMSD Sectional.

iv. Field telephone/DFIS should be used for liaison with the Control during the block.

c) Removal of Engineering Block–

i. When DFIS is properly working the block shall be cancelled on DFIS system duly informing the speed restrictions with locations.

ii. When removing a block if DFIS is not working, the IMSD In-charge/IMSD Sectional or authorised DFC official responsible will transmit a message to any one of the Station Master on either side of the block section blocked, copy to the IMD In-charge/Dy.CPM, Controller and OCC in charge, advising them that the block has been removed and asking for acknowledgement from Station Masters. Particular kilometrage, restriction of speed and position of Engineering Indicators should be given in the message.

iii. The Station Master who receives the message for transmission will sign for it, noting the time of receipt and transmit the message to the Station Master of the other station. The message must be acknowledged by the latter, addressed to the IMSD In-charge/IMSD Sectional and Station Master of the transmitting station.

iv. On receipt of this acknowledgement the Station Master who originally imposed the block, will remove it in the manner prescribed. The Control or the OCC in charge will advise the Station Masters on the train ordering stations when a block is finally removed.

1112. Issue of Caution Orders to Drivers– Caution order to Drivers of all trains will be issued by the Station Masters for temporary engineering restrictions. Caution order will indicate the exact kilometrages and speed restrictions. In case of Poor Visibility (in thick foggy or tempestuous weather impairing visibility) no rail shall be displaced and no other work, which is likely to cause obstruction to the passage of trains shall be performed except in case of emergency. When such work must be undertaken the situation should be informed to SM/OCC/Track officials on mobile phone and the site is protected by temporary engineering fixed signals, 2 detonators on the line 10 metres apart should be fixed not less than 270 metres in rear of the caution indicator and a caution hand signal exhibited to approaching trains.

1113. Temporary Signals in Emergency:

a) Whenever in consequence of an obstruction of a line or for any other reason, it is necessary for a DFC official to stop a approaching train.He shall plant a danger signal at the spot and proceed with all haste (during run he will inform OCC/Station Master/Track official by mobile phone or by SOS of GPS tracker) in the direction of an approaching train with a danger signal (red flag by day and red light by night) to a point 600 metres from the obstruction and place one detonator on the line after which he shall proceed further for not less than 1200 metres from the obstruction and place three detonators on the line 10 metres apart. He should then take a stand at a place not less than 45 metres from there, from where he can obtain a good view of an approaching train and continue to exhibit the danger signal, until recalled. If recalled, he shall leave on the line three detonators and on his way back pick up the intermediate detonator continuing to show the danger signal.

b) On single line, the line must be protected on each side of obstruction.

c) Where there are adjacent lines and it is necessary to protect such lines, action should be taken on each such line in a similar manner.

1114. Permanent Speed Restriction Indicators –

a) Permanent speed restrictions boards–

i. Permanent speed restrictions in force are notified in working timetable. The speed indicators are erected to indicate to the Drivers the speed restrictions to be observed e.g., between stations, and at stations due to weaker track/bridges, restrictions on curves, grades and points and crossings etc.

ii. The indicators to be used are like those used for temporary restrictions, namely, caution indicator, speed/stop indicators and termination indicators (T/750 Meters & T/1500 Meters). The details of the indicators and the distance at which they are to be fixed are the same in both the cases (Annexure – 11/3 & 11/4).

b) Board indicating speed over points– Where the speed over the points at a station is less than the speed sanctioned at other stations on the same section, a permanent speed indicator should be fixed on the first approach signal of the station.

c) The posts of permanent speed indicator marker boards should be painted with 300 mm high bands in white and black.

d) Where a permanent speed restriction is in force on any intermediate track on triple or multiple lines, the engineering indicators should be fixed between tracks to within 300 mm from rail-level to avoid infringement of standard dimensions.

1115. Indicators (General):-

a) Whistle indicator–Whistle boards should be provided in rear of all places where the view of the Drivers is obstructed by cuttings or tunnels or curves and where it is necessary to give audible warnings of the approach of a train to those working on the track. The whistle boards are fixed at 600 metres.

b) Shunting limit Boards– They are provided at an adequate distance in advance of the trailing points. This shall consist of 600 mm x 1000 mm rectangular board painted yellow with a black cross on the top and words "shunting limit" written in black below it. Its height should be 2 metres from the rail level to the underside of the portion containing the cross and the post on which it is fixed, painted with 300 mm high bands in white and black. It should be fitted with a light showing white light in both directions.

1116. Detonating Signals– Detonating signals otherwise known as detonators or fog signals are appliances, which are fixed on the rails, and when an Engine (or vehicle) passes over them, they explode with a loud sound to attract the attention of the Driver.

a) Care and Custody–

i. Detonators should be protected against dampness. They should be stored in tin cases with papers wrapped over them, a layer of waste cotton must be kept at bottom and top of the tin cases to avoid contact with the metal.

ii. In one tin case not more than ten detonators should be kept.

iii. The tin cases should be stored in wooden boxes which should be kept in dry places and not left in contact with the brick walls, damp wood, Chloride of lime or other disinfectants; these should not be exposed to steam or other vapours.

iv. Unexploded detonators should not be, as far as possible, sent from place to place by consignment; they should be conveyed personally or by a messenger.

b) Stock with Engineering Official–

i. Each P.Way Engineer shall have a stock of detonators sufficient to recoup the number annually tested and any which may be exploded for works and emergency. The IMSD in-charge shall ensure that all Outsourced/Contractual maintenance teams, Keymen, Patrolmen and Watchmen are equipped with the specified number of detonators.

ii. Every Track official, Outsourced/ contractual maintenance gangmate, Keyman, Patrolman and Watchman, whose duties include protection of track shall carry the specified stock of detonators with him on duty, for use during an emergency.

iii. The month and year of manufacture are shown on the label outside each case and stamped on each detonator. Detonators should be used in the order of the dates stamped on them, the oldest being used first. To facilitate ready withdrawal in this sequence, they should be stored also accordingly.

c) Use of Detonators–

i. The staff in possession of detonators shall not make any improper use of them. All Engineers are responsible to ensure that the staff working under them know

how and when to use detonators. Ex service men of defence sector working as keymen shall have the authority to use detonators after training.

ii. A detonator when required to be used shall be placed on the rail with the label or brand facing upwards and shall be fixed to the rail by bending the clasps around the head of the rail.

d) Testing–

i. Once a year, one detonator shall be taken by the IMSD in-charge from his own stock and from Out sourced/ contractual maintenance team mate, Key man, Patrolman and Watchman for testing, one also from each of the lots in the personal custody of Dy.CPM, IMSD In-charge/IMSD Sectional where the headquarters of these officials falls within the IMSD jurisdiction. The oldest detonators should be selected for the test.

ii. The testing of detonators should be done under an empty 8-wheeled wagon propelled by an engine and moving at walking speed under the direct supervision of the IMSD in-charge, who shall ensure safety range during testing. Results of tests should be entered in a Register.

iii. The IMSD In-charge shall submit by the end of the year (31st December) a certificate in duplicate to the IMD In-charge/Dy.CPM to the effect. "I certify that I have tested the detonators from stocks mentioned below in accordance with standing orders for the year ending and append a list of those that failed to explode." The IMD In-charge/Dy.CPM shall countersign and forward one copy of the certificate to the RMU In-charge. Orders regarding the return or destruction of those lots, the samples from which failed to explode, shall be issued by the Dy.CPM.

e) **Life of Detonators** – The normal life of detonators is five years. The life of the detonators can be extended to eight years on a yearly basis subject to the condition that two detonators from each lot of over 5-year-old ones are tested for their effectiveness as discussed above and the results being found satisfactory. Such time extended detonators can be used on all sections after satisfactory testing. In case the results are not satisfactory, they should be destroyed as envisaged in Sub-Para (f) below. In any case, no detonator should be kept in use after 8 years.

f) **Disposal of Time-barred Detonators**– No detonator that bears any sign of rust and is time- barred shall be held in stock. Such detonators shall be destroyed by one of the following methods: -

i. By soaking them in light mineral oil for 48 hours and then throwing them one by one into fire with due precautions.

ii. By burning them in incinerator.

iii. By detonating them under wagon during shunting operations.

iv. By throwing them in deep sea.

v. The destruction of time-barred detonators should be done in the presence of a IMSD In-charge/IMSD Sectional who should ensure that every care is taken to see that splinters of detonators do not cause any injury to life and property. They should not be buried or thrown in places from where they could be recovered.

g) **Safety Range**– When detonators are being tested, no person should be allowed within a radius of 45 metres from the detonators to be exploded; the engine crew shall remain well within the cab. In practice, splinters from detonators when exploded seldom fly in a direction to the rear of the wheel, which det-

onates them. Staff should therefore, when observing the safety radius, place themselves, as far as possible on the rear side.

1117. Warning Signal-Descriptions– The signals to be used to warn the incoming train of an obstruction or danger ahead shall be a red flashing hand signal lamp during night/ weather impairing visibility or a red flag during day.

1118. Use of Warning Signals– When it becomes necessary to protect an obstruction in a Block section, a warning signal may be used, as prescribed under Para 1117 while the DFC official proceeds to place detonators. A warning signal is to be shown to give timely warning to a driver of approaching train of any obstruction such as derailed train obstructing adjacent lines, breaches, wash away, floods, landslides etc., when the DFC official does not have adequate time to do the protection in the normal manner with the detonators as envisaged under rules. The knowledge and possession of warning signals shall be ensured by every DFC official concerned with the use of warning signals as stipulated in Para 3.67 of INDIAN RAILWAYS GENERAL & SUBSIDIARY RULES.

1119. Safe Working of Contractors– A large number of men and machinery are deployed by the contractors for track renewals, bridge rebuilding etc. It is therefore essential that adequate safety measures are taken for safety of the trains as well as the work force. The following measures should invariably be adopted:

a) The contractor shall not start any work or obstruct the track without the presence of DFC supervisor or his representative and contractor's supervisor at site.

b) Wherever the road vehicles and/or machinery are required to work in the close vicinity of DFC line, the work shall be so carried out that there is no infringement to the DFCCIL's Standard Schedule of Dimensions. For this purpose, the area where road vehicles and/or machinery are required to ply, shall be demarcated and acknowledged by the contractor. Special care shall be taken for turning/reversal of road vehicles/machinery without infringing the running track. Barricading shall be provided wherever justified and feasible as per site conditions.

c) The look out and whistle caution orders shall be issued to the trains and speed restrictions imposed where considered necessary. Suitable flagmen/detonators shall be provided where necessary for protection of trains.

d) The supervisor/workmen should be counselled about safety measures. A competency certificate to the contractor's supervisor as per proforma annexed shall be issued by IMD IN-CHARGE which will be valid only for 6 months or the validity of contract whichever is earlier. (Annexure – 11/5).

e) The ballast/rails/sleepers/other P. Way materials after unloading along track should be kept clear off moving dimensions and stacked as per the specified heights and distance from the running track.

f) Supplementary site-specific instructions, wherever considered necessary, shall be issued by the Engineer in-charge.

g) The Engineer in-charge shall approve the methodology proposed to be adopted by the contractor, with a view to ensure safety of trains, passengers and workers and he shall also ensure that the methods and arrangements are actually available at site before start of the work and the contractor's supervisors and the workers have clearly understood the safety aspects and requirements to be adopted/ followed while executing the work.

h) There shall be an Assurance register kept at each site, which will have to be

signed by both, i.e. DFC Supervisor or his representative as well as the contractor's supervisor as a token of their having understood the safety precautions to be observed at site.

i) All the road vehicle drivers, tractor drivers, truck drivers who are working with maintenance team should have valid certificate to observe precautions in the vicinity of track.

Annexure – 11/1

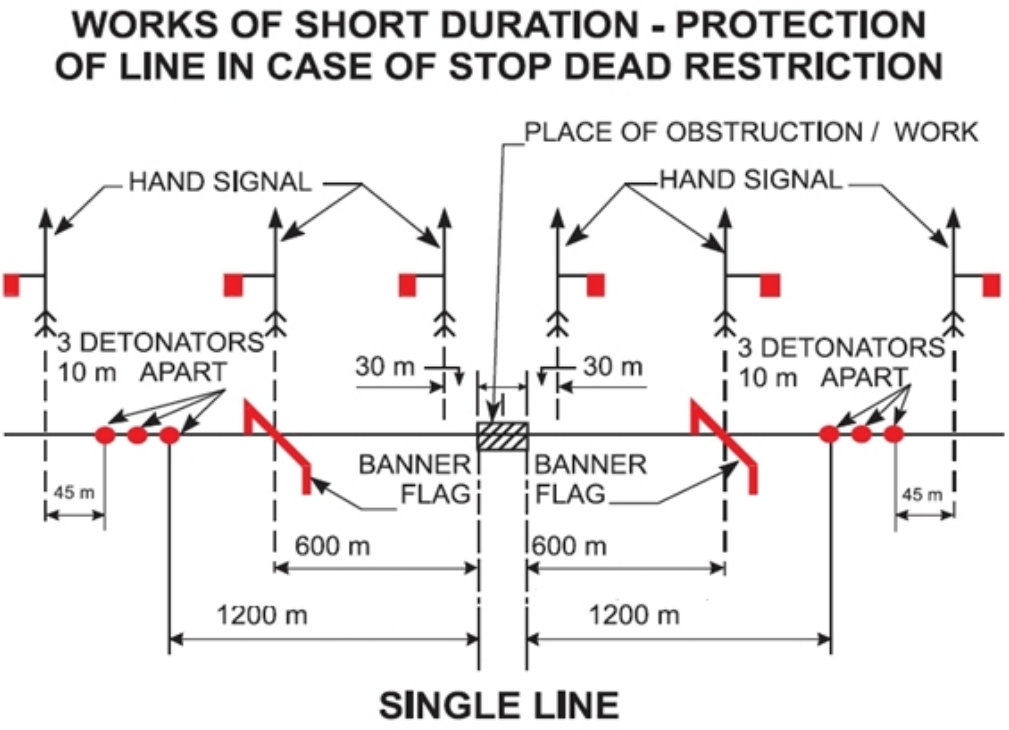


Fig. 11.1

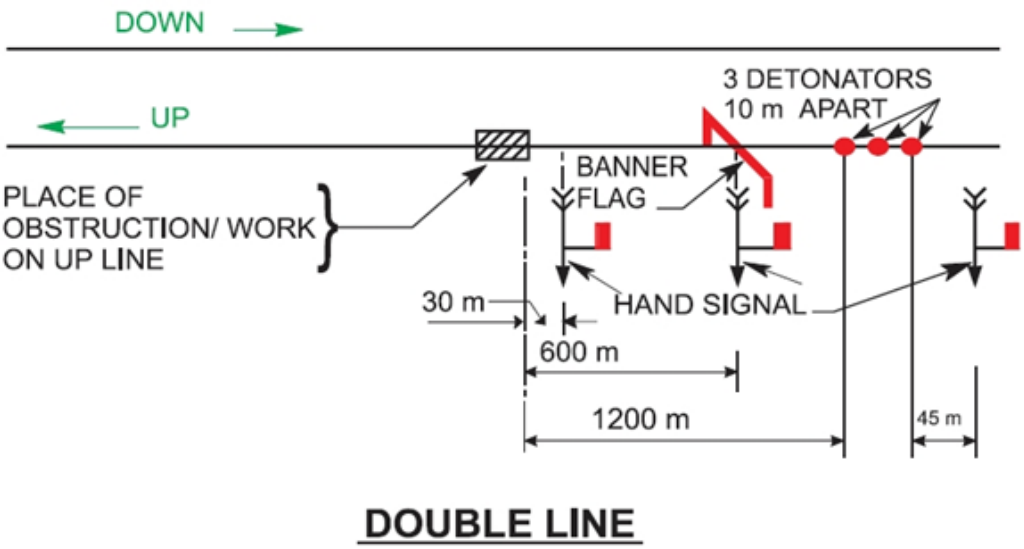
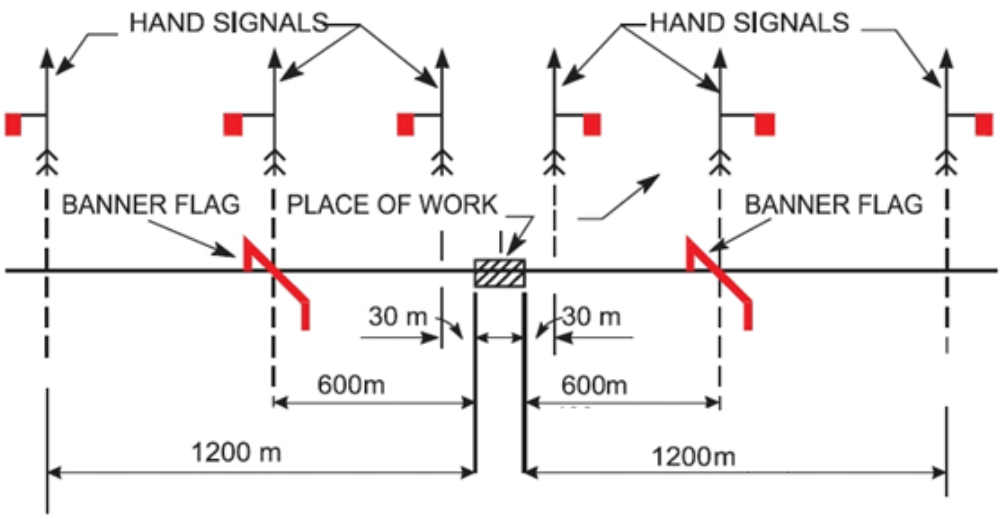


Fig. 11.2

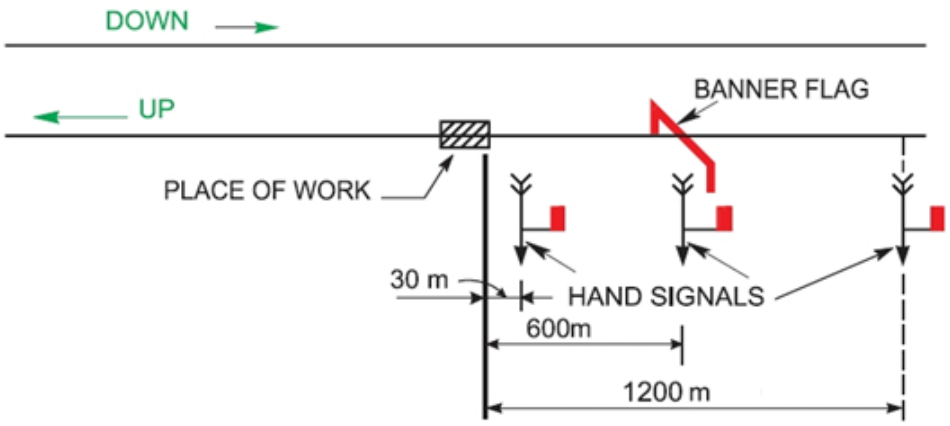
Annexure – 11/2

WORKS OF SHORT DURATION - PROTECTION OF LINE IN CASE OF REDUCED SPEED



SINGLE LINE

Fig. 11.3



DOUBLE LINE

Note-

INTERMEDIATE FLAGMAN WILL KEEP BANNER FLAG UNTIL THE SPEED OF THE TRAIN HAS BEEN REDUCED, AFTER WHICH THE BANNER FLAG WILL BE REMOVED AND TRAIN HAND - SIGNALLED FORWARD.

Fig. 11.4

Annexure – 11/3

RETRO REFLECTIVE TYPE BOARDS – TO BE PROVIDED IN NEW CONSTRUCTION AND DURING REPLACEMENT OF EXISTING BOARDS

FOR STOP - DEAD RESTRICTIONS

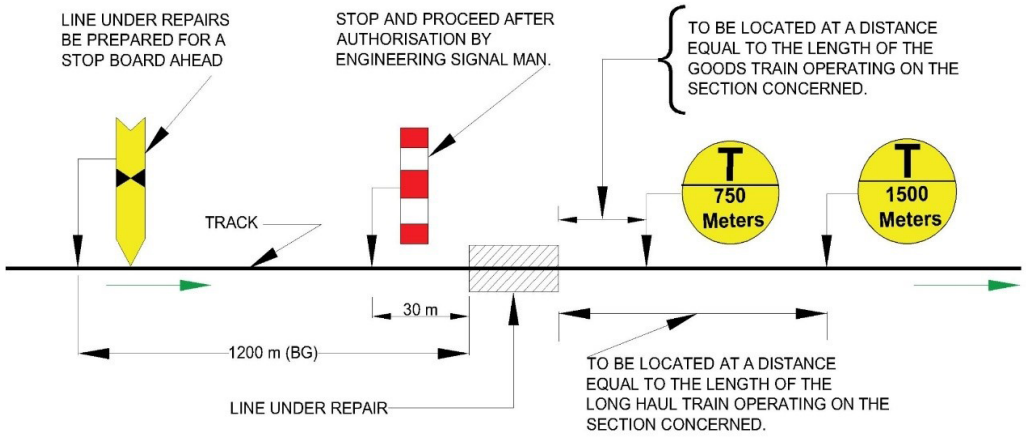


Fig. 11.5

FOR REDUCED SPEED

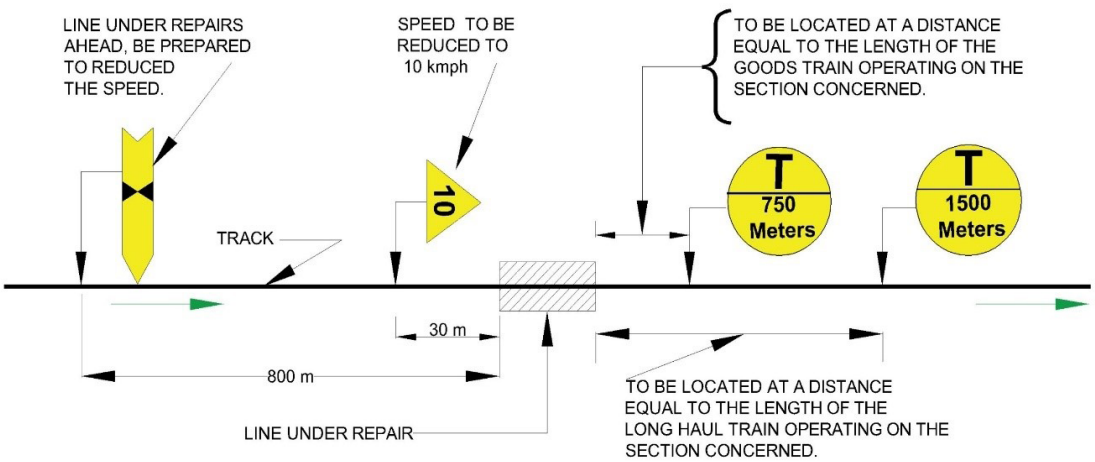


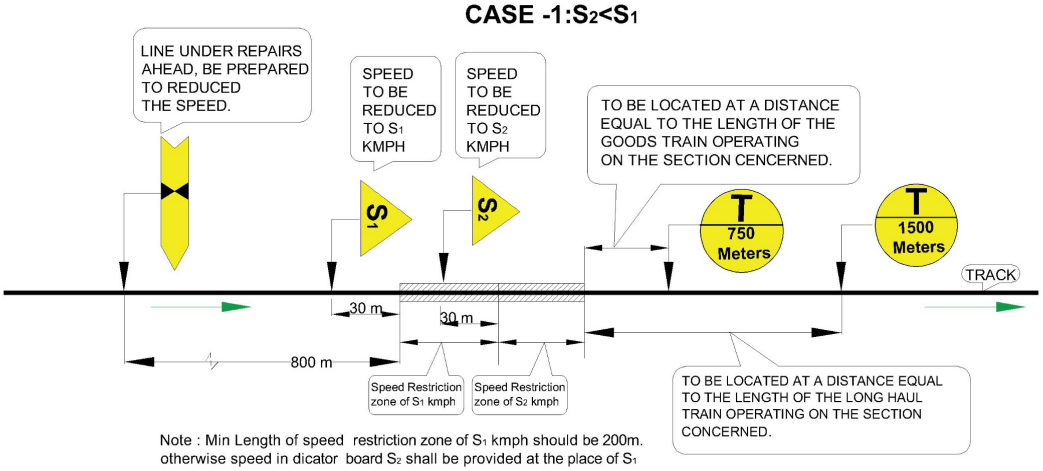
Fig. 11.6

Annexure - 11/3A

RETRO REFLECTIVE TYPE BOARDS - TO BE PROVIDED IN NEW CONSTRUCTION AND DURING REPLACEMENT OF EXISTING BOARDS

POSITION OF ENGINEERING INDICATORS IN CASE OF MULTI SPEED RESTRICTIONS

CASE -1: $S_2 < S_1$



Note : Min Length of speed restriction zone of S_1 kmph should be 200m. otherwise speed in dicator board S_2 shall be provided at the place of S_1

CASE -2: $S_2 > S_1$

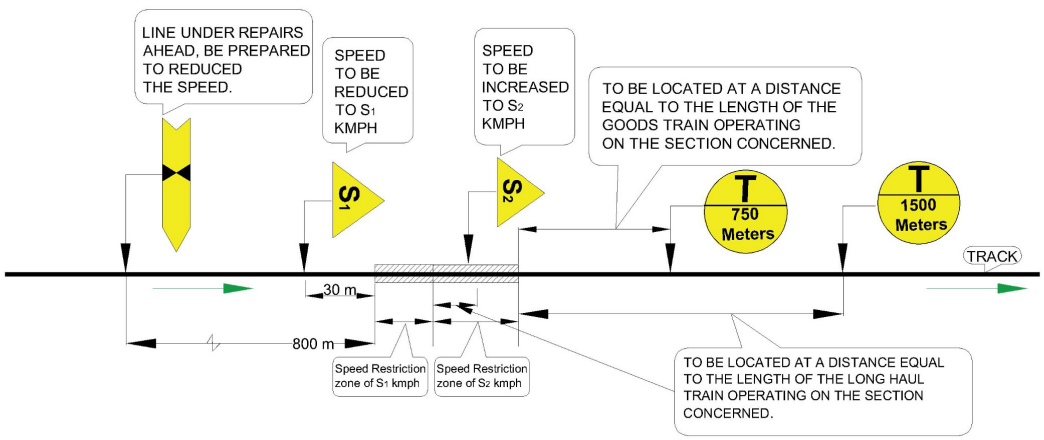
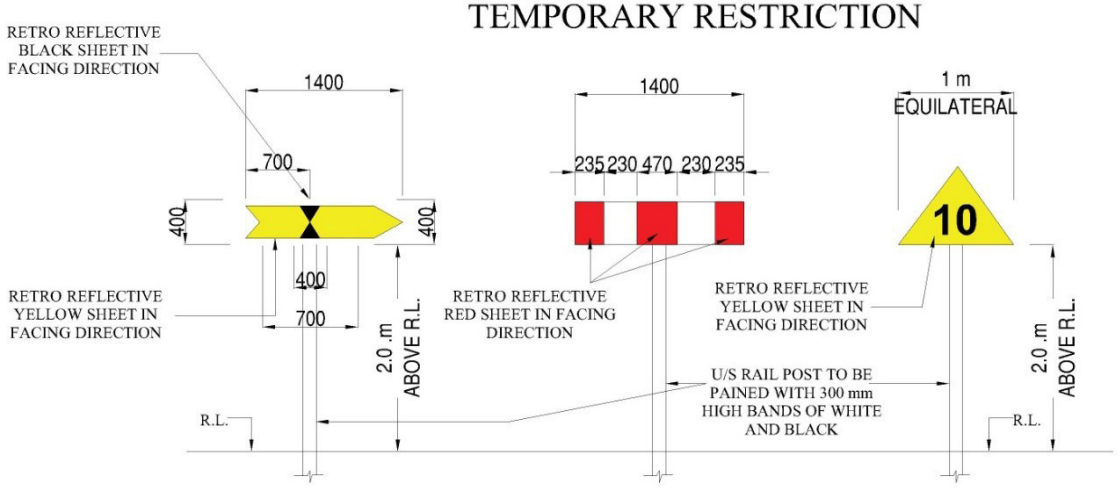


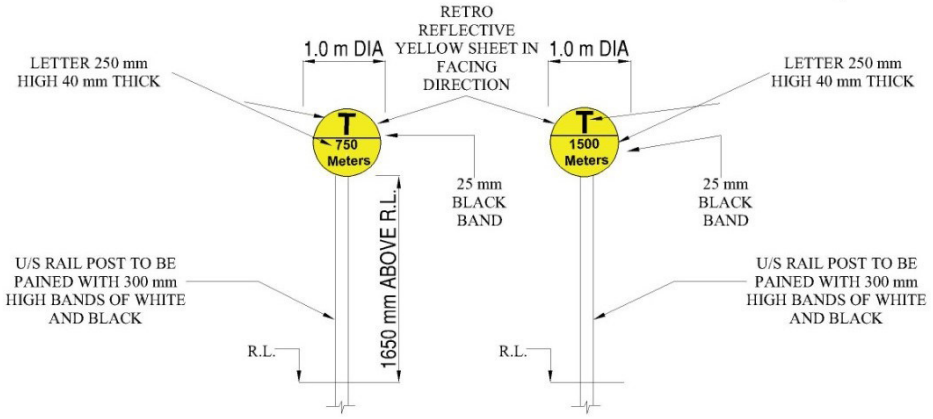
Fig. 11.7

Annexure - 11/4

ENGINEERING INDICATORS FOR TEMPORARY RESTRICTION



CAUTION INDICATOR | **STOP INDICATOR** | **SPEED INDICATOR**



TERMITATION INDICATOR FOR GOODS TRAINS | **TERMITATION INDICATOR FOR LONG HAUL TRAINS**

Fig. 11.8

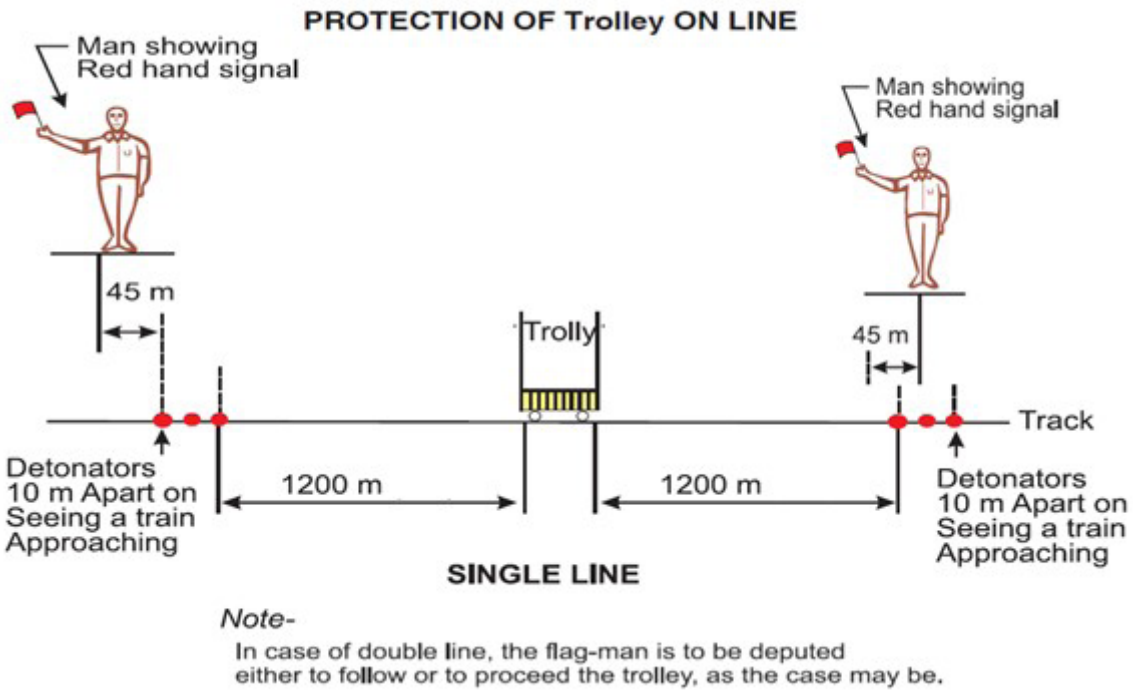
Annexure - 11/5

COMPETENCY CERTIFICATE

Certified that shri..... P.Way supervisor of M/s .... has been examined regarding P-Way working on ..... work. His knowledge has been found satisfactory and he is capable of supervising the work safely.

IMD In-charge

Annexure – 11/6



Note-

In case of double line, the flag-man is to be deputed either to follow or to proceed the trolley, as the case may be.

Fig. 11.9

CHAPTER – 12

PLANNED RENEWAL OF TRACK ASSETS

RAIL RENEWALS

1201. Factors Governing Rail Renewal– In DFC condition-based renewal shall be adopted. There are incidence of rail fractures/failures/large USFD defect generation or Wear on rails.

1202. Incidence of Rail Fractures/Failures– A spate of rail fractures on a particular section having 10 withdrawals of rails per 10 km in a year due to fracture and/ or rail flaws detected ultrasonically falling in the category of IMR will have priority while deciding rail renewals. Through Rail renewal is allowed in location of track where more than 20 defective welds per km are existing. Rail renewals in main line and loop line shall be done by new rails.

1203. Wear on Rails

a) The limiting loss in rail section, as a criterion for recommending rail renewals shall be as given below-

Rail Section	Loss in section in percentage
60 Kg/m	7

b) Wear due to corrosion– Corrosion beyond 3 mm in the web or foot may be taken as the criterion for wear due to corrosion. Existence of the localized corrosion such as corrosion pits, especially on the underside of the foot and liner biting etc. on rail foot, act as stress raisers for the origin of fatigue cracks and may necessitate renewals.

c) Vertical wear is to be measured at the centre of the rail either by measuring the height of the worn-out rail by callipers or by plotting the profile. In the first case, the wear is the difference between the height of the new rail and the height of the worn-out rails. Modern scanners can also be used for wear and profile measurements. A typical profile showing the measure of vertical wear of the rail is given below–

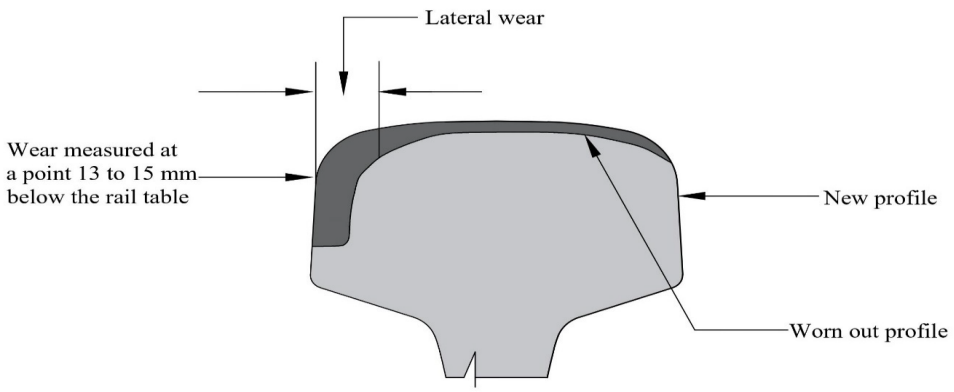


Fig. 12.1

Limits of Vertical wear

Rail Section	Vertical Wear
60 kg/m	13.00mm
60 kg/m HT	13.00 mm

d) Lateral Wear– Lateral wear is to be measured at 13 to 15 mm below the rail top table. Worn rail profile should be recorded and superimposed over new rail profile to find out the lateral wear. Limits of lateral wear and a typical profile of the worn rail showing the measurement of lateral wear is shown below–

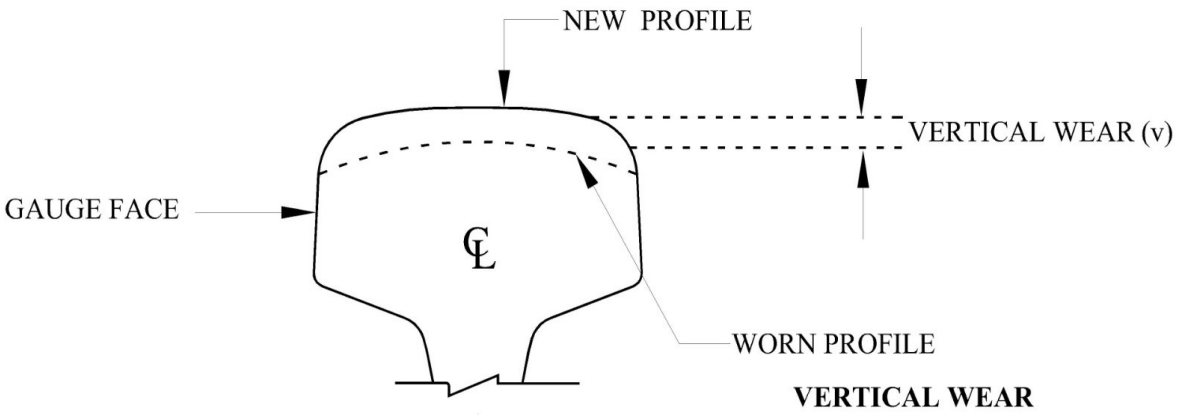


Fig. 12.2
Limits of Lateral wear

Section	Lateral wear
Curves	10 mm
Straight	8 mm

RENEWAL OF SLEEPERS

1204. Renewal of such special track components to be planned after they have degenerated to a level where they are not able to serve their desired purpose.

1205. Criteria for Renewal of Sleepers–Generally a sleeper is serviceable if it can hold gauge, provide satisfactory rail seat and permitted rail fastenings being maintained in tight condition, and retain the packing underneath the sleepers. Concrete sleepers will be considered for replacement/renewal if they have developed notches more than 3 mm at rail seat locations, their inserts are broken or elongated, or they are not able to provide required toe load, sleeper themselves are broken or any other reason for which they are not able to hold gauge and level. Where only sleeper renewal is justified, this should be carried out in continuous stretches, through sleeper renewal should be considered if the percentage of such sleepers exceeds 20% in a patch. On girder bridges when several sleepers are defective, renewals should be carried out for the full span.

1206. Planning of Renewals– Renewals may be planned in as long and continuous lengths as practicable, within the available resources with priorities to meet the projected traffic. Short, isolated stretches of 10 km and less, not due for renewal on condition basis may be programmed along with the adjoining lengths, if these stretches do not confirm to the required standards. Renewal of loop lines and laying of new loop lines is to be done with new 60 kg rails with sleeper density of 1660 no's per KM.

1207. Planning of Traffic Facilities for Renewals–

a) In the case of relaying works in busy sections additional sidings as necessary should be provided at the depots for receipt and dispatch of materials as well as for working of track relaying machines.

b) Arrangements for special rakes for movement of rails and sleepers should be made by the Dy.CPM of RMU in consultation with the Operating Department. Where necessary, separate power and crew should be arranged. Provision of Engineering Time Allowance should be arranged with the Traffic Department.

c) Traffic block will invariably be required for operation of track relaying trains In such cases, the IMD incharge should give adequate notice to the Operating Department well in advance for the period during which the track renewal work will be carried out. Such information is useful to the Operating Department in regulating the traffic flow. In case of any difficulty, the IMD In-charge should refer the matter to the CGM/RMU, who will arrange for the required blocks in consultation with the GM/GGM/OPBD. A minimum block of 4 to 6 hours duration is necessary where renewal works are carried out by machines.

d) The IMD In-charge, in consultation with the Operating Department Officers, should manage to carry out permanent way renewals with the minimum obstruction and detention to traffic.

e) Arrangements should be made for notification by the Operating Department to all concerned regarding work to be executed by Engineering Department and imposition of blocks and protection by temporary Engineering fixed signals. Issuance of caution orders to Drivers by Station Masters on daily advice of actual kilometerage received from the Exe/Sr. Exe/JPM of the work.

1208. Speed Restrictions–The speed restrictions to be imposed during various sequences of work are given in Table I and II which are as shown below:

Table I
Machine Packing followed by stabilisation using DTS
(Mechanised laying of Track by TLE Single rail panels)

Day	Sequence of Events	Speed in Kmph
1st	Opening, Relaying and equalisation of ballast	20
2nd & 3rd	Rail renewal and welding & attention to track as required	20
4th	1st tamping in smoothening mode and 1st stabilisation in maximum settlement mode.	40 (after tamping and stabilisation)
5th	Ballasting	40

6th	2nd tamping in smoothening mode and 2nd stabilisation in maximum settlement mode.	75 (after tamping and stabilisation)
7th	3rd tamping in design mode and 3rd stabilisation in controlled settlement mode.	Speed up to 100 (After tamping and stabilisation

Table-II
Machine Packing followed by stabilisation using DTS
(Mechanised laying of Track by TRT)

Day	Sequence of Events	Speed in Kmph
1st	Opening, Relaying and equalisation of ballast	30
2nd	Welding and Manual attention to track as required	30
3rd	1st tamping in smoothening mode and 1st stabilisation in maximum settlement mode.	40 (after tamping and stabilisation)
4th	Ballasting	40
5th	2nd tamping in smoothening mode and 2nd stabilisation in maximum settlement mode.	75 (after tamping and stabilisation)
6th	3rd tamping in design mode and 3rd stabilisation in controlled settlement mode.	Speed up to 100 (after tamping and stabilisation)

1209. Project Report for Track Renewal Works– Systematic and meticulous planning for various items of execution of track works is essential for achieving quality, economy and timely completion of works. For every sanctioned track work e.g. CTR, TSR, TRR, deep screening, bridge sleeper renewal, etc.

a) A detailed project report should be prepared. The report should, inter alia, cover the inventory of existing track structure including the rails, sleepers, fittings, turnouts, SEJs, Glued Joints, ballast quantity/deficiency in track, width of formation, bridges, electrical fittings, curves, height of bank/ cuttings, yards, sidings, etc. and other details should be taken as prescribed in P.Way diagram.

b) Classification of existing track materials– During inventory of the existing track structure by foot-by-foot survey, identification, classification and colour marking of existing track materials as second hand and scrap would be done as provided in Para 1218 & 1219. The classification should be approved by the competent authority. Action plan for stacking/ storage and disposal of the released materials should be clearly indicated. Inventory of existing track materials would normally be prepared jointly by the IMSD sectional (P.Way) of the section and the IMSD In-charge/Exe./Sr.Exe (Spl).

c) Proposed track structure– The proposed P.Way diagram of the affected length should be prepared in the same format as done for the existing track structure and incorporated in the project report.

d) Method of execution– The work should be executed “bottom upwards” i.e. sequence of execution of works will be in the following order–

Formation → Ballast → Sleepers → Rails

e) Repair and widening of cess– The project report should indicate the requirement of and plan for widening of formation in both banks and cuttings wherever

necessary. Provision of proper drains in cuttings should also be planned.

f) Formation treatment– Areas needing formation rehabilitation should be identified and a study for possible solutions and method of execution of the rehabilitation scheme should form part of the project report.

g) Ballast– The requirement of depot supply and the source and means of each should be spelt out clearly (mode of providing ballast cushion i.e. deep screening or raising should be identified along with sketches of cross sections present and proposed). Sleeper renewal would normally not be started unless adequate arrangements for supply of ballast have been made.

h) Transportation of P. Way materials– The mode of transportation for various track components and unloading of rails and sleepers, at the work sites should be indicated in the project report.

i) Welding– The complete details of welding requirements, the arrangements need to be made for its execution whether departmentally or through contract should be clearly indicated in the report.

j) Renewal of turnouts, bridge sleeper, etc.– The project report should cover the complete details of turnouts, bridge sleepers, level crossings, etc. where renewal is to be carried out. Whether turnouts are to be laid manually or by mechanized means, should be clearly brought out indicating the arrangements made (the report should also include the mode and agency for overhauling, track laying and making up of road surface at the level crossings).

k) Use of machines– The requirement of machines for renewal, (if mechanized renewal is planned) deep screening (if mechanized deep screening is planned) and tamping/ stabilizing and the duration for which the machines are required should be indicated. The machines that would be deployed should be identified and staff nominated. The planning for repair of machines at the works site, supply of fuel and other consumables should be planned. The requirement of additional lines in the existing yards for making base depot and arrangements made for the same should be indicated.

l) Contracts–The contracts that are required to be entered into for various activities of works.The planning for deployment of staff/supervisors for execution at various activities should be indicated.

m) Material Planning– The material requirement should be arranged by the RMU against each material, the proper nomenclature and drawing number should be indicated. Rails nos. and sizes (including lead rails, checkrails etc.), sleepers (including specials), rails and sleeper fastenings, switches and crossings, and bridge sleepers and fittings, etc. should be fully covered. The consignee particulars and the destination, the mode of transport should also be indicated.

n) Manpower Planning– The requirement of manpower including the officers, supervisors, artisan and other staff should be worked out with minute details. The arrangements made for camping of these officials and mobilization should be reflected.

o) Requirement of speed restrictions, traffic blocks and other material train– Planning for execution of track renewal works should be such that the time loss on account of speed restriction is minimal. The report should indicate requirement of speed restrictions and traffic blocks together with duration. The corridor blocks is required to be planned in consultation with the Operating Department and accordingly reflected in the report after obtaining the approval of concerned ED of Corridor. Arrangements made for various types of

wagons for transportation of ballast, sleepers, etc. together with requirement of locomotives should be indicated in the report in consultation with GM/GGM/ OPBD and with the approval of ED.

p) Monitoring mechanism– The list of all activities involved and the time estimation for each activity should be worked out. These activities should be sequenced and co-related in logical manner and network diagram prepared duly identifying the critical activities. These should form part of the project report.

1210. Where complete track renewal or through sleeper renewal is planned, deep screening of ballast should also be planned and executed. The progress of deep screening should match with the progress of renewals and should precede complete track renewal or through sleeper renewal by a couple of days.

a) Treatment of bad formation should be carried out in advance of the relaying.

b) Reference for Centre line and level for realignment of curves and straight should be fixed beforehand. Where necessary, curves should be realigned and transitioned. Longer transitions should be provided to cater for future increase in speed wherever possible. In case heavy slewing is necessary for providing longer transitions, centre line indicating revised alignments should be fixed and new track laid accordingly. The formation should be suitably widened.

c) On sections where creep is noticeable, joints should be squared and gaps rectified for short length at the point of commencement.

d) On section with single rail and 3 rail panel, as a preliminary measure, the IMSD /Sectional should actually mark out the position of the new rail joints with a tape. The lengths marked out should be the length of the new rail together with one expansion space. On a curve, the rail lengths should be set out along each rail, starting from a point on the straight where the sites of the two joints have been set out opposite one another by means of square. The square should be used at each joint on the curve to determine the amount by which the inner rails gaining over the outer rail. As soon as the lead of the inner rail is equal to half the distance between fish bolt holes, a length shall be sawn off the end of the rail equal to the full distance and a new fish bolt hole drilled. The length of cut rails varies according to the degree of each curve, and should be determined beforehand; a cut rail will be required after every two or three full length rails depending on the curvature.

e) Sufficient track gauges, gauge-cum-levels, spanners, keyman hammers, insert cleaning brush, wire basket, crow bars, tommy bars, claw bars, beaters, ballast rakes, wire claws, forks, wire brushes, ballast screens, rail thermometers, expansion liners, slotted fish-plates, rail closures, combination fish-plates, and all tools and equipment necessary for efficient execution of work including that for rail cutting, rail drilling and mechanical tampers where used, should be arranged by the IMSD (Sectional) in advance. Before starting and during work, the track gauges and the gauge-cum-levels should be checked periodically for their accuracy.

f) Labour should be properly organized and suitably distributed to ensure maximum efficiency.

g) Before carrying out track renewal work in electrified areas sufficient notice should be given to the Electrical Traction Distribution Department so that they can arrange for adjustment of overhead wires to conform to the new alignment and level. They will also arrange for bonding the new track. In track circuited sections and in yards where change in yard layout is contemplated notice

should be given to the Signalling Department for getting assistance in executing joint works. Advance Notice should be given to the Operating Department of the actual commencement of work by the IMSD Sectional, for sending advice to all concerned. The safety of traffic is of Paramount

1211. Unloading of Rails, Sleepers and Fastenings–

a) It should be ensured that materials are unloaded opposite to the position where they are to be laid. Care should be taken to avoid unloading of materials more than the actual requirement, to avoid double handling.

b) Utmost care should be exercised in unloading rails. Ramps made of unserviceable rails should be used for unloading. Short, welded panels as well as rail panels for laying welded rails may be unloaded by "end-off-loading" method, wherever possible.

c) The unloaded panels should be carefully stacked on a level base; care being taken to prevent formation of kinks. Flat footed rails, as a rule should rest on the foot. Any carelessness in unloading and stacking is liable to cause irreparable damage, resulting in bad running. While carrying rails they should be supported at several places by rail tongs or rail slings. Carrying of rails and heavy articles on the head or shoulder should be avoided. Kinked rails must be jim-crowed and straightened. Punch marks on rails or marking by chisel is prohibited as these cause incipient failures.

d) New rails and sleepers for the next day's work should be hauled from the place of unloading to opposite to the place, where they are to be laid.

e) Material new or old, lying alongside the track is always a potential source of danger and efforts should be made to remove the same as soon as possible.

f) Detailed guidelines on unloading of rails and related to operation of End Unloading Roller Rakes as contained in RDSO's Guidelines for Handling and Stacking of Rails October 2014 (CT-35) shall be followed.

1212. Only 260m long panels are to be used in laying during renewal. These should be unloaded along the track. After linking these should be made LWR by Flash-Butt Welding.

1213. Track Laying standards–The laying standards of track geometry during primary renewals should be achieved as per original geo coordinates(Track to be laid with new materials). The track geometry will be recorded three months after the speed is raised to normal. Track parameters to be measured in floating condition (Refer Para 618). Standard Deviation and Peak based limits for unevenness and alignment as measured by TRC, shall be as per Para 615.

1214. Renewal of Points and Crossing–Life of TWS is 800 GMT and Life of WCMS crossing after 3 round of in situ reconditioning using robotic welding machine is 350 GMT .Renewal of Points and Crossing shall be planned when life of TWS and WCMS crossing reaches the above value or when wear of switches and crossing reaches as per Para 835(j) whichever is earlier.

1215. Housing of Switches– Before stretcher bars (if provided) are connected, each tongue rail should be examined to see that it lies properly housed against the stock rail up to JOH, without any pressure being applied to keep it in position. Close co-ordination should be maintained by the Executive (P. Way) with the Executive (Signal) and Executive (Elect) and work should be carried out jointly. Actual procedure of carrying

out renewals–

a) Before renewing points and crossings, the ballast in the layout should be deep screened. After deep screening, the ballast should be laid only up to the bottom of the sleepers and extra quantity of ballast kept ready by the side of the layout for fully ballasting the layout, after renewal. Equipment for rail cutting and rail drilling should be kept ready at site.

b) Renewals can be carried out by any of the following methods–

i. Slewing of pre-assembled turnout at site (Manual) – The turnout is assembled by the side of the existing layout. The ground on which the turnout is to be assembled is levelled first. If necessary, room is not available, additional space is created by doing extra earthwork or by constructing a working platform with the old rails and sleepers. The assembly is usually built on a rail grid, the top surface of which is greased beforehand to facilitate easy slewing. During the block period, the existing layout is dismantled and removed, and the pre-assembled layout is slewed in its correct position, aligned and packed.

ii. Preassembling & laying with mechanical (Machines) –IRTMM may be referred for mechanized laying of turn out.

1216. Renewal of Track Fittings and other track components- Renewal of track fittings to be planned after they have degenerated to a level where they are not able to serve their desired purpose. Service Life of different fittings are as under:

SN	Item	Location	Criteria for Renewal
a	GFN-66 Liners	Plain Track	6 years or on condition basis
d	Metal Liner	Plain Track	8 years or on condition basis
c	ERC	Plain Track	8 years or on condition basis*
d	GRSP	Plain Track	4 years or on condition basis
e	CGRSP	Plain Track	8 years or on condition basis
f	PSC Sleepers	Plain Track	Conditional based renewal

*** Note: -For load testing and renewal of ERC, the provision of IRPWM shall be followed.**

1217. Rails in Station Yards– While carrying out through rail renewals or complete track renewals in yards, 260 m long panels may be used initially and subsequently welded to form LWR/CWR.

1218. Classification and Use of Released Material:

a) After a section of track has been renewed, the released material shall be carefully sorted out so that greatest possible reuse may be done. They should then be classified by the IMSD In-charge. Tools and plant left over should also be classified and action taken for their disposal.

b) The rails should be graded according to their weight and condition into groups suitable for re-use in running lines, non-running lines and for conversion into posts or structural members for various purposes or for sale as scrap. Where rail-ends are worn or hogged, the feasibility of “Cropping” the ends should be considered if the condition of the rail is otherwise satisfactory.

c) The sleepers should be sorted into various grades suitable for re-use in the track or as unserviceable material not fit for use in track works.

d) Fish-plates, fish-bolts, ERCs & Liners should be sorted into those suitable for re-use and the rest as scrap.

e) If the switches and crossings themselves are badly worn to be re-used, the small fittings such as stretcher bars, switch anchors, stud-bolts and blocks can generally be used. Crossings should be reconditioned by welding, if the wear is not excessive.

1219. Basis for Classification of released Materials – For the purpose of classification, Permanent Way materials should be divided into three classes depending upon the section and condition as detailed below–

a) Class I material is that which is new and of standard section. New items of obsolescent sections, which are interchangeable with standard materials and are purchased from time to time to prevent wastage of other serviceable material, should be brought on to the stock account as Class I material. These items should be included in the price lists for the miscellaneous and common items. No other material of an obsolescent section is to be treated as Class I, even though it may never have been put in the track.

b) Class II (a) material includes all new material of obsolescent sections other than those included under Class I and all standard and obsolete material released from the track and fit for further use on track. Only Switches and X-ings will be classified as class II (a). Small quantity of rails may be classified as class II (a) after arising out of the requirement in DFC. Class II(b) material is to be scraped.

c) Class III materials shall include all materials that has become unserviceable. This is either metal scrap or unserviceable sleepers. This class will include all rails which are neither Class I nor Class II (a).

1220. Accountal of released P-Way materials:

a) The quantity of released materials from every work included for track renewal will be based on yardsticks for loss of weight to be fixed on the basis of data collected during foot by foot survey. If there is more than one work on the same route, near to each other and under similar ground conditions, only one set of yardsticks would suffice.

b) List of materials likely to be released will be prepared indicating the quantum of such materials separately as second hand (SH) and scrap.

c) While second hand materials will be indicated only in length/nos. in case of scrap materials, the accountal will be following:

i. Rails– in length, then converted to weight.
ii. Sleepers– nos. as whole.
iii. Fittings & fastenings– by weight.

d) The accountal of the actual weight loss after release will be done based on the actual measurement.

e) The periodical returns for track renewals are to be submitted at the laid down periodicity as per rules and the existing procedure for checking should be streamlined to ensure that the returns are investigated in detail in the IMD office in nos.

f) In cases where the track work is to be done by contractor, the list of released materials shall be jointly prepared on the basis of a field survey to be conducted by the IMSD Sectional and contractor's representative after the work has been awarded but before the dismantling work is allowed to commence. The contractor shall be bound to hand over the materials according to the said agreed list

and should be responsible for any shortages.

1221. Marking of Permanent Way Material – All Permanent Way material should be distinguished as followed: -

a) Class I– No marks.

b) Class II (a) Second handrail fit to be re-laid in non-running lines– Ends to be painted with a daub of white.

c) Unserviceable material Class III & Class II (b) - not fit for use– Ends to be painted with a daub of red.

1222. Works to be attended after completion of relaying–

a) Classification and loading of released materials– Materials as and when removed during the progress of relaying should be collected, classified, accounted and despatched to the destination.

b) Revision of Permanent Way Diagrams– As soon as the rail or the sleeper replacement work is completed, the Permanent Way diagrams, the station yard diagrams and the index section that embody the detailed particulars of the track in regard to the year of laying, section of rail, type of sleepers, fishplates & fittings should be amended up-to-date by respective RMU. The daily progress details will also be updated in TMS. Copies of amended diagrams should be issued by the Dy. CPM to the IMD In-charge concerned for record in their offices.

1223. Second hand material will not be used in normal course but one set each of all types of Switches and X-ings shall be kept at station as Second hand released material for emergency use with caution, if required.

CHAPTER – 13

TRAINING & COMPETENCY

1301. Types of Training Courses – Permanent Way staff need to be trained for their job both through classroom training and practical work on site using the tools and equipment of the particular trade. The use of audio video aides is desirable for better understanding of the subject. Training is a continuous process right from the time of recruitment. Following four types of training courses should be organized in the Training Institutes run by Dedicated Freight Corridor Corporation of India Limited (DFCCIL)/RDSO/IRICEN or any other institute specified by DFCCIL administration. The Induction and Refresher training to JPM, Executive and Jr. Executive should be as per Training module issued by DFC vide Letter No. HQ/HR/TRG/RIT/05/2021 dated 12.10.2023 and for MTS as per Training module issued by DFC vide Letter No. HQ-ENWC0GENL(HR)/1/2021 dated 28.04.2023. The following training are to be imparted to DFCCIL staff who are involved in P-way activities:

a) Initial/Induction/Basic Courses.
b) Promotional Courses.
c) Refresher Courses.
d) Special Courses.

1302. Induction Training – Initial and induction Courses are for new entrants. It is meant for directly recruited categories such as MTS, Technicians (Jr. Executives), Executives and Junior Project Manager. The Prescribed Induction training duration is as under:

Post	Place of Training	Classroom Training	Field Training
MTS	HHI or any other training center under CGMs/RMU	12 days	12 days
Junior Executive	HHI and IRICEN/Pune	22 Weeks	04 Weeks
Executive	HHI and IRICEN/Pune	25 Weeks	04 Weeks
Junior project manager	HHI, IRICEN, IRIEEN, IRIMEE, IRISET, IRTMTC & NICMAR	25 Weeks	15 Weeks

1303. Promotional/Refresher/Specialized Training: Course Duration of Promotional, Refresher, Specialized trainings for DFC Engg. employees are as under:

Name of Course	Course Type	Place of Training	Training Duration	Frequency
MTS to Jr. Executive	Promotional	HHI	3 Weeks	-
Jr. Executive to Executive	Promotional	HHI/IRICEN	2 Weeks	-
Sr. Executive to JPM	Promotional	HHI/IRICEN	7 Weeks	-

MTS	Refresher	HHI or any other training center under CGMs/RMU	1 Weeks	5 Years
Jr Executive	Refresher	HHI	2 Weeks	5 Years
Executive	Refresher	HHI/IRICEN	4 Weeks	5 Years
JPM/APM/DPM	Refresher	HHI/IRICEN	3 Weeks	5 Years
USFD (Executive)	Initial	RDSO	4 Weeks	-
USFD (Executive)	Refresher	RDSO/IRICEN	1 week	1st - 3 years thereafter -5 Years
Welding Supervisor (Executive)	Initial	TPP/LKO and TWC/ Vijaywada	1 Week	-
Welder (Jr. Executive)	Initial		2 Weeks	-
Welder (Jr. Executive)	Refresher		1 Week	2 years

1304. Promotional Courses – The course for promotional training will be necessary in the case of staff promoted from a lower to a higher grade by a process of selection. The promotional training courses should be undertaken by the employees immediately after the promotion at the first available opportunity.

1305. Refresher Courses – It will be necessary to conduct Refresher Courses to enable the staff to keep themselves abreast with the latest rules and techniques. Keymen, Technicians/MTS, IMSD Sectional/IMSD In-charge should be sent for Refresher Courses once in five years. In the Refresher Courses, all subjects pertaining to the concerned categories shall be covered as enumerated under promotional courses, but the extent of coverage will be on a limited scale.

1306. Special Courses – In addition to the regular courses mentioned above, special courses on any of the following subjects should also be arranged periodically to increase a sense of awareness of the staff on these subjects – Rail Wheel Interaction & derailment, Geotechnical Investigation, Survey, USFD, AT & FB welding, Mechanized Maintenance, Points & Crossings, Curves, High Speed Track, Track Recording, TMS including Store Modules. It is desirable that the staff posted for the maintenance of welded track or posted on sections maintained by Machines, should be given a special training on the relevant subjects pertaining to their duties in a short course arranged before they are posted in these areas.

1307. Outsourced P-way Staff Training: Training of aspects to be dealt by outsourced Keyman and Patrolmen including safety Training are to be imparted before deploying outsourced staff for track work duties. The Required technical as well as Safety training to outsourced staff are to be imparted in CGM/RMU units. The Training Module for the same should be kept as per Keyman/Patrolmen duties and normally duration of training should be 1 week.

1308. Certificate of Competency – In order to ensure safe working & proper output, a qualified person shall be appointed. Such a qualified person shall be responsible for supervising Track works and its proper protection. The qualified person shall hold a

certificate of competency, which shall be issued according to prescribed instructions. Staff in whose favor a certificate is issued should be literate, having knowledge of Hindi or other local language, should have passed the prescribed medical test. The certificate of competency will be issued for a specified period by an authorized officer and renewed periodically. Categories of staff competent to supervise and execute the works are listed in Annexure - 13/1. Competency certificates are also to be issued to outsourced Staff.

1309. Training and Certification of welders:

a) Certification of Welders of Approved portion manufacturing firms and labor contracting firms shall be done by RDSO as per provisions of "Indian Railway Standard Specification for Fusion Welding of Rails by the Alumino-Thermic process".

b) Training and certification of Departmental welders and supervisors shall be done by Thermit Portion Plant (TPP), Northern Railway, Lucknow and Thermit Welding Centre (TWC), Vijayawada as per procedure for certification given in Annexure - 1 of "Indian Railways Manual for Fusion Welding of Rails by The Alumino-Thermic process".

1310. Training, certification of initial & refresher course for USFD supervisor & operator shall be organized as per the provision of Indian Railway Manual for Ultrasonic testing of rails & welds as mentioned in Annexure 13/1.

1311. Category of Medical Examination – In order to secure continuous effective service and to ensure that one shall not possess any disease, unfitting him or likely to unfit him for that Service, Regular medical examination of DFC staff should be done. Following different medical category, based upon the nature of work and responsibility for P-Way (Track staff) as prescribed in Indian Railway Medical Manual which is reproduced as under -

a) Group A: Vision tests required in the interest of public safety. Categorized as A-1 to A-3.

b) Group B: Vision tests required in the interest of the employee himself or his fellow workers or both. Categorized as B-1 & B-2.

Frequency and Standard of medical test shall be qualified by P-Way staff during their service as listed in Annexure - 13/2. Authorized Medical Examiner for these tests shall, reputed medical officers of nominated hospitals by DFCCIL.

1312. Books of Reference – Books of reference listed in Annexure - 13/3 and other publications from RDSO and IRICEN/Pune including Technical Monograms considered essential, should be supplied to the officers and the Jr. Exe/Exe/Sr. Exe/JPM of each Corridor. The Chief General Manager and the ED Offices should make arrangement to ensure circulars and instructions are available in TMS and/or at Zonal web site as a separate tab on Engineering department page.

Annexure - 13/1

LIST OF FUNCTIONARIES AUTHORISE TO ISSUE COMPETENCY CERTIFICATE FOR VARIOUS TRACK ACTIVITIES.

SN	Nature of Activity /Work	Lowest Authorized Level of Supervision	Functionaries Authorized to Issue Competency / Permission for Work. (Minimum Level)
1	To carry out Maintenance work under their personal supervision in LWR/ CWR for following works	Executive P-way	Subject to passing of Initial/Refresher/ Promotional courses
a.	Renewal of fastenings not requiring lifting.		
b.	Emergency repairs to Rail fracture		
c.	Inspection and Checking of SEJ, oiling and greasing and re-tightening/ renewal of fittings once a fortnight.		
2	a. All patrolling activities	Technicians/ MTS (Outsourced)	IMD In-charge
	b. For passing of train in emergency at rail/weld fracture site.		
3	Carrying out various activities in connection with maintenance of track as given in relevant chapters of this manual.	IMSD Sectional	Subject to passing of Initial/Refresher/ Promotional courses
4	To use Motor trolley	Motor Trolley Operator	IMD IN-CHARGE (Valid for Two years) safety officer of RMU
5	To work as Gateman	MTS/Outsourced Staff	IMD In-charge (Valid for 5 years from the date of issue) safety officer of RMU
6	To use of trolley/ Lorries	IMSD Sectional	PM/Dy.CPM, (Valid for Two years)
7	To Supervise AT welding.	IMSD Sectional or welding supervisor	TPP/Lucknow or TWC/ Vijayawada (after satisfactory completion of TW3 course)

8	To execute AT weld (Provisional Certificate)	Departmental AT Welder	TPP/Lucknow or TWC/ Vijayawada (TW1 competency valid for executing 100 joint or 6 months whichever is earlier)
9	To execute AT weld (Regular Competency Certificate for departmental welding.	Departmental AT Welder	TPP/Lucknow or TWC/ Vijayawada (after satisfactory completion of TW2 course with validity up to 2 years and after two year reassessment valid for next 2 year.)
10	Provisional Competency certificate for welder of private firm.	Contractor/ Firm AT Welder	M&C Directorate of RDSO or any other institute approved by DFCC (Valid for 2 years)
11	Regular Competency Certificate for Welder of private firm.	Contractor/ Firm Welder	M&C Directorate of RDSO or any other institute approved by DFCC (Valid for 5 years)
12	Supervision of FB Welding (Min Diploma in Mech/Elect Engg. Or BSc duly passing test as per Flash Butt welding manual provision)	Departmental/ Firm FB welding supervisor	CTE/DFC
13	Welder for FB welding (Min class X or equivalent duly passing test as per Flash Butt welding manual provision)	Departmental/ Firm FB welders	CTE/DFC
14	USFD operator of departmental USFD machines (Initial certification)	Dept. USFD Operator	M&C Directorate of RDSO (Valid for 3 years)
15	USFD operator of dept. USFD machines (Subsequent certification.)	Dept. USFD Operator	M&C Directorate of RDSO (Valid for 5 years)
16	USFD operator of contracted USFD machines (Provisional certificate)	USFD Testing by contractor operator	M&C Directorate of RDSO (Valid for 6 months)
17	USFD operator of contracted USFD machines (Regular Certificate)	USFD Testing by contractor operator	M&C Directorate of RDSO (Valid for 2 Years)
18	Quality Control in charge for outsourcing of USFD	Quality control In- charge by contractor	M&C Directorate of RDSO (Valid for 3 Years)

Annexure - 13/2

Medical Examination Standard

SN	Category	Visual standards	Validity/ Periodical medical exam (PME)
1	JPM/Executive/ Jr Executive	A-3	Every four years till 45 yrs. and then every two years till 55 yrs. and thereafter annually till retirement. In case Trolley man is not A3 and he is having at least B1 standard then he is allowed to take trolley under traffic block with a helper having A-3 category.
2	MTS working as Trolley men		
3	Track Maintainer (MTS/outsourced Staff)	B-1	On attaining the age of 45 yrs. and there after every 5 yrs.

Annexure - 13/3

Item No	Publication	Offices, which should be equipped with a copy of the publication			
		For the personal use of such officers and inspectors as may be prescribed	CGM unit/ RMU offices	IMD In-charge	IMSD Sectional/ In-charge
1	Act- Indian Railways	...	1	1	1
2	Code- Indian Railway for the Engineering Department.	...	1	1	1
3	DFC Railroad mannual	1	1	1	1
4	DFC Works Manual	1	1	1	1
5	DFC Bridge Manual	1	1	1	1
6	Manual- Accident & Circulars pertaining to Accidents.	1	1	1	1
7	DFC Rules- General and Subsidiary	1	1	1	1
8	DFC- Standard Schedule of Dimensions	1	1	1	1
9	Orders Technical and Safety Circulars-Engineering Department	1	1	1	1
10	Working Time Table and Appendix thereto	1	1	1	1
11	IR Manual for Flash Butt Welding of Rails	...	1	1	1
12	IR Manual for Fusion Welding of Rails by the Alumino-Thermic process	...	1	1	1
13	IR Small Track Machine Manual	...	1	1	1
14	IR Track Machine Manual	...	1	1	1
15	IR Manual for ultrasonic testing of rails and welds	...	1	1	1
16	Special Instructions for maintenance of TWS, Canted turnouts by OEMs	...	1	1	1

CHAPTER – 14

SANCTION FOR WORKS AFFECTING RUNNING LINES & MODIFICATION IN RRM

1401. Works Requiring the Sanction of MD/DFCCIL:

a) As per Railway Board letter No. 2017/Infra/6/33 dated 02.08.2018 , DFC lines can be opened after completion of works for goods traffic by MD/DFCCIL after joint inspection by concerned CTE, CEDE, CSE and CSO of Zonal Railway. All the papers required for opening of line shall be same as required for seeking sanction of CRS as per IRPWM.

b) Introduction of New Rolling stock in DFC: As per Railway Board letter No.2017/ Infra /6/33 dated 18.09.2019, MD/DFCCIL is empowered by Section 27 of Railway Act 1989 to sanction, over DFC lines, the use of locomotive or rolling stock already sanctioned by Central Government (Railway Board) duly following the same procedure as given in Rule 28A (2) and (3) of the Railways (Opening of Public Carriage of Passengers) Rules 2000 (as amended from time to time) for sanction of use of locomotive of Rolling Stock.

c) Following works also require sanction of MD/DFCCIL:

i. New Signaling and Interlocking installations
ii. New stations, temporary or permanent
iii. Heavy re-grading of running lines involving lowering/raising of track in excess of 500 mm
iv. Permanent diversion (deviation) more than 2 km in length without any station in between or irrespective of length when a new station is involved, is to be treated as new line.
v. Temporary diversion irrespective of length, except those laid for the restoration of through communication after an accident.
vi. Works Arising Out of Accidents Including Breaches.
vii. Any work covered in Section 21 to 23 of The Railways Act, 1989 which are not included in para 1402, 1403 of this manuals.

1402. Works requiring Sanction of Zonal Railways: Railway Board vide letter No. 2022/ Trans Cell/Civil/CRS dated 04.11.2022 has specified that DFCCIL will take sanction of PCE/PCSTE/PCEE of Zonal Railway for following works which are affecting existing IR running lines. The Details of same are as under:

a) Works requiring sanction of PCE of Zonal Railway:-

i. Construction, Rebuilding, Modification and Strengthening of Foot Over Bridges and Road Over Bridges.
ii. Construction, Rebuilding/Regirding and Strengthening of Minor Bridges.
iii. Regirding and Strengthening of all existing Bridges and other Minor bridges, and
iv. Upgradation of non-interlocked level crossing and diversion of Roads at LCs.

b) **Works requiring sanction of PCSTE of Zonal Railway:**
Up-graduation of interlocked level crossings, including interlocking outside station limit

c) Following procedure will be followed by DFC for introduction of electric traction works which are affecting existing IR running lines:

i. 25 KV AC charging of section for Railway Electrification work for existing lines/

new lines/gauge conversion lines/doubling/ multiple lines and energization of any high tension installation in this regard shall be done with the approval of Electrical Inspector to Government (EIG) of India as laid down in Indian Electricity Act-2003

ii. The competent authority to grant sanction to open the section with electrical traction for above mentioned works shall be the PCEE of zonal railway with no further delegation

d) For seeking above sanctions all necessary documents required shall be prepared in the same format as listed down in "The railway opening public carriage of passengers rules 2020" as amended time to time.

1403. For Modification/alterations in existing DFCCIL yards, modification of existing DFC-CIL lines, introduction of FOBs, ROBs, RUBs and upgradation of Electrical/S&T systems for DFCCIL network which is not affecting existing Indian Railway System, The Procedure laid down in DFC Joint Procedural Order No. 01/2023 dated 24.03.2023 are to be followed. All the papers required for seeking sanction of Competent Authority should be as per documents required for works indicated in para 1402(d).

1404. Application for Sanction of Works– Application for sanction of works indicated in para 1401, 1402 and 1403 of Competent Authority should be submitted by CGM/RMU of unit enclosing all papers required for seeking sanction as laid down in para 1402(d) shall be submitted to Co-ordinating Executive Directors for obtaining the sanction of Competent Authority.

1405. Notification to DFC Officials When Opening Works– No new work affecting the running of trains or the traffic working at stations should be brought into use until the staff of all departments has been notified by means of a circular notice issued by the GM/Safety. Timely intimation of the date of opening of works should be sent to the GM/OPBD wherever any new or revised working rules are to be brought into operation, to enable him to give the running staff due notice.

1406. Correction Slip for Railroad Manual: Any inclusion, deletion or modification in Railroad manual will be done by issuance of correction slip. Following procedure is to be adopted.

a) Corrections may be proposed by CGMs, GMs/AGMs of corporate office for inclusion in RRM.

b) This will be referred to a committee consisting of CTE/DFC, CBE/DFC and GM/Technical. In case of non-availability of above GMs having minimum 2 years of experience of maintenance of track may be nominated by Director infrastructure.

c) After recommendation Director Infra will approve the recommendation for issuance of correction slip.

1407. CTE/DFC is competent to clarify the interpretation of the language in RRM. Any dispensation in the any para of this manual will be done by Director Infrastructure of DFCCIL.

1408. All the field officials should place latest correction slip issued time to time, at the end of this manual.