For Official use Only
केवल कार्यालय उपयोग हेतु

सत्यमेव जयते

GOVERNMENT OF INDIA - MINISTRY OF RAILWAYS
भारत सरकार – रेल मंत्रालय



ट्रैक मेंटेनर के लिए प्रवेश पाठ्यक्रम

INDUCTION COURSE FOR TRACK MAINTAINER



हस्त पुस्तिका भाग-VI

Booklet Part-VI



लम्बी और छोटी वेल्डेड रेल

Long and Short Welded Rails

कैमटेक/2024/सी/टीएमआईसी/भाग-VI/1.0

CAMTECH/2024/C/TMIC/Part-VI/1.0

An ISO 9001-2015 Certified Organisation
उच्च अनुरक्षण प्रौद्योगिकी केन्द्र
EXCELLENCE IN MAINTENANCE
INDIAN RAILWAYS

Centre for Advanced Maintenance Technology (CAMTECH)
MAHARAJPURA, GWALIOR - 474005

ट्रैक मेंटेनर के लिए इंडक्शन कोर्स
हस्त पुस्तिका भाग - VI: लंबी और छोटी वेल्डेड रेल

Handbook on Induction course for Track Maintainer Booklet Part VI: Long and Short Welded Rails'

प्रस्तावना

भारतीय रेलवे संरचना और रेल ट्रैक के रूप में देश में सिविल इंजीनियरिंग संपत्ति का बड़ा हिस्सा रखता है।

कैमटेक ने रेलवे में शामिल होने वाले ट्रैक मेंटेनर को निर्धारित प्रशिक्षण मॉड्यूल के अनुसार 'लंबी और छोटी वेल्डेड रेल' के बारे में सभी जानकारी प्रदान करने का एक अच्छा प्रयास किया है।

मुझे आशा है कि यह पुस्तिका विषयों पर ज्ञान का एक मूल्यवान स्रोत साबित होगी और भारतीय रेलवे के इंजीनियरिंग विभाग में काम करने वाले ट्रैक अनुरक्षकों के लिए काफी उपयोगी होगी।

कैमटेक, ग्वालियर ***एच. के रघु***
सितम्बर, 2024 ***प्रधान कार्यकारी निदेशक***

Foreword

Indian railway holds the major chunk of civil engineering assets in the country in the form of structure and rail track.

CAMTECH has made a nice attempt to provide all the information about the 'Long and Short Welded Rails' as per prescribed training module to the Track maintainer who has initially joined the railways.

I hope this handbook will prove to be a valuable source of knowledge on topics and will be quite helpful to Track maintainers working in the engineering department of the Indian Railways.

CAMTECH, Gwalior ***H. K. Raghu.***
September, 2024 ***Principal Executive Director***

भूमिका

भारतीय रेलवे के पास पूरे भारत में फैले रेल ट्रैक का एक विशाल नेटवर्क है। एसएसई /जेई/ मेट, की-मैन, गेटमैन और ट्रैक मेंटेनर जैसे परमानेंट वे स्टाफ द्वारा पूरे ट्रैक का रखरखाव किया जाता था।

रेलवे बोर्ड ने आरबीई 3/2024 पत्र संख्या ई(एमपीपी)2019/3/46 दिनांक 09.01.2024 के माध्यम से भारतीय रेलवे के सिविल इंजीनियरिंग विभाग के ट्रैक मेंटेनर्स के इंडक्शन और रिफ्रेशर कोर्स के लिए प्रशिक्षण मॉड्यूल को मंजूरी दी गयी है। यह पुस्तिका ट्रैक मेंटेनर के इंडक्शन कोर्स के भाग-VI: लंबी और छोटी वेल्डेड रेल की आवश्यकता को पूरा करने के लिए तैयार की गई है।

इस पुस्तिका को इंजीनियरिंग विभाग के नवनियुक्त ट्रैक मेंटेनर को प्रशिक्षण मॉड्यूल के अनुसार प्रशिक्षित करने के लिए उपयोगी बनाने का हर संभव प्रयास किया गया है।

भारतीय रेलवे का अधिकांश रेलपथ ब्रॉड गेज में परिवर्तित हो चुका है। इसलिए यह दस्तावेज़ ब्रॉड गेज ट्रैक को ध्यान में रखते हुए तैयार किया गया है। अन्य गेज के लिए कृपया संबंधित दस्तावेज़ देखें।

यह पुस्तिका रेलवे बोर्ड, आरडीएसओ, आईआरपीडब्ल्यूएम और भारतीय मानकों द्वारा जारी इस विषय पर उपलब्ध किसी भी मौजूदा जानकारी का स्थान नहीं लेती है। यह पुस्तक वैधानिक नहीं है और इसकी सामग्री केवल मार्गदर्शन के उद्देश्य से है। यहाँ उल्लिखित अधिकांश डेटा, रेखाचित्र और जानकारी किसी न किसी रूप में विभिन्न पुस्तकों या मुद्रित सामग्री में उपलब्ध हैं।

यह पुस्तिका श्री एस.एस.पाठक, एस.एस.ई./पी.वे/कैमटेक के ईमानदार प्रयासों का परिणाम है, जिन्होंने विभिन्न स्रोतों से सूचना, डेटा आदि एकत्रित और संकलित किया, तथा सम्पूर्ण पाठ का अध्ययन किया।

आगे के सुधारों के लिए हम अपने पाठकों के बहुमूल्य सुझावों का स्वागत करते हैं।

कैमटेक, ग्वालियर ***दीपक मेहरा***

सितम्बर, 2024 ***निदेशक (सिविल)***

Preface

Indian Railway having a vast network of rail track spread all over India. Whole track were maintained by Permanent way staff like SSE/JE/Mate/Keyman, Gateman, and the Track maintainers.

Railway Board vide RBE 3/2024 letter No. E(MPP)2019/3/46 dated 09.01.2024 has approved the training modules for Induction & Refresher courses of Track Maintainers of the Civil Engineering department of Indian Railways. This handbook has been prepared to fulfil the requirement of Part-VI: 'Long and Short Welded Rails' of induction course of track maintainer.

Every effort has been made to make this handbook useful to train the newly recruited track maintainer of the engineering department as per the training module.

Most of the tracks of Indian Railways have been converted into Broad Gauge. Hence This document is prepared keeping in mind for the Broad Gauge track. For other Gauges please refer relevant document.

This booklet does not supersede any existing information on subject issued by Railway Board, RDSO, IRPWM and Indian standards available on the subject. This book is not statutory& contents are for the purpose of guidance only. Most of the data, sketch and information mentioned here are available in some form or the other in various books or printed matter.

This booklet is the result of sincere efforts of Shri S.S.Pathak, SSE/P.Way/CAMTECH, who collected and compiled information, data, etc. from different sources, and went through the complete text.

We welcome valuable suggestions from our readers for further improvements.

CAMTECH, Gwalior ***Deepak Mehra***
September, 2024 ***Director/Civil***

CONTENTS

SN	Description	Page No.
	Foreword	*i*
	Preface	*ii*
	Contents	*iii*
	Correction Slip	*iv*
1.	INTRODUCTION	1
2.	DEFINITIONS	1
	(1) Short Welded Rail (S.W.R.)	1
	(2) Rail temperature	1
	(3) Long welded Rail (L.W.R.)	3
3.	Types of Rail Thermometers	4
	(1) Embedded type	4
	(2) Dial Type	5
	(3) Continuous recording type	5
	(4) Magnetic Base Type Rail Thermometer	5
4.	Measurement of temperature	5
5.	Temperature Records	6
6.	SHORT WELDED RAILS	6
	(1) General	6
	(2) Maintenance of Short Welded Rails	6
	(3) Gap survey	7
	(4) Recommended range of value of gaps during service	8
	(5) Counteraction and Adustment of Creep	9
	(6) Buckling of Track	11
	(7) Do's and Don'ts for SWR Track	13
7.	LONG WELDED RAILS	14
	(1) Maintenance of LWR/CWR	14
	(2) Regular Track Maintenance	16

	(3) Special Track Maintenance	17
	(4) Certificate of Competency	19
	(5) Work Chart and authorised level of supervision	20
	(6) DOs and Don'ts for LWR Track	21
	(7) Hot and Cold Weather Patrolling	24
8.	Action to be taken in case of Rail fractures/Weld failures	27
9.	Buckling of LWR Track	28
10.	De-stressing of LWR when required during maintenance	30
11.	De-stressing Operation of LWR	31
	(1) De-stressing without Rail Tensors	31
	(2) De-stressing with Rail Tensors	33
12.	Different types of SEJ	37
	(1) Conventional Switch Expansion Joint (SEJ)	37
	(2) Improved Switch Expansion Joints (ISEJ)	38
	(3) Thick-Web Switch Expansion Joint	41
13.	Renewal of Switch Expansion Joints	42
14.	Routine Maintenance & Special Maintenance of SEJ	42
15.	Gaps at SEJ	43
	Annexure-I	52
	Annexure-II	53
	Revised Training Modules of Non-Gazetted Staff of Civil Engineering Department.	59
	References	64
	Notes	65

संशोधन पर्चियों का प्रकाशन
ISSUE OF CORRECTION SLIPS

इस हस्तपुस्तिका के लिए भविष्य में प्रकाशित होने वाली संशोधन पर्चियों को निम्नानुसार संख्यांकित किया जाएगा:

The correction slips to be issued in future for this handbook will be numbered as follows:

केमटेक/2024/सी/टीएमआईसी/भाग-VI/1.0/सीएस# XX दिनांक_____

CAMTECH/2024/C/TMIC/Part-VI/1.0/CS # XX date_____

जहाँ XX संबन्धित संशोधन पर्ची की क्रम संख्या है (01 से प्रारम्भ होकर आगे की ओर)

Where "XX" is the serial number of the concerned correction slip (starting from 01 onwards).

प्रकाशित संशोधन पर्चियाँ
CORRECTION SLIPS ISSUED

क्र.सं./ Sr. No.	प्रकाशन दिनांक/ Date of issue	संशोधित पृष्ठ संख्या तथा मद संख्या/ Page No. and Item No. modified	टिप्पणी/ Remarks

1. INTRODUCTION

Earlier, railway tracks were laid on 13 m and 12 m free rails, due to which the number of fish plated joints was more. Rail joints are the weakest link in the railway track. Fish plated rail joints face a lot of maintenance problems like increased battering and hogging of rails, elongation of fish bolt holes, bending of fish plates, etc causing track maintenance problem and poor riding comfort.

In order to get rid of the problem due to a rail joint, the best remedy lies in welding the rails and reduce the number of joints to the extent possible. So, Short Welded Rails (SWR) track was made by welding the three free rails. Normally the length of SWR is 3 X 13 M for Broad gauge. Gradually the technology improved and Long Welded Rail (LWR) tracks were created by welding the rails to reduce the number of rail joints. A length of welded rail greater than 250m on Broad Gauge will normally function as LWR.

The systematic welding of rails will provide modern welded railway track, which have the potential to carry trains at fast speeds with better riding comforts and lesser maintenance cost.

2. DEFINITIONS

(1) Short Welded Rail (S.W.R.)

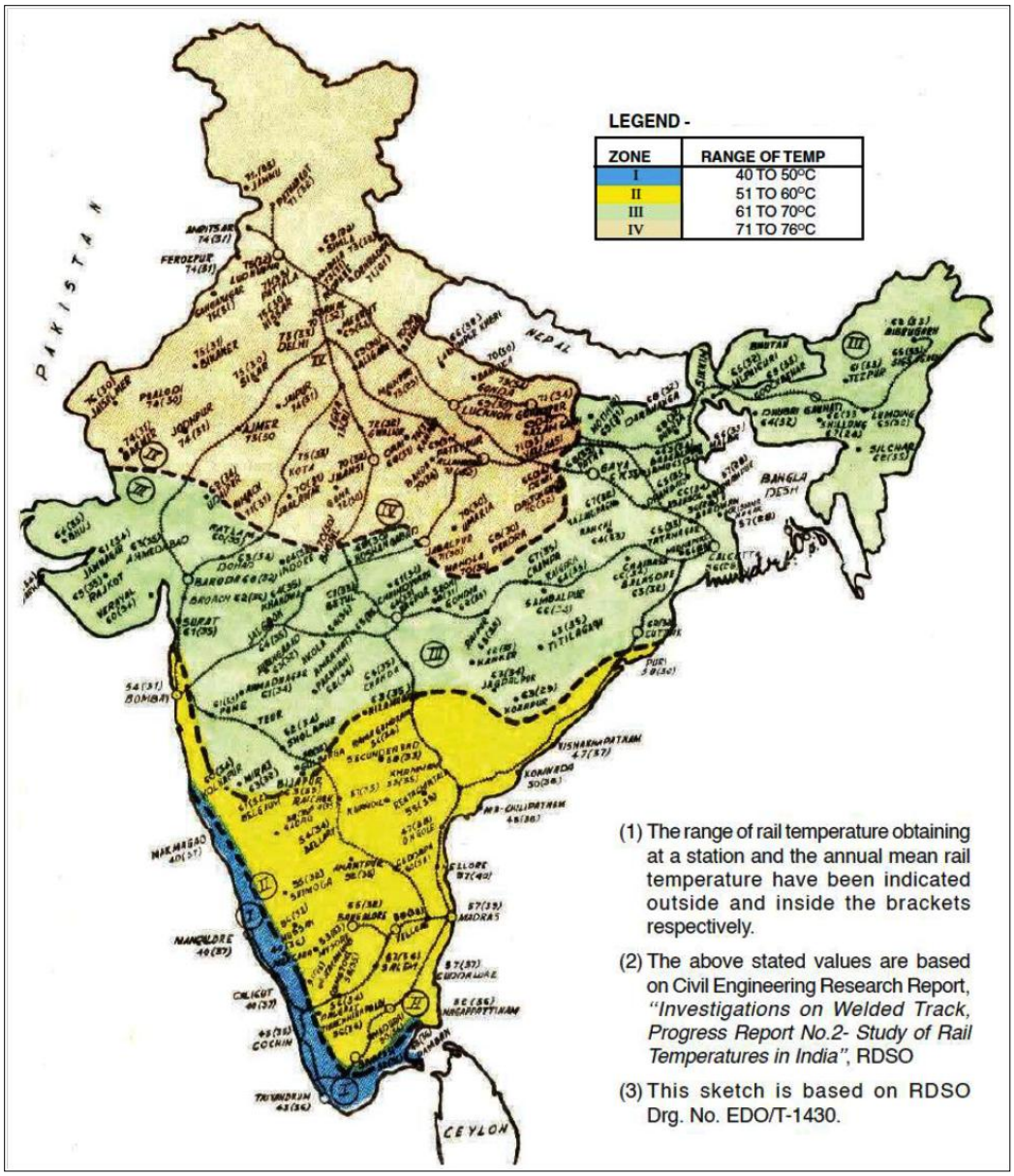
Short welded rail is a welded rail, which contracts and expands throughout its length.

Note – Normally the length of SWR is 3X 13 M for Broad gauge and 3X12 M for Meter gauge

(2) Rail temperature *(Ref: Para of IRPWM)*

Rail temperature is the temperature of a rail as measured by an approved type of rail thermometer at the site. Indian Railways have been divided into four rail temperature zones.

In India, four zones have been created by determining the range based on the difference in minimum and maximum temperatures. A map showing the four temperature zones and the annual mean rail temperatures at all important places are as shown below in the map.



The following terminology for temperature is commonly used:

(a) Mean rail temperature (tm)

Mean rail temperature for a section is the average of maximum and minimum rail temperatures recorded for the section.

Tm will be fixed locally wherever rail temperature records are available for a reasonable period of five years. Where rail temperature records are not available tm Can be read from the rail temperature map.

(b) Installation temperature (t_i)

The average rail temperature, during the process of fastening the rails to the sleepers, at the time of installation of SWR/LWR/CWR.

(c) Standard installation temperature (ts)

It is the installation temperature at which the standard gap of six mm is provided for the fish plated joint.

(d) Prevailing rail temperature (tp)

It is the rail temperature prevailing at the time when any operation connected with LWR such as de-stressing etc., is carried out.

(e) Stress Free temperature (to)

It is the rail temperature in LWR/CWR at which the rail is free of thermal stresses.

(f) De-stressing temperature (td)

It is the average rail temperature during the period of fastening of the rails to the sleeper after de-stressing L.W.R. /C.W.R. without use of rail tensors. If rail tensor is used, t_d for all practical purposes is equal to t_0. 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	All Sections	t_m to t_m+ 5° C
IV	52 kg/m & heavier	t_m+5° C to t_m+10° C

(3) Long welded Rail (L.W.R.)

Long Welded Rail (LWR) is a welded rail, the central part of which does not undergo any longitudinal movement due to temperature variations. A length of greater than 250 m on Broad Gauge (BG) will normally function as LWR.

The maximum length of LWR under Indian conditions shall normally be restricted to one block section.

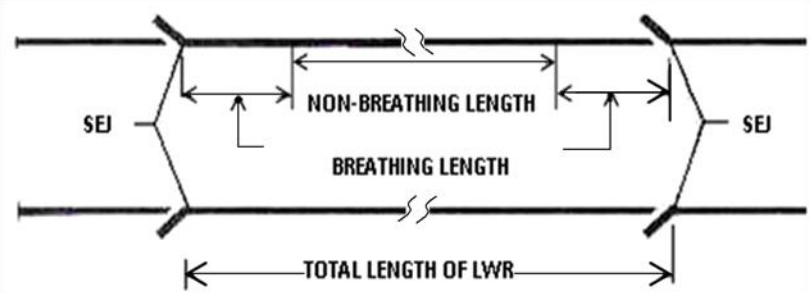


Figure - Long Welded Rails

(4) Continuous Welded Rail (C.W.R.)

A LWR, which continues through station yards including points and crossings.

Following are some definitions regarding LWR/CWR:

(5) Breathing length

The length at each end of LWR/CWR, which is subjected to expansion/ contraction on account of temperature variations.

(6) Anchor length(la)

The length of track required to resist the pull exerted on rails by the rail tensor at temperature (tp). For practical purposes, it is taken as equal to 2.5 metre per degree Celsius of (to - tp). If t_0 is not known, td can be assumed as t_0.

(7) Switch expansion joint (S.E.J.)

An expansion joint installed at each end of L.W.R. /C.W.R. to permit expansion or contraction of the adjoining breathing lengths due to temperature variations.



(8) De-stressing

An operation undertaken with or without rail tensor to secure stress free conditions in the L.W.R./C.W.R. at the desired/specified rail temperature.

3. Types of Rail Thermometers *(Ref: Para 332 of IRPWM)*

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

(1) 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.



(2) 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.

(3) Continuous recording type



This device is used for continuously displaying rail temperature, storing the data at pre-set interval and transferring this data to PC through USB port of PC. This unit can be placed at nearby cabin to continuously monitor and store the rail temperature. The Device shall be capable of continuous operation during the varying atmospheric and climatic conditions as follows:

(4) Any other type of thermometer approved by RDSO/Chief Engineer.

Magnetic Base Type Rail Thermometer *(Ref: RDSO specification No. TM-67 dt. 28.01.2002 rev. 01 of 2010)*



The thermometer is designed to firmly stick to the rail top by magnetic action of the base of the thermometer when placed on the top of rail head and stand in vertical position. It is be capable to measure the rail temperature correctly to the specified accuracy and tolerance within six minutes. Red, Yellow & Green colour code for easy understanding for P. Way staff.

4. Measurement of temperature *(Ref: Para 333 of IRPWM)*

(1) The existing SSE/P. Way (In-charge) shall record rail temperature using preferably a well-calibrated continuous recording type thermometer and data to be updated in TMS.

(2) The maximum and minimum rail temperature for a continuous period of at least 5 years shall be ascertained and the mean rail temperature (tm) for the region arrived at.

(3) 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.

(4) The rail thermometer shall also be available with each Gang and sectional JE/SSE/P.Way to enable the Gangs to work within the prescribed temperature ranges.

5. Temperature Records *(Ref: Para 334 of IRPWM)*

(1) 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 SSE/P.Way (In-charge) or as built up by measuring rail temperature for a continuous period of at least 5 years.

(2) If rail temperature records of preceding five years are not available, the mean and range of rail temperatures shown in the 'Map of India showing Rail Temperature Zones', shall be adopted.

6. SHORT WELDED RAILS

(1) General

SWR shall be laid generally on stable and efficiently drained formation. 100 mm extra, width of shoulder ballast over and above the standard ballast section on tangent track shall be provided on outside of curves upto 875 metre radius. In case of sharper curves, the extra width shall be 150 mm. In case of 60 kg/m Rails, LWR profile shall be adopted.

(2) Maintenance of Short Welded Rails

(a) Regular maintenance operation *(Ref: Para 324 of IRPWM)*

I. Regular track maintenance operations like packing, lifting, aligning, local adjustment of curves, screening of ballast other than deep screening and scattered renewal of sleepers may be carried out without restriction when the rail temperature is below tm + 25°C in the case of zone I & II and tm + 20°C in the zone III and IV.

However, on curves of less than 875 metre radius in Broad Gauge or yielding formation, the above temperature limit shall be restricted to tm + 15°C in the case of Zone I and II and tm +10°C in the case of Zone III and IV.

II. If the maintenance operations have to be undertaken at temperature higher than that mentioned above in Sub-Para I above, not more than 30 sleeper spaces in one continuous stretch shall be opened, leaving at least 30 fully boxed sleeper spaces between adjacent lengths which are opened out. Before the end of the day's work, it shall be ensured that the ballast is boxed up.

III. As an additional precaution, during summer months, to be specified by the Chief Engineer, for attention to run down track, even if temperature is less than the temperature specified in Sub-Para (1) above, not more than 30 sleeper spaces in one continuous stretch shall be opened, leaving at least 30 fully boxed sleeper spaces between adjacent lengths which are opened out.

Further, if joint gaps are not available at the time of opening of the track

even when rail temperature are less than those specified in clause Sub-Para I above not more than 30 sleepers in one continuous stretch should be opened leaving at least 30 boxed sleeper spaces between adjacent length which are opened up.

IV. Major lifting, major alignment of track, deep screening and renewal of sleepers in continuous length- Each of these operations shall be done under suitable precautions and normally when the rail temperature is below tm + 15°C in the case of Zone I and II, and tm + 10°C in the case of Zone III and IV.

If it becomes necessary to undertake such works at rail temperature exceeding the above values, adequate speed restrictions shall be imposed.

V. Adequate number of joggled fishplates with special clamps shall be provided to the gangs for use in emergencies.

VI. 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 5.5m to carry out the re-welding duly introducing a rail piece of equivalent length, also ensuring that no weld lies closer than 4 m from the fish- plated joint.

(b) Gap survey *(Ref: Para 320 of IRPWM)*

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).

I. The gap survey shall be conducted on a clear and sunny day in the cool hours of the day in rising rail temperature trend.

II. 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.

III. The joint gaps shall be measured by taper gauge in mm and the readings entered in the proforma as shown below:

PROFORMA FOR GAP SURVEY AND RECTIFICATION OF GAPS

Between stations Nawabpalem and Nidadavole Down line
Between Km 551/13-551/0
Rails 52 Kg on PRC Sleeper M + 7 Density
Mean annual rail temperature t_n
T_n = 38°C Zone II

Survey Details
Date 28th February 1981
Time : 12.00 hrs

Rail temperature-
At start ..44°C
At Close .. 46°C

Adjustment details-
Date 2nd March 1981 Time: 4.30 Hrs

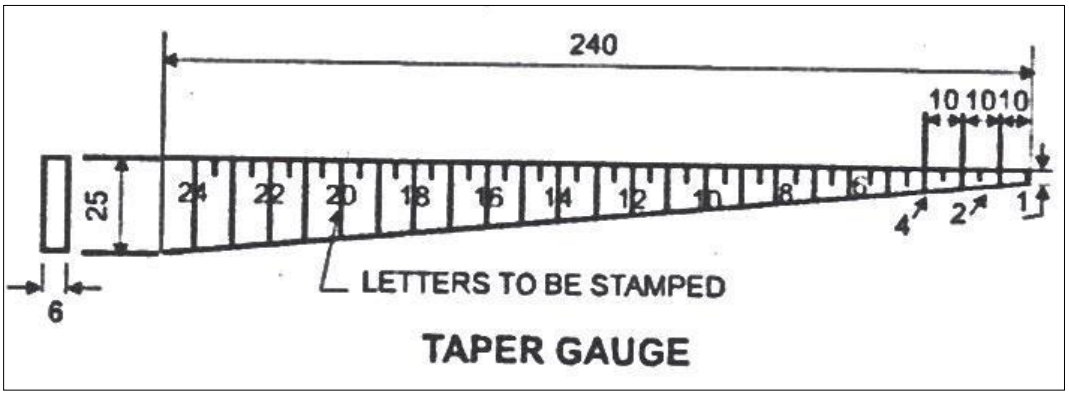
Rail Temperature
Aat start: 40°C, close: 45°C
Average temperature: 42.5°C(t_n+4.5°C)

Average rail temperature 45°C (t_n+7) during gap survey

Recommended range of gap for 45°C noted at the time of survey As per Table-2 : 5 - 9 mm

To be adjusted to the gap as shown in Table-1 = 4mm

Location and description of immovable point	Sr.No. of Joints	Gap in mm		Action taken with JE/SSE/P.Way initials and date	Adjusted gaps in mm.	
		Left	Right		Left	Right
Girder Bridge at Km 55/13 (First fix point)	1	15	11	Gaps systematically adjusted from one end to the other end and by providing a longer rail on 2nd March 1981 and gap adjusted to 4 mm. (Sd/-) JE/SSE/P.Way	4	4
	2	14	9		4	4
	3	17	14		4	4
	4	14	15		4	4
	5	10	15		4	4
	6	15	15		4	4
	7	17	14		4	4
	8	17	12		4	4
	9	16	10		4	4
	10	14	9		4	4
	11	11	6		4	4
	12	8	10		4	4
	13	11	12		4	4
	14	5	9		4	4
	15	13	12		4	4
	16	8	13		4	4
	17	15	15		4	4
	18	12	14		4	4
	19	14	14		4	4
	20	15	14		4	4
	21	13	16		4	4
	22	14	14		4	4
	23	15	17		4	4
Km 551/0 Level Crossing (Second fixed point)	24	18	20		4	4
	25	19	10		4	4
	26	20	20		4	4
	Total	359	340		104	104
	Average	13.8	13.1			
		This falls in case 2				



IV. Recommended range of value of gaps during service

The recommended range of value of gaps (in mm) during service for various ranges of rail temperature is indicated in the Table given below:

Table – 2

For Zone I and II		
Rail Temperature During Gap Survey	**Permissible Values of gaps (in mm)**	
	For 39 m panels	**For 26 m rolled rails**
tm - 17.5°C to tm - 12.6°C	11-14	8-13
tm - 12.5°C to tm - 7.6°C	9-13	6-11
tm - 7.5°C to tm - 2.5°C	7-11	5-10
tm - 2.4°C to tm + 2.5°C	5-9	3-8
tm + 2.6°C to tm + 7.5°C	3-7	2-7
tm + 7.6°C to tm + 12.5°C	1-5	1-5

For Zone III and IV		
tm - 12.5°C to tm - 7.6°C	11-14	8-13
tm - 7.5°C to tm - 2.6°C	9-13	6-11
tm - 2.5°C to tm + 2.5°C	7-11	5-10
tm + 2.6°C to tm + 7.5°C	5-9	3-8
tm + 7.6°C to tm + 12.5°C	3-7	2-7
tm + 12.6°C to tm + 17.5°C	1-5	1-5

(3) Counteraction and Adjustment of Creep *(Ref: Para 321 of IRPWM)*

(a) General

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. Among the troubles caused by 'creep' are –

I. Sleepers getting out of square

II. Distortion of gauge

III. Loosening of joints

IV. Shearing and breaking of bolts and fishplates

V. Buckling in extreme cases

(b) Causes for creep in track

The following are some of the avoidable causes to which creep is attributed:-

I. Inadequate toe loads of the fastening and rails not secured properly to sleeper.

II. Inadequate ballast resistance to the movement of sleepers due to poor or insufficient ballast or other causes

III. Inefficient or badly maintained rail joints

IV. Improper expansion gaps

V. Damaged sleepers, uneven spacing of sleepers

VI. Lack of proper drainage

VII. Yielding formation

VIII. Loose/uneven packing

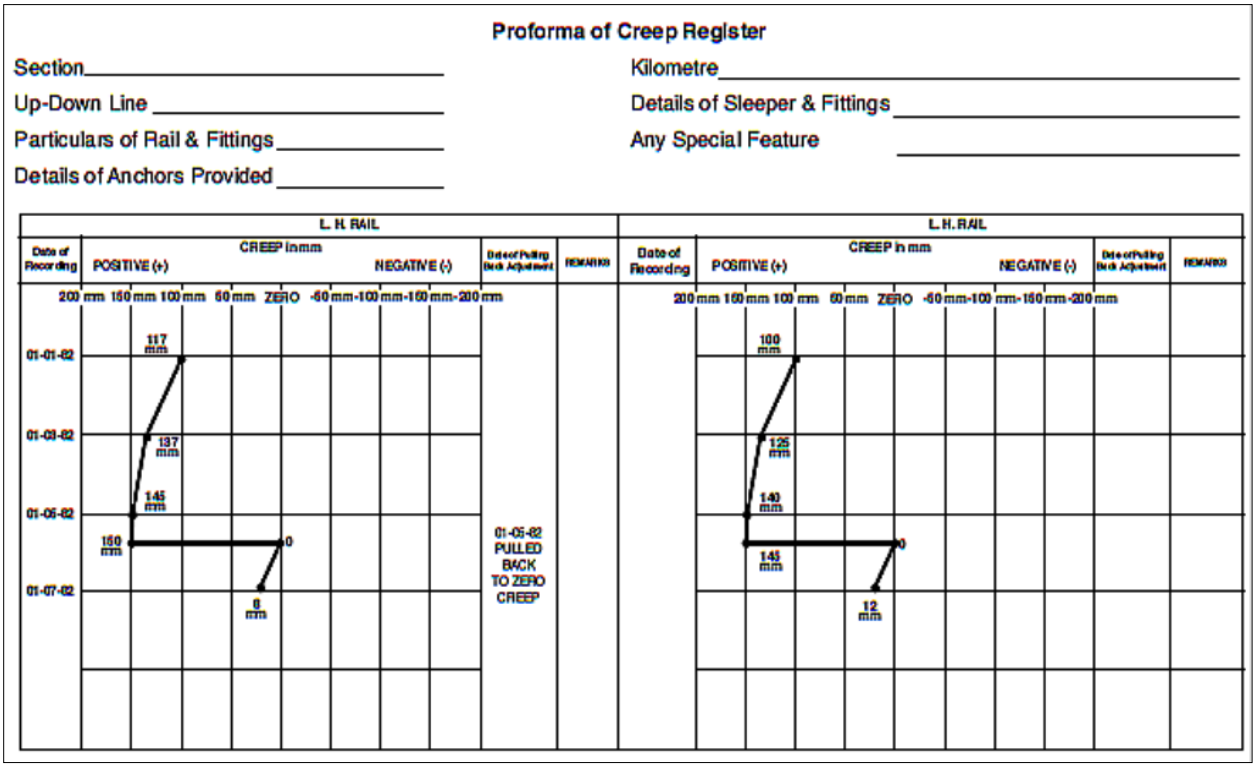
(c) Precautions to reduce creep

The PSC sleepers with effective elastic fastenings are considered as creep resistant and therefore no other creep anchors are required. In case, excessive creep is observed on PSC sleeper road, the condition of elastic fastenings, sleepers and adequacy of ballast resistance should be examined. Action for replacement/ renewal of fittings, sleepers and providing adequate

ballast resistance etc. should be taken as necessary.

(d) Creep Record

Creep records should be maintained in the proforma given below. Entries should be complete as regards kilometerage, section and length of rail, sleeper density. Periodical readings of creep should be recorded in TMS in the prescribed proforma.



(e) Creep indicator posts

Creep indicator posts, square to the track should be erected on either side of the track on the cess at suitable intervals of not more than one km apart. These may be unserviceable rail posts with chisel mark square to the joints. The top of the post should be about 25 mm above the rail level and the amount of creep one way or the other measured with a fishing cord stretched over the chisel marks.

(f) Permissible amount of creep

Creep in excess of 150 mm shall not be permitted.

(g) Adjustment of creep

Adjustments of creep should be carried out in the following manner:-

I. 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.

II. Careful measurement of expansion gaps, as existing, should be done and appropriate length, which can be dealt with in one operation should be chosen.

III. 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.

IV. 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 JE/SSE/P.Way as Works of Short Duration or under traffic block, on busy routes. *(Please refer Annexure-II for Protection for works of short duration)*

V. 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.

(4) Buckling of Track *(Ref: Para 322 of IRPWM)*

Sudden or Gradual shifting of Track in lateral or vertical direction due to unbalanced thermal stress in rail / track is called Buckling.

(a) Buckling of Track (other than LWR)

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.

(b) Conditions, which induce Buckling

I. The following conditions create high compressive forces in the rail:

A. Inadequate expansion gaps,

B. Failure to counteract creep in time.

C. Non-lubrication of rail joints,

II. 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.

(c) 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 as per procedure explained below. Similarly, in case of free rail track, joint gaps should be adjusted wherever necessary.

IV. Adequate precautions are taken to reduce creep as detailed below,

The PSC sleepers with effective elastic fastenings are considered as creep resistant and therefore no other creep anchors are required. In case, excessive creep is observed on the PSC sleeper road, the condition of elastic fastenings, sleepers, and adequacy of ballast resistance should be examined. Action for replacement/ renewal of fittings, sleepers, and providing adequate ballast resistance, etc should be taken as necessary.

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 (refer Para above). Jammed joints at such junctions call for remedial measures.

VII. Adequate shoulder ballast should be provided at all places.

(d) Protection of Line

The Gang Mate/Keyman/Track Maintainer as soon as he notices that buckling does occur or appears imminent or that there is a tendency towards buckling of the track should first protect the track with hand signal flags and detonators as per the protection rules laid down in annexure-I. *(Please refer Annexure-I for Temporary Signals in Emergency)*

(e) Repairs to buckled track *{Ref: Para 351(3)of IRPWM}*

The rectification shall normally be carried out in the following stages under the supervision of JE/SSE/P.Way,

I. Emergency repairs *{Ref: Para 351(3)(i) of IRPWM}*

A. 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 due 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 for first train STOP DEAD & 10 kmph and Subsequent trains at 20 kmph. *(Ref: S.N. 4 of Annexure - 3/8 of IRPWM)*

B. 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.

II. Permanent repairs *{Ref: Para 351(3)(i) of IRPWM}*

As soon as possible, the clamped joints shall be welded. The speed restriction shall be removed after welding.

(5) Do's and Don'ts for SWR Track

A. Do's

(a) Any track maintenance operation/ activity should be done only under suitable precaution and within prescribed temperature.

(b) The greasing of fishplates is done before the hot weather sets in.

(c) 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.

(d) 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.

(e) Adequate number of joggled fishplates with special clamps shall be provided to the gangs for use in emergencies.

(f) 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 5.5m to carry out the re-welding duly introducing a rail piece of equivalent length, also ensuring that no weld lies closer than 4 m from the fish- plated joint.

(g) When closure rails are put in, a speed restriction of 30 Kmph should be imposed, which should be removed, when closure rail is changed.

(h) 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.

(i) Plan the gap survey and adjustment of gaps before the end of February once a year (i.e. before onset of summer).

(j) The gap survey shall be conducted on a clear and sunny day in the cool hours of the day in rising rail temperature trend.

(k) The condition of elastic fastenings, sleepers and adequacy of ballast resistance should be examined where excessive creep is observed on PSC sleeper road and action for replacement/ renewal of fittings, sleepers and providing adequate ballast resistance etc. should be taken as necessary.

(l) Creep indicator posts, square to the track should be erected on either side of the track on the cess at suitable intervals of not more than one km apart.

(m) 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.

(n) The work of creep adjustments should start at the running-on end of the length, commonly just beyond the points and crossings or level crossings.

(o) The work of creep adjustments should be carried out under the protection of engineering signals by the JE/SSE/P.Way or under traffic block, on busy routes.

B. Don'ts

(a) Operations, which impair the lateral resistance of track, are not carried out when rail temperatures are high. 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) SWR on PSC sleepers shall not be laid on curves sharper than 440 metre radius. (Existing SWR laid on sharper curves may, however, be allowed to continue if there is no difficulty experienced in maintaining these lengths).

(c) No rail joint in check rails and on the running rails, within the level crossings and six metres on either side from the end of level crossing.

(d) No fish-plated joint should be located on the girder or within six metre 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.

(e) Not allowed the following causes to which creep is attributed:

I. Inadequate toe loads of the fastening and rails not secured properly to sleeper.

II. Inadequate ballast resistance to the movement of sleepers due to poor or insufficient ballast or other causes.

III. Inefficient or badly maintained rail joints.

IV. Improper expansion gaps.

V. Damaged sleepers, uneven spacing of sleepers.

VI. Lack of proper drainage.

VII. Yielding formation.

VIII. Loose/uneven packing.

(f) Creep in excess of 150 mm shall not be permitted.

(g) Over tight of fish bolts, but they should be reasonably tight.

7. LONG WELDED RAILS

(1) Maintenance of LWR/CWR *(Ref: Para 344 of IRPWM)*

An important prerequisite for proper functioning of LWR/CWR is its initial

laying to a high standard and its subsequent maintenance by trained personnel possessing valid competency certificates and level of authorization.

(2) Regular Track Maintenance *(Ref: Para 345 of IRPWM)*

Regular track maintenance in LWR/CWR includes following operations:-

(a) Tamping/packing

(b) Lifting

(c) Aligning including minor realignment of curves

(d) Shallow screening/shoulder cleaning

(e) Renewal of fastenings requiring lifting

(f) Maintenance of SEJ

I. General

A. The regular track maintenance in LWR/CWR shall be confined to hours when the rail temperature is between td+10°C and td-30°C and shall be completed well before onset of summer. However, for LWR on wider base sleepers, regular track maintenance shall be confined to hours when the rail temperature is between td+15°C and td-30°C.

B. If rail temperature after the maintenance operation exceeds td+20°C for conventional PSC sleeper and td+25°C for wider base sleepers during the period of consolidation, then the speed restriction of 50 Km/h shall be imposed.

C. Consolidation of track can be achieved by the following,

a. For Existing track where maintenance activity involving disturbance to ballast compaction (tamping operation) has been undertaken.

(i) For the track structure consisting of concrete sleepers, passage of at least 50,000 gross tonnes of traffic or a period of two days whichever is later.

(or)

(ii) At least one round of stabilisation by Dynamic Track Stabiliser (DTS).

b. For newly laid track (CTR/TSR) or freshly deep screened Track

Three rounds of packing, last two of which should be by on-track tamping machines

D. Ballast section shall be properly maintained, especially on pedestrian & cattle crossings, curves and approaches to level crossings and bridges. Cess level should be correctly maintained. Dwarf walls may be provided on pedestrian and cattle crossings to prevent loss of ballast.

E. 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

Gang Mate 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.

F. Sufficient quantity of ballast shall be collected to provide full ballast section before commencing any maintenance operation, specially lifting.

G. When crowbars are used for slewing, care shall be taken to apply these in a manner to avoid lifting of track.

H. Special attention shall be paid to maintenance of track at following locations:-

   a. SEJs/breathing lengths

   b. Approaches of level crossings, points & crossings and un-ballasted deck bridges

   c. Horizontal and vertical curves

I. All fastenings shall be complete and well secured in position.

II. Mechanised Maintenance

A. Tamping in LWR/CWR with general lift not exceeding 50 mm including correction of alignment shall be carried out during the period when prevailing rail temperatures are as per above Para 7.(2)I.A&B together with precautions laid down therein.

B. 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.

C. Mechanised cleaning of shoulder ballast shall be undertaken when prevailing rail temperatures are within the limits prescribed together with the precautions mentioned therein.

III. Manual maintenance

A. At no time, not more than 30 sleepers 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 in between lengths shall not be undertaken till passage of traffic for at least 24 hours in case of BG carrying more than 10 GMT or 2 days in case of other BG routes.

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 td-30°C or maximum does not go beyond td+10°C, upto 100 sleeper spaces may be opened under the direct supervision of JE/SSE/P.Way.

D. It should however, be ensured that rail to sleeper fastenings on the entire length of LWR including SEJs are functioning satisfactorily.

IV. Casual renewal of sleepers

A. 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 temperature limits specified in Para 7.(2)I.A&B together with precautions mentioned therein.

B. Renewal of fastenings

The work of renewal of fastenings shall be carried out when rail temperature is within the limits specified in Para 7.(2)I.A&B 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 sleepers 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.

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 Gang Mate.

Alternatively, if prevailing rail temperature is lower than td-10, fastening up to 5 sleepers on either side may be removed for replacement of rubber pad under the rail.

(3) Special Track Maintenance *(Ref: Para 346 of IRPWM)*

Special track maintenance in LWR/CWR includes following operations:-

I. Through fittings renewal

II. Deep screening/mechanised cleaning of ballast

III. Lowering/Lifting of track

IV. Major realignment of curves

V. Sleeper renewal other than casual renewals

VI. Rehabilitation of bridges and formation causing disturbance to track

A. Through fittings renewal

Whenever it is decided to carry out through renewal of fittings, the LWR shall be distressed immediately after the TFR is completed of complete or part LWR.

B. Deep screening/mechanised cleaning of ballast

a. Provisions as laid down below shall apply to LWR/CWR regarding the sequence of operations of Ballast Cleaning Machine (BCM).

SCHEDULE OF SPEED RESTRICTION FOR DEEP SCREENING BY BCM FOLLOWED BY TAMPING AND STABILISATION BY DYNAMIC TRACK STABILIZER (DTS) MACHINE

Details of Work	Days of Work	Speed Restriction
Deep screening of track by BCM, ballast equalisation 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)	40 Kmph
Ballasting for recoupment of ballast deficiency (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 (2nd Tamping)	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	75 Kmph
Third round of tamping in design mode followed by two round of stabilization of track by DTS in controlled settlement mode.	8th day (3rd Tamping)	110 Kmph
Footplate/last vehicle inspection and speed raising	10th day	130 Kmph
Footplate/last vehicle inspection and speed raising	12th day	160 Kmph

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

c. 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. Any of the following two methods may be adopted for carrying out the work of deep screening/mechanised cleaning:

(i) If range of rail temperature falls within td+10°C to td-20°C, deep screening may be done without cutting or temporary de-stressing.

(ii) If range of rail temperature falls outside (a) above, temporary de-stressing shall be carried out 10°C below the maximum rail temperature likely to be attained during the period of work.

d. Constant monitoring of rail temperature shall be done during the progress of work. Should the temperature rise more than 10°C above td / temporary de-stressing temperature, adequate precautions shall be taken including another round of temporary de-stressing as required.

Note: *Deep screening shall be undertaken within a reasonably short period of temporary de-stressing so as to ensure that the temperature range as prescribed* at Sub-Para B.(c)(ii) above is *ensured, failing which temporary de-stressing may become due again.*

e. During the period of deep screening, if there is any possibility of minimum temperature falling 20°C below td / temporary de-stressing temperature,

cold weather patrol should be introduced to detect / guard against rail fractures.

f. Sequence of operation

(i) Deep screening of LWR may be done from one end of LWR to other end.

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

C. Other special maintenance

a. Other types of special track maintenance constitute jobs like lowering of track, major realignment of curves, renewal of large number of sleepers or rehabilitation of formation/ bridges causing disturbance to track.

b. For carrying out such maintenance, the affected length of track may be isolated from LWR/ CWR by introducing SEJs as needed.

c. After completion of work, the affected length of track shall be de-stressed at the required de-stressing temperature and joined with rest of the LWR/CWR.

(4) Certificate of Competency *(Ref: Para 1406 of IRPWM)*

In order to ensure safe working & proper output, a qualified person shall be appointed. Such 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.

Competency to carry out various Maintenance and Repair works in LWR Categories of staff competent to supervise and execute the works are listed in below table:-

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: ▪ Renewal of fastenings not requiring lifting.	Keyman	Divisional Training centre. (Valid for 5 years from the date of issue) In exceptional cases, by ADEN for one year

	▪ Emergency repairs to Rail fracture. ▪ Inspection and Checking of SEJ, ▪ Oiling and greasing and re-tightening/renewal of fittings once a fortnight.		as per Para 1402 (3) (c) of IRPWM.
2.	▪ Hot weather patrolling ▪ Cold weather patrolling ▪ Protection of track and secure safety of trains in case of buckling, rail fractures, or any abnormal behavior of track. ▪ Any other Patrolling ▪ For passing of train in emergency at rail/weld fracture site.	Patrolman (Railway Employee)	SSE/P.Way (Overall In-charge) (Experienced and trust worthy men from the Permanent Gang to work as patrolman/Watchman.)

(5) Work Chart and authorised level of supervision *(Annexure - 3/10 of IRPWM)*

SN	**Nature of work**	**Lowest level of staff/ Supervisor in charge of work**
1.	Manual Packing, Alignment.	Gang Mate
2.	Packing or renewal of single isolated sleeper not requiring lifting or slewing of track.	Gang Mate
3.	Renewal of fastenings not requiring lifting.	Keyman
4.	Renewal/recoupment of fastenings requiring lifting.	Gang Mate
5.	Making up of shortage of ballast in shoulders at isolated places.	Gang Mate
6.	Imposing speed restriction if the temperature exceeds (td + 20°) Celsius after maintenance work is completed, manually or by machines.	Gang Mate
7.	Ensuring that hot weather patrolman turns out promptly for duty during the required period of patrolling and during other periods when rail temperature exceeds (td + 20°) Celsius.	Gang Mate

8.	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
9.	Cold weather patrolling	Cold weather patrolman
10.	Emergency repairs	Keyman. Trackmen with valid competency Certificate
11.	Protection of track and secure safety of trains in case of buckling, rail fractures, or any abnormal behavior of track.	Patrolman

(6) DOs and Don'ts for LWR Track

I. DOs

(1) Each Gang mate should check and carry LWR/CWR equipment daily. Mate should keep joggled fishplates, 2 clamps, special 1m long fish-plates, rail closure pieces one rail thermometer. The thermometer should be regularly checked with that of standard thermometer kept in SSE/PW's office.

(2) Know the td of LWR of their section.

(3) Keep the ballast section full and in compacted condition particularly in cribs and shoulders. Deficiency in ballast shall be brought to the notice of SSE/P.Way.

(4) Keep close watch on pedestrian and cattle crossings, where the ballast is always disturbed. Make up ballast deficiency promptly.

(5) Get your SEJs oiled and greased once in a fortnight and tightening of fastenings shall be done simultaneously.

(6) Check the gaps of SEJ at extremes of temperatures.

(7) Train track maintainer to detect rail fractures, buckling etc. and to safeguard trains in such cases.

(8) Keep the patrolling equipments always handy and start patrolling of track as soon as temperature exceeds td + 20^{O}C. *{Ref: Annexure - 3/10 5(C) of IRPWM).* This is to be marked on the thermometer in red.

(9) Commence patrolling as per laid down schedule for the prescribed periods.

(10) Keep sharp look out for severe alignment defects in summer. Protect the

trains and report to supervisors.

(11) Ballast section shall be properly maintained, especially on pedestrian & cattle crossings, curves and approaches to level crossings and bridges. Dwarf walls may be provided on pedestrian and cattle crossings to prevent loss of ballast.

(12) Cess level should be correctly maintained.

(13) 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 Gang Mate 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.

(14) Sufficient quantity of ballast shall be collected to provide full ballast section before commencing any maintenance operation, specially lifting.

(15) 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.

(16) When crowbars are used for slewing, care shall be taken to apply these in a manner so as to avoid lifting of track.

(17) 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 temperature limits specified for working range together with precautions mentioned therein.

(18) The work of renewal of fastenings shall be carried out when rail temperature is within the working range for LWR with following additional precautions:-

(i) 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 sleepers 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.

(ii) 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 Gang Mate. Alternatively, if prevailing rail temperature is lower than td-10, fastening up to 5 sleepers on either side may be removed for replacement of rubber pad under the rail.

(19) Ensure that fittings are complete and tightly fitted at proper places at all times.

(20) Pack loose sleepers without lifting or opening track in summer.

(21) Attend only one or two sleepers at a time for adjusting fittings while removing a kink.

(22) Confine essential maintenance to period when the temperature is between td+10°C and td-30°C for conventional PSC track and td+15°C and td-30°C for wider base sleepers track.

(23) Impose speed restriction of 50 Km/h, If rail temperature after the maintenance operation exceeds td+20°C for conventional PSC sleeper and td+25°C for wider base sleepers during the period of consolidation. *(Ref:ACS-17 of IRPWM)*

(24) Pay special attention to SEJs, breathing lengths, curves, approaches to level crossings, un-ballasted bridges, horizontal and vertical curves.

(25) Keep the rail thermometer with proper markings with limiting temperature ranges thereon in proper working order. Learn the limits of temperature restrictions as marked on thermometers for various operations.

(26) Check that reference posts at SEJ and at centre of LWR/CWR are correctly maintained.

(27) Learn the six items about which you should be very careful to avoid buckling

(i) Missing and loose fastenings,

(ii) Shortage of ballast,

(iii) Misalignment

(iv) Slewing

(v) Lifting

(vi) Improper packing

(28) Learn what to do when there is buckling or fracture in the track.

(29) Ensure that all bridges and its approaches have all fittings at all times and are regularly tightened.

II. Don'ts

(1) Do not touch the track unnecessarily unless specially instructed by SSE/P.Way.

(2) Do not undertake through packing after, the onset of summer months.

(3) Do not open shoulder and crib ballast at one and the same time.

(4) Do not try to lift the track while packing sleepers for replacement of fastenings and slewing with crow bars.

(5) Do not open the track for more than 30 sleepers in a stretch. Keep at least 30 fully boxed sleeper between adjacent lengths opened out. Do not open the adjacent length till the passage of 20,000 tone of traffic or two days, whichever is later.

(6) Do not renew more than one sleeper within 30 sleepers at a time.

(7) Do not allow loose, missing or ineffective fastenings to remain in track.

(8) Do not neglect checking and attending to the breathing lengths of LWR/CWR in a fortnight.

(9) Do not lift track by more than 50 mm even if temperature is within td.

(7) Hot and Cold Weather Patrolling *(Ref: Para 353 & 1005 of IRPWM)*

Walking on track and monitoring the track during summer when rail temperatures are well above the de-stressing temperature and during winter when rail temperature is significantly lower than stress-free/de-stressing temperature.

I. Hot Weather Patrolling

Period for hot weather patrolling is laid down by the Chief Track Engineer for each section and patrol charts prepared where necessary. Patrolling shall be organised by JE/SSE/P.Way accordingly. In addition, the JE/SSE/P.Way and the Gang Mate shall be vigilant during summer and on hot days.

A. Patrolling will be introduced when the rail temperature rises above:-

a. Td + 30°C on Wider Base PSC sleeper track with sleeper density 1660 nos. per km and above.

b. Td + 25°C on PSC sleeper track with sleeper density 1540 nos. / km and above.

c. Td + 20° C on PSC sleeper track with sleeper density less than 1540 nos. / km

B. Patrol beat for Hot weather patrolman

a. On single line or where only one road in a double line section is having LWR/CWR- One patrolman for 2 km.

b. On double line section when LWR/CWR exist on both roads - One patrolman for 1 km length of UP and DN road. The beats of each hot weather patrolman will thus be restricted to 2 km.

c. Changes in beat length and man power deployment as given above, if found necessary, may be decided by the Sr. DEN (Co) of the division depending on prevailing local conditions, frequency of train service, weather conditions etc.,

C. Equipment of hot weather patrolman: -

HS Flags - Red 2 nos.

Staff for Flags 1 nos.

Detonators 10 nos.

Canne-a-boule fitted with rubber ball 1 no.

D. 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. He shall protect the track at the site of the prominent kinks, incipient or actual buckles and report the same to nearest Station Master and JE/SSE/P.Way immediately. The patrolman shall preferably be provided with a GPS tracking device, to monitor his movements so as to ensure effective patrolling.

He 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 side of rail in the return direction. On double lines, he will repeat this procedure alternately on UP and DN tracks. He will be vigilant and look out for kinks in the rail especially during the hottest part of the day. 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 meticulously sound each and every sleeper, 100 sleepers on either side of the kink, to determine any floating condition. The amount of rebound will be noted by dropping a Canne-a-boule on each end of the sleeper to determine the extent of void under the sleeper. Should the amount of rebound reveal a floating condition, under which a buckle may be anticipated or 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 Gang Mate, JE/SSE/P.Way of his apprehension of a buckle/actual buckle.

The Gang Mate 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 means. No attempt should be made to slew or align the track or disturb the existing ballast section. The Gang Mate should continue to remain at site till the arrival of JE/SSE/P.Way. 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.

II. **Cold Weather Patrolling**

Period and section where cold weather patrolling is to be done shall be laid down by Sr. DEN (Co) of the division based on rail/weld fracture analysis, extent of rail corrosion, overdue rail renewals and traffic density. Cold weather patrolling shall compulsorily be started when rail temperature goes below (td-30^{0}C). Patrol charts will be prepared where necessary. Patrolling shall be organized by JE/SSE/P.Way (In-charge) accordingly.

A. Patrol Beat for Cold Weather Patrolman

a. On single line or where only one road in a double section is having LWR/CWR - One patrolman for four kilometres.

b. On double line section when LWR/CWR are on both roads - One patrolman for Two-kilometres length of UP and DN road.

c. Changes in beat length and man power deployment as given above, if found necessary, may be decided by the Sr. DEN (Co) of the division depending on prevailing local conditions, frequency of train service, weather conditions etc.

B. Equipments of Cold Weather Patrolman

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

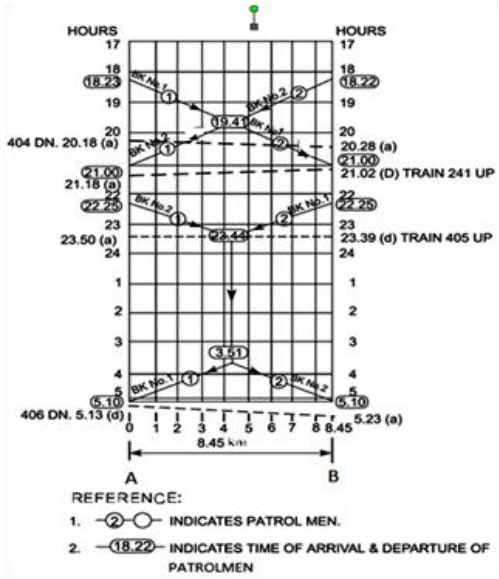
f. One staff

g. Number plate

h. Spanner

C. Protective clothing according to local dress regulations including industrial safety shoe / Gum boots, Safety jacket, Rain coat, Helmet with Head light.

D. Patrol Charts shall be prepared as per following sample chart,



E. 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. 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/JE/SSE/P.Way. The patrolman shall preferably be provided with a GPS tracking device, to monitor his movements so as to ensure effective patrolling.

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. After protecting the track, the patrolman will arrange to report to Keyman/Gang Mate, JE/SSE/P.Way who shall arrange for making emergency repairs to pass the traffic.

8. Action to be taken in case of Rail fractures/Weld failures *(Ref: Para 1406 of IRPWM)*

It is of Paramount importance that whenever a fracture of a rail/welded joint is noticed, immediate action is taken to restore the track, if necessary with restricted speed, with the least possible delay.

(1) Protection of Line

(a) The Gang Mate/Keyman/Trackman, as soon as he notices the rail fracture/weld failure should first protect the track. He should also send information to the JE/SSE/P.Way and the Station Master of the nearest station.

(b) **Temporary Signals in Emergency**

Please refer Annexure-I for Temporary Signals in Emergency

(2) Emergency repairs

The fractured rails shall be joined by using the Special 1 m long fishplates with screw clamps and joggled fishplates with bolted clamps for fractures at welded joints with or without insertion of closure rail piece as per site conditions and feasibility.

(a) If the fracture is with a gap of less than 30 mm, the fractured rail ends should be joined with fish plates and clamps.

(b) When the fracture gap is more than 30 mm, a closure of appropriate length should be used, and fish plated with clamps.

(c) In cases where a small portion or piece of rail has come off or in the case of multiple fractures, the rail has to be changed before allowing traffic.

(d) In the case of weld failure, joggled fishplates and clamps should be used.

(3) Restoration of traffic

(a) After carrying out the emergency repairs the trains may be passed by a Gang Mate/Keyman at speed **STOP DEAD & 10 kmph and** Subsequent trains with speed limit of 20 kmph, until the Permanent Way official replaces the rail *(Ref: Annexure - 3/10 of IRPWM)*.

(b) Trackman deputed as patrolman (Railway Employee) may also pass only the first train (Speed for **First train STOP DEAD & Proceed with 10 kmph)** which is stopped by him in the course of protection of track after detecting rail/weld failure and after carrying out the emergency repairs, if he feels confident of passing the train.

9. Buckling of LWR Track *(Ref: Para 351 of IRPWM)*

When high compression forces are developed in the tracks due to inadequate lateral resistance in the track, the track alignment gets disturbed, is known as 'buckling'.

A special watch should be kept on the kinks in the rail especially during the hottest part of the day. P.Way staff will be vigilant and look out for sun kinks in the rails.

(1) Conditions, which may induce Buckling

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 prescribed procedure, which can lead to the disturbance to the forces in the LWR.

(2) Tendency towards Buckling

(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.

(3) Repairs to buckled track

(a) When the track actually buckles, the traffic shall be suspended and the cause of buckling ascertained.

(b) The rectification shall normally be carried out in the following stages under the supervision of JE/SSE/P.Way:-

I. Emergency repairs *(Ref: Para 351(3)(b)(i) & Annexure-3/8 of IRPWM)*

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 due 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 for first train STOP DEAD & 10 kmph and Subsequent trains at 20 kmph.

II. Permanent repairs

As soon as possible, the clamped joints shall be welded**.** 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 length of track of minimum 500 m on either side of the location of buckling of the affected LWR shall be de-stressed as soon as possible and

complete LWR shall be inspected by ADEN and further action as deemed necessary shall be taken.

10. De-stressing of LWR when required During maintenance

A. Abnormal behavior of LWR/CWR *(Ref: Para 347 of IRPWM)*

(1) Abnormal behavior of LWR/CWR can be inferred by observing one or more of the following:-

(a) When the gap observed at SEJ

(i) Differs beyond limits as specified for various Rail Temperatures

(ii) Exceeds the maximum designed gap of SEJ

(iii) When tip of tongue rail/corner of Stock Rail crosses the reference line

(b) In case of excessive creep of more than 20 mm in the central portion of LWR is noticed.

(2) In such cases of abnormal behavior, LWR/CWR shall be inspected by ADEN for,

(i) Deficiency of ballast,

(ii) Poor compaction / consolidation of ballast,

(iii) Deficiency of fittings,

(iv) Poor toe load of ERC

(v) Formation trouble if any,

(vi) Whether the specified procedures for rectification of rail fractures were followed during the permanent repairs after earlier rail fracture(s),

(vii) The possibility of defective thermometers being used by the staff.

After the above inspection, the deficiency shall be made good at the earliest by suitable corrective action, to improve the track resistance. Thereafter, the SEJ/LWR shall be kept under close observation by active monitoring by the JE/SSE/P.Way. If LWR/CWR still behaves abnormally, a decision shall be taken by ADEN for distressing of LWR/CWR.

B. After following special maintenance operations, de-stressing shall be undertaken. *(Ref: Para 346 & 347 of IRPWM)*

(1) Through fittings renewal

(2) Deep screening/mechanized cleaning of ballast

(3) Lowering/Lifting of track

(4) Major realignment of curves

(5) Sleeper renewal other than casual renewals

(6) Rehabilitation of bridges and formation causing disturbance to track

C. After restoration of track following an unusual occurrence as mentioned below, distressing shall be undertaken. *(Ref: Para 347 & 348 of IRPWM)*

(1) Rail fractures or replacement of defective rail/ glued joint.

(2) Damage to SEJ.

(3) Buckling or tendency towards buckling.

(4) Factors causing disturbance to LWR/CWR such as accidents, breaches etc.

D. If number of locations where repairs by way of replacement of rail / weld have been done, exceed three per km, de-stressing of affected portion of LWR / CWR shall be done.

11. De-stressing Operation of LWR *(Ref: Para 339 of IRPWM)*

The work of de-stressing shall be done during a traffic block under the personal supervision of JE/SSE/P.Way.

De-stressing shall be done when rail temperature falls between the range provided for td. If required temperature cannot be obtained in field, de-stressing can be done at a little lower temperature than the targeted stress-free temperature to with the use of rail tensors.

(1) De-stressing without Rail Tensors *(Ref: Para 340 of IRPWM)*

In case rail temperature at the time of de-stressing is within the range specified for td, detailed procedure as given below may be adopted.

(a) The LWR, if longer than manageable lengths that cannot be de-stressed at a time, then, the LWR shall be de-stressed in parts by tackling manageable lengths depending on the availability of Block, labour etc.

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

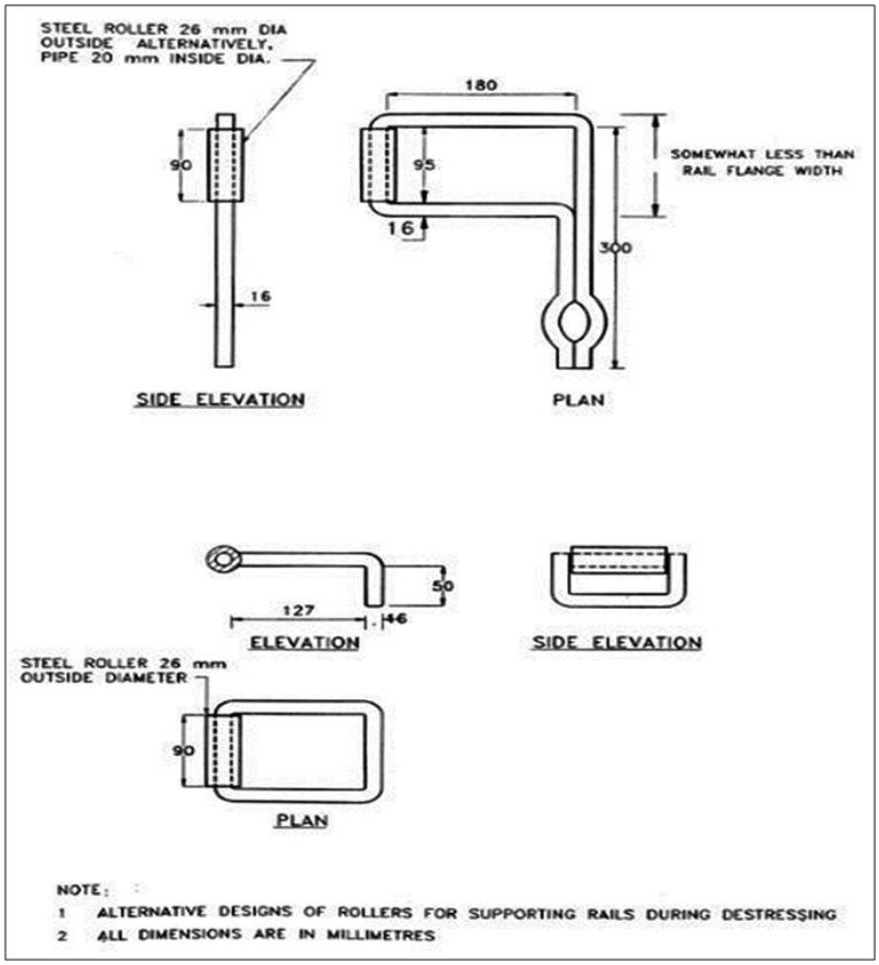
(c) A traffic block of adequate duration should be arranged at such a time that the rail temperature will be within the temperature range specified for td during the fastening down operations of fittings.

(d) Before the traffic block is actually taken, a speed restriction of 30 Kmph should be imposed and fastenings on alternate sleepers loosened.

(e) When the traffic block is taken, a closure rail near the SEJ shall be cut and removed, the 40 mm gaps at SEJ to be provided at 52 kg/60 kg SEJs at the time of de-stressing (at ‘td’) of LWR/ CWR and fastened.

(f) The remaining fastenings on both running rails shall be loosened/removed starting from the ends near the SEJs and proceeding towards the centre of LWR. The rail shall be lifted and placed on rollers at every 15th sleeper to

permit the rails to move freely. While de-stressing on curved track, provision of side rollers may be adopted. The rails shall be struck horizontally with wooden mallets to assist in their longitudinal movement.





(g) The rollers shall then be removed, the rails lowered to correct alignment and fastenings tightened, starting from the middle of LWR and proceeding towards both ends simultaneously. The tightening of fastenings shall be completed within the temperature range for td. The actual range of temperature during the period of tightening shall be recorded by JE/SSE/P.Way along with the

time and date.

(h) Simultaneously with the tightening of fastening, arrangements for insertion of cut rails, 4 metre or longer, between the SEJ and LWR shall be started. The four gaps shall be measured individually and the rails of required length cut by saw keeping required gaps for AT welding. The cut rails shall then be placed in position, fastened to the sleepers and welded at each end. Fastenings for 20 m on each end of the LWR shall be removed before welding.

(2) De-stressing with Rail Tensors



Hydraulic Rail Tensor

For de-stressing of LWR with the use of rail tensor, the following procedure shall be adopted:-

(a) The LWR, if longer than manageable lengths that can be de-stressed at a time, then, the LWR shall be de-stressed in parts by tackling manageable lengths depending on the availability of Block, labour and the capacity of the tensor available etc.

(b) 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 shown in Fig. (2).

(d) Mark the anchor length A1 A2 and C1 C2 each equal to la at either end of the length A2 C2 to be de-stressed {Fig. (2) (a)}.

Note: *The anchor length ‘la’ should be determined on the basis of the lowest value of tp at which the de-stressing is likely to be carried out. Anchor length shall be increased suitably based on the condition of the fastenings, rubber pads, liners or ballast.*

(e) Erect marker pillars W0 W1 etc., on each of the length A2 B and C2B. Transfer the marks W0 onto the rail foot {Fig. (2) (a)}.

Note: *The distances W0 W1, W1 W2 etc. shall be marked at about 100 m intervals, the distance from the previous pillars and the last pillar WB may be less than 100 metre.*

(f) When tp is less than the desired to {Fig. (2) (b)}, de-stressing operation shall be carried out for the lengths A2 B and C2 B as described below:-

I. Unfasten and mount on rollers the portion from A2 C2.

Note: *Side rollers on the inside of curve shall also be used while undertaking distressing on curved track these should be spaced at every nth sleeper,*

Where, n = Radius of curve (R) x No. of sleepers per rail length 50 x (to-tp)

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

III. Fix the rail tensor across the gap at 'B' and apply tension so as to obtain some movement at W0 to remove any kinks or misalignment and to minimize the friction in the rollers etc. Release the tension and note the movement Y0 at W0.

IV. Transfer marks W1, W2,..... onto the rail foot and note temperature tp.

V. Calculate the required movement at W1 = Yo + elongation of length W0 W1 (L) due to temperature difference (to - tp) = Y0+ Lα (to - t p)

VI. Calculate the required movement at W2 = Movement at W1 + elongation of length W1W2 (L) due to temperature difference (to - tp). Similarly, calculate the required movements successively at each of the remaining points.

VII. Mark the above calculated extensions with respect to the transferred marks referred at (d) above on the rail foot on the side away from the tensor.

VIII. 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.

IX. 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.

Note:

(i) Below extension table gives the value of Lα (to - tp) for different values of L and (to - tp).

EXTENSION TABLE

(°C)	L in metres													
$t_o - t_p$	10	20	30	40	50	60	70	80	90	100	200	300	400	500
1	-	-	-	-	1	1	1	1	1	1	2	3	5	6
2	-	-	1	1	1	1	2	2	2	2	5	7	9	11
3	-	1	1	1	2	2	2	3	3	3	7	10	14	17
4	-	1	1	2	2	3	3	4	4	5	9	14	18	23
5	1	1	1	2	3	3	4	5	5	6	11	17	23	29
6	1	1	2	3	3	4	5	6	6	7	13	21	28	34
7	1	2	2	3	4	5	6	6	7	8	16	24	32	40
8	1	2	3	4	5	6	6	7	8	9	18	28	37	46
9	1	2	3	4	5	6	7	8	9	10	21	31	41	52
10	1	2	3	4	6	7	8	9	10	11	23	35	48	57
11	1	3	4	5	6	7	9	10	11	13	25	38	50	63
12	1	3	4	5	7	8	9	11	12	14	28	41	55	69
13	1	3	4	6	7	9	10	12	13	15	30	45	60	75
14	2	3	5	6	8	10	11	13	14	16	32	48	64	80
15	2	3	5	7	9	10	12	14	16	17	34	52	69	86
16	2	4	6	7	9	11	13	15	17	18	37	55	74	92
17	2	4	6	8	10	12	14	16	18	19	39	59	78	98
18	2	4	6	8	10	12	14	17	19	21	41	62	83	103
19	2	4	6	9	11	13	15	18	20	22	44	66	87	109
20	2	5	7	9	11	14	16	18	21	23	46	69	92	115
21	2	5	8	10	12	14	17	19	22	24	48	73	97	121
22	3	5	8	10	13	15	18	20	23	25	51	76	101	126
23	3	5	8	11	13	16	19	21	24	26	53	79	106	132
24	3	6	8	11	14	17	20	22	25	28	55	83	110	138
25	3	6	9	12	14	17	20	23	26	29	57	86	115	144
26	3	6	9	12	15	18	21	24	27	30	60	90	120	149
27	3	6	9	12	16	19	22	25	28	31	62	93	124	155
28	3	6	10	13	16	19	23	26	29	32	64	96	129	161
29	3	7	10	13	17	20	23	27	30	33	67	100	133	167
30	3	7	10	14	17	21	25	28	31	34	69	103	138	172

Extension in mm, based on formula $e = L \alpha (t_o - t_p)$

(ii) Only one value of tp has to be taken at the time of marking W1, W2 etc. on the rail foot.

The values of tp is not required to be taken thereafter. 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.

(iii) If for any reason, both the lengths A2B and C2B cannot be fastened down simultaneously, the final adjustment in pull and fastening down of the individual segments may be done in series, first from A2 to B and then, from C2 to B.

X. After the fastening down of the last length A2B and C2B is completed, make a paint mark near free end of one rail at a distance of (X metre + 2 x 25 mm -1 mm), measured from the end of the other rail across the gap spanned by the rail tensor.

XI. Remove the tensor, close the 1 m gap temporarily and allow traffic at restricted speed {Fig. (2) (c)}.

(g) During traffic block, cut the rail at the paint mark, insert a rail closure of length exactly equal to X metre and weld one end thereof {Fig. (2) (d)}.. If the gap at the other end is also 25 mm, it can be welded in the same block. Otherwise, fasten with special fishplates and clamps and allow traffic at restricted speed. In the latter case, during a subsequent block, when tp is not greater than to, release rail fastenings on either side to the required extent of about 50 to 75

m and pull the rails with rail tensor to get the desired gap of 25 mm {Fig. (2) (e)}; refasten the rail and weld the joint. Release the tensor after a lapse of a minimum of 30 minutes after pouring of the weld metal.

Note:

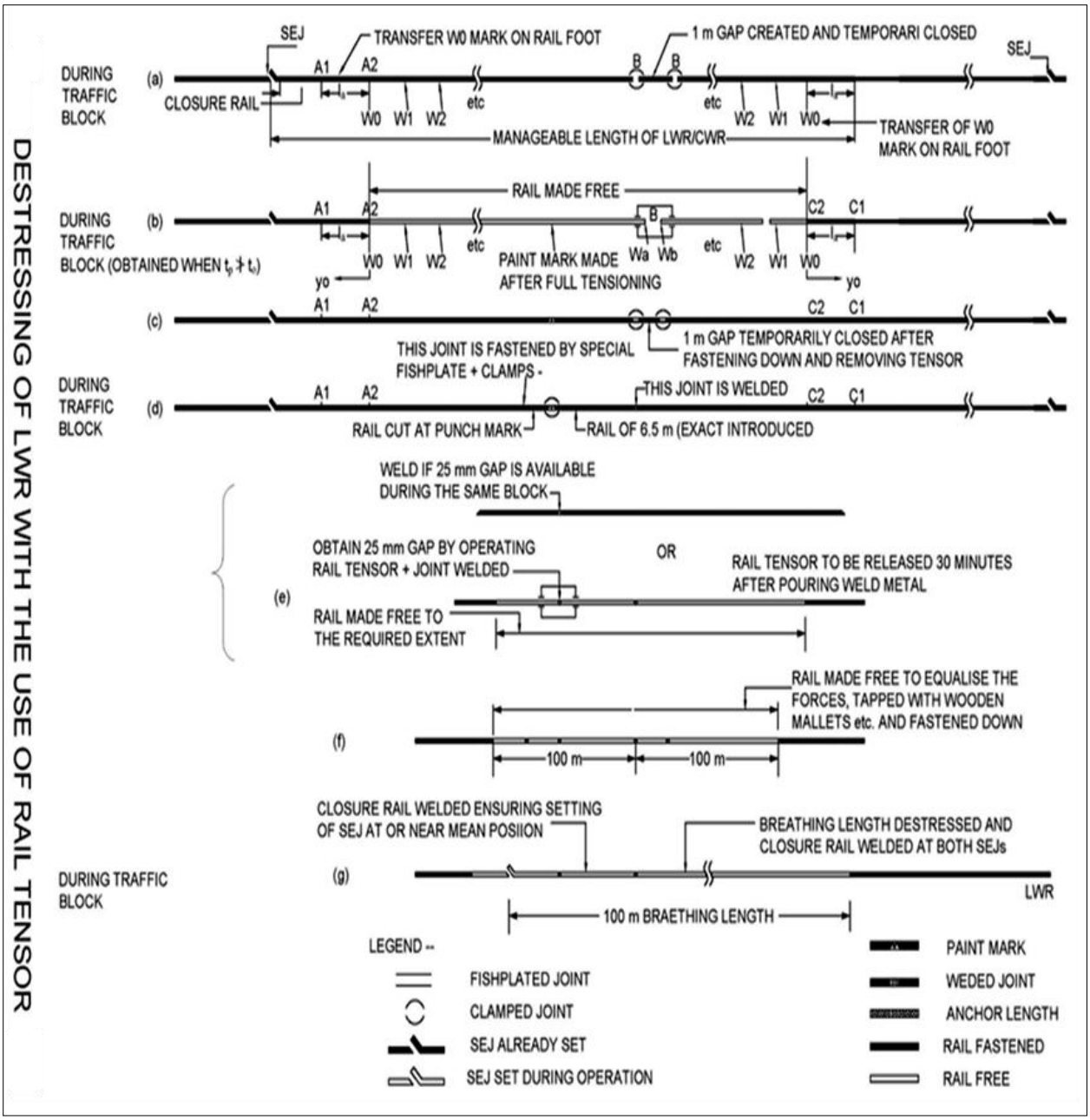
(i) X=4 metre or longer

(ii) In case gap at the time of the second weld as above is less than the desired welding gap, additional cutting of rail shall NOT be done to create correct gap for welding. In such cases, the welding should be done below td and the requisite gap for welding shall be created by using rail tensor and equalization of forces as described below shall be done.

(h) During a traffic block, when tp is less than td, 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. {Fig. (2) (e)}. Fasten down the rail and allow traffic.

(i) The above procedure should be repeated for the remaining segments, if the entire LWR is to be de-stressed.

(j) During another traffic block, when tp is within the range of temperature specified for td, destress the end 125 metre from SEJ. Thereafter, weld the closure rail next to SEJ duly ensuring setting of the gaps at SEJ.



12. Different types of SEJ

(1) Conventional Switch Expansion Joint (SEJ) (*Ref: IRICEN-Digital Model Room (I)*)

The SEJ has a pair of tongue rails and stock rails resting on 6 wide sleepers of width 300 mm. The centre line of sleeper which also coincides with centre line of middle Tee head bolt (total of 3 bolts on middle sleeper). This centre line coincides with the tip of the tongue rail. Then after 20mm the mark for reference line is made. Beyond that mark, after 20 mm, tip of stock rail is kept. This gives an initial gap of 40 mm. The centre to centre spacing of middle two sleepers is 700 mm while the sleepers spacing of others is kept at 650/600 mm based on sleeper density.



Sl No	Drawing No.	Brief Description	Max. Gap
1	RDSO/T - 4160	SEJ with 80 mm max. gap for LWR B.G. 52 Kg.	80 mm
2	RDSO/T - 4165	SEJ with 80 mm max. gap for LWR B.G. 60 Kg.	80 mm

{Ref: RDSO/track/drawings/point_crossing/S.N.4}

(2) Improved Switch Expansion Joints (ISEJ) 52 Kg & 60 Kg *{Ref: RDSO/track/ drawings/point_crossing/S.N.12}*

Sl No	Drawing No.	Brief Description	Max. Gap
1	RDSO/T - 6902	Assembly for improved SEJ for LWR B.G. 60 Kg (UIC) ON PSC Sleepers (Single Gap)	80 mm
2	RDSOT - 6914	Assembly for improved SEJ for LWR (with 80 mm max. gap) B.G. 52 Kg. (Single Gap)	80 mm
3	RDSO/T - 6922	Assembly for improved SEJ for LWR with max. gap B.G. 60 Kg. (Double Gap)	65 mm
4	RDSO/T - 6930	Assembly for improved SEJ for LWR B.G. 52 Kg.(Double Gap)	65 mm

Note: - Combination SEJ to RDSO Drawing No. RT-6782 with 80 mm gap shall be provided between the junction of 52 Kg rail and 60 Kg rail

(a) Salient features of Improved SEJ

I. Excellent riding comfort.

II. Low life cycle cost.

III. No undue stress on the rails.

IV. Capable of being laid on curved tracks.

V. Head hardened wheel transfer zone leading to longer service life

VI. Smooth wheel transfer, increasing the life of rolling stock.

VII. Capable of handling gaps up to 200mm and more with minor modifications.

VIII. Safe due to presence of check rails which guard against excessive play of worn out wheels.

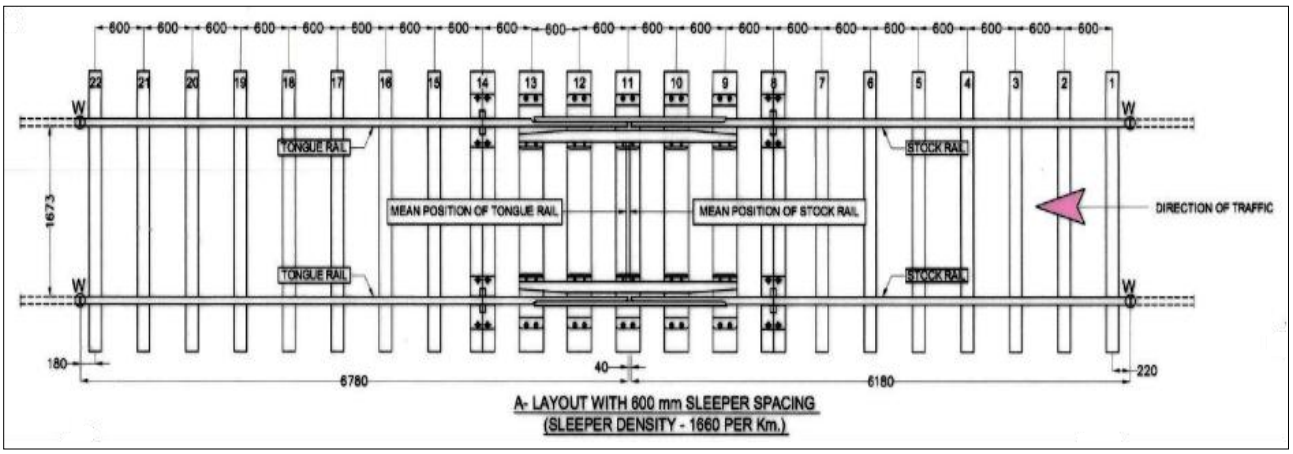
IX. Continuous support for wheel-set on rail ; no jump or change in level of wheel-set while negotiating gaps.

X. The tongue rail is kept at mean position at center line of sleeper and stock rail end kept at 40mm from mean position, thus creating a gap of 40mm.

(b) Improved Switch Expansion Joint (SEJ) - Single Gap *{Ref: IRICEN-Digital Model Room (I)}*

This running rail along with the gap avoiding rail fastened to it, together form the stock rail. The other running rail is called the tongue rail. The non-bolted part of the gap avoiding rail supports the machined segment of the tongue rail. The whole arrangement rests on 5 wide sleepers 300 mm wide.





A- LAYOUT WITH 600 mm SLEEPER SPACING
(SLEEPER DENSITY - 1660 PER Km.)

(c) Improved Switch Expansion Joint (SEJ) - Double *{Ref: IRICEN-Digital Model Room (I)}*

This stock rail is now considered to be static with negligible expansion and contraction in length due to temperature. The LWR of each side expands and contracts at the gap while this stock rail remains static. This SEJ makes use of 6 wider concrete sleepers in total, 3 sleepers at each gap. MS angle tie bracket is used to maintain the sleeper spacing on these wide sleepers.

I. Advantages of Two gap SEJ *(Ref: IRICEN/ ZTRI Track Module ppt 3.3)*

A. The maximum gap is 57 mm which lead to lesser impact under passing wheels as compared to gap of 74 mm in IRS type.

B. It gives the field staff better control in providing correct nominal gap at the time of installation/ replacement of SEJ.

C. The minimum head width of tongue rail is more than 61% of full rail head width (44.75mm) as against 35% of head width (25.5mm) in conventional type.

D. The wear prone areas of heads of stock and tongue rails are pearlitised through a special process to achieve a hardness of 320 BHN

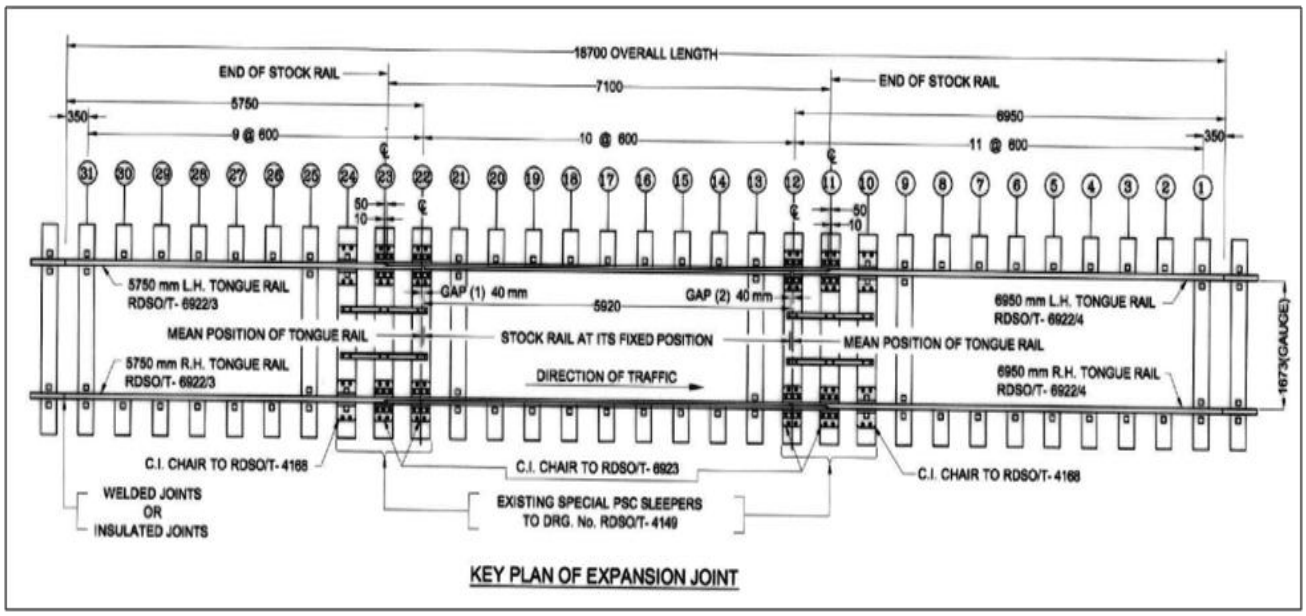
E. Maximum head thickness of stock rail is 89.5 mm as compared to 72 mm in IRS type of SEJ which in turn increases wheel support.

F. Status of stock rail is static as compared to moving type in IRS type of SEJ.

G. It is suitable to be laid in curves in steps of 1º,1.5º,2º,2.5º,3º,3.5º,4º by supplying pre curved stock rails.

H. The tongue rail being slender can be curved at site by the field staff.

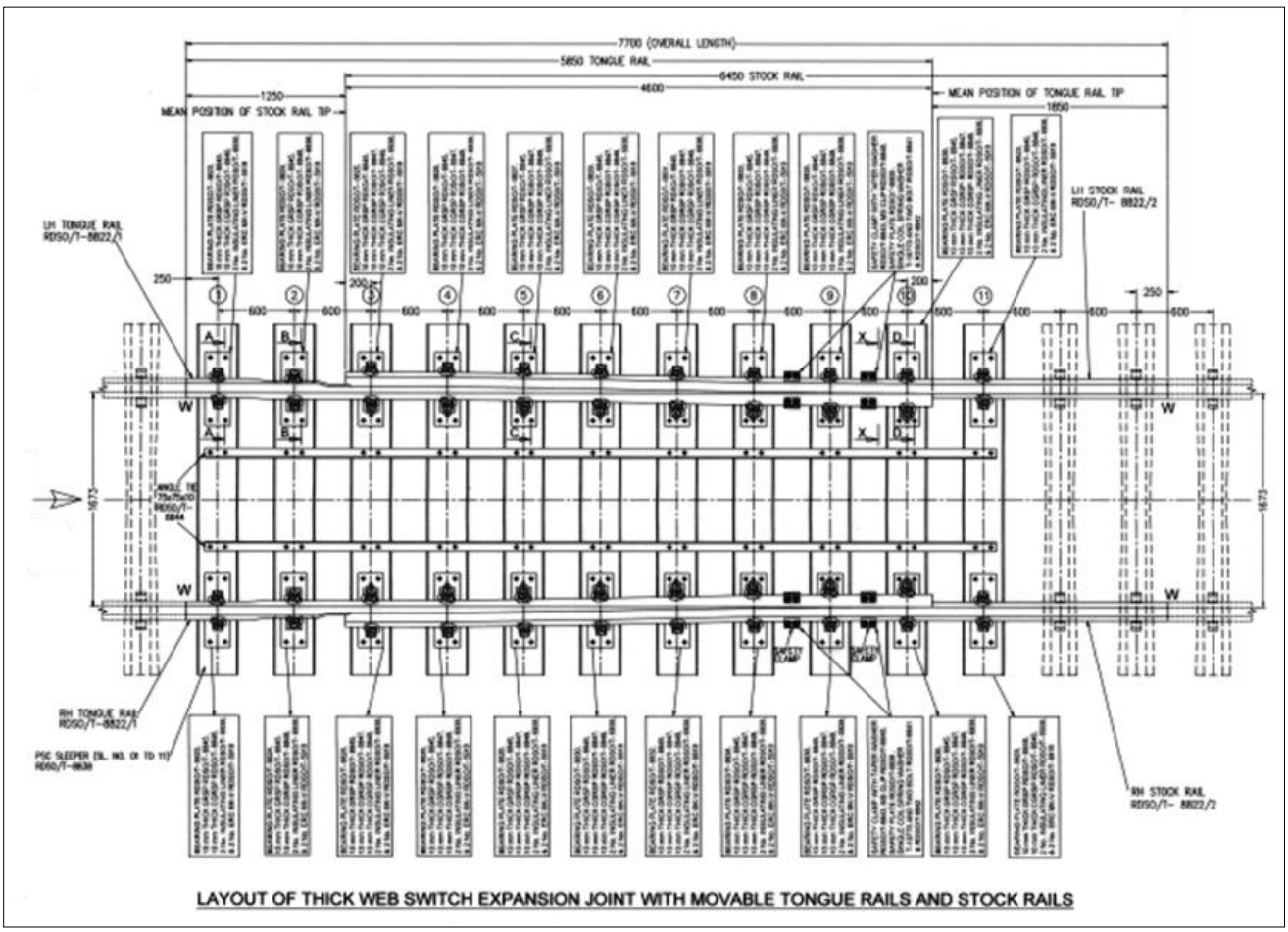




(3) Thick-Web Switch Expansion Joint (RDSO/T-8822)

{Ref: RDSO/track/drawings/point_crossing/S.N.19}

Assembly for Thick web switch expansion joint (TWSEJ) (Up to 100 mm permissible movement at each end) for LWR 60 Kg (UIC) rail.



13. Renewal of Switch Expansion Joints *{Ref: Para 1602 (4)(e) IRICEN Handbook for Track Maintenance}*

SEJs shall be planned for renewal as per the service life specified below. All renewals of SEJs shall be carried out with improved SEJs only. Conventional SEJs shall be eliminated in phased manner.

Service life of SEJ in GMT

Item	Service life (In GMT)	
	60 Kg	52 Kg
Ordinary SEJ 200	200	150
Improved SEJ	400	300

14. Routine Maintenance & Special Maintenance of SEJ *(Ref: IRICEN/ ZTRI Track Module ppt 3.3)*

- All fastening shall be complete and well secured.
- Fastening shall be renewed on not more than one rail seal at a time.
- Once in fortnight the SEJ shall be checked, packed and aligned if necessary.
- Oiling and Greasing of Tongue rail & Stock rail shall be carried out once in fortnight.
- During daily patrolling, the Key man shall keep special watch on the SEJ.
- Initial gap at SEJ at t_d to be adjusted during distressing.

(1) Lubrication of SEJ by Keyman

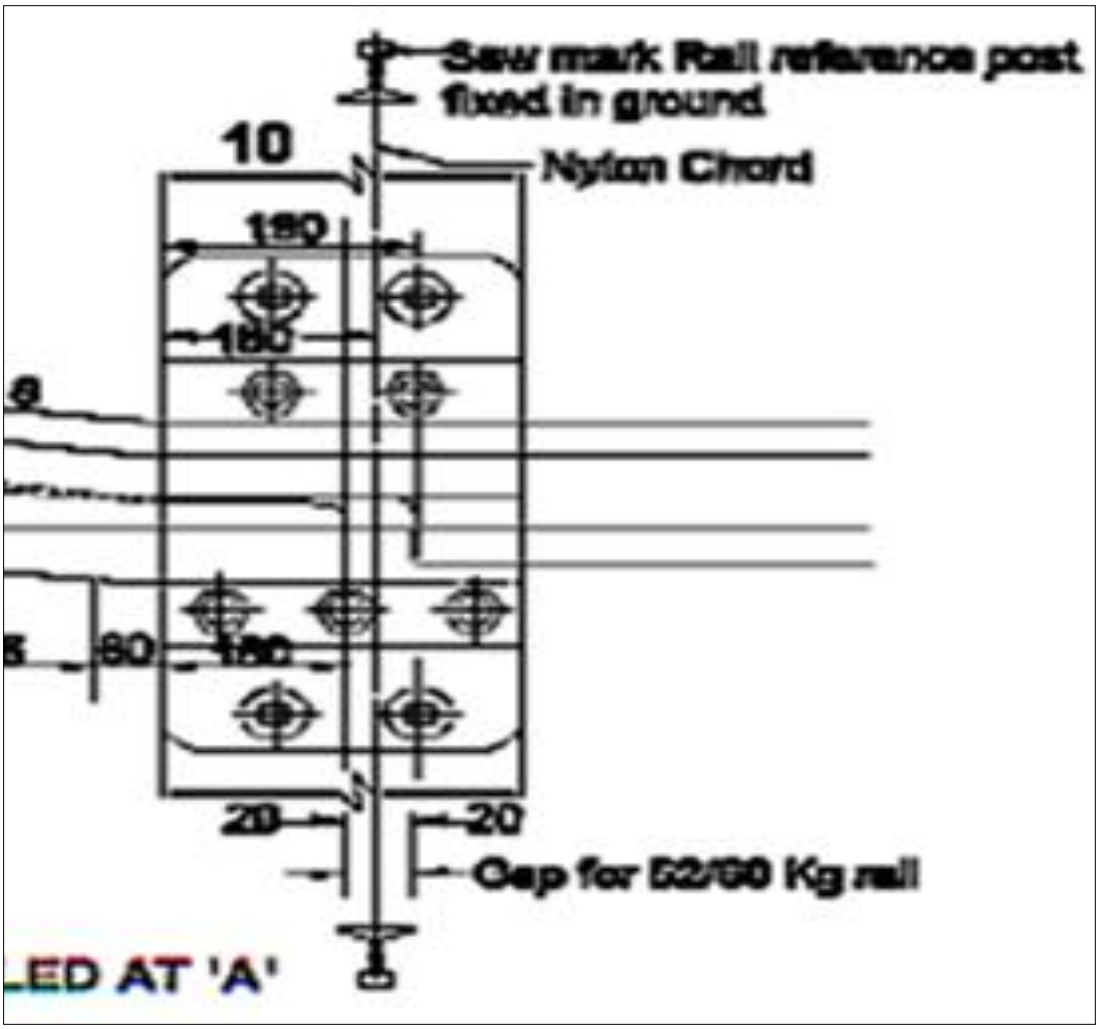
Periodical (fortnightly) oiling and greasing of SEJ, checking and retightening of fastenings at SEJ and other sleepers, if necessary.

To watch for sun kinks, loose or missing fastening which may result in buckling or any damage to SEJ.

(2) Reference Mark and measurement *(Ref: IRICEN/ ZTRI Track Module ppt 3.3 andPara 343 of IRPWM)*

(a) Reference marks shall be fixed at each SEJ and at the centre of LWR/CWR, on the reference pillars erected for this purpose. Pillars shall be erected at Centre of SEJ and reference marks shall be marked on these pillars on either side of track during distressing and shall not be shifted or tampered with thereafter.

(b) At the time of distressing SEJ gap to be provided 40 mm. The tip of tongue rail is kept at the centre of ‘mid bolt of SEJ plate’. Reference line is fixed 20 mm from the tip of tongue rail towards stock rail. Total gap measured between tip of tongue rail to sdge of stock rail is 40 mm. Illustreted in image below;



(c) 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.

(d) In no case, a saw mark shall be made on the running rail.

(e) A string shall be stretched across track over the saw marks of reference for measuring SEJ gap with respect to tip of Tongue rail/Edge of Stock rail.

(3) Unusual Occurrences *(Ref: IRICEN/ ZTRI Track Module ppt 3.3)*

(a) If another SEJ is not available for replacement, both damaged SEJ rail and undamaged SEJ rail on opposite side shall be replaced by closure rail and connected to LWR/SWR with suitable clamps and fishplates.

(b) New SEJ to be installed.

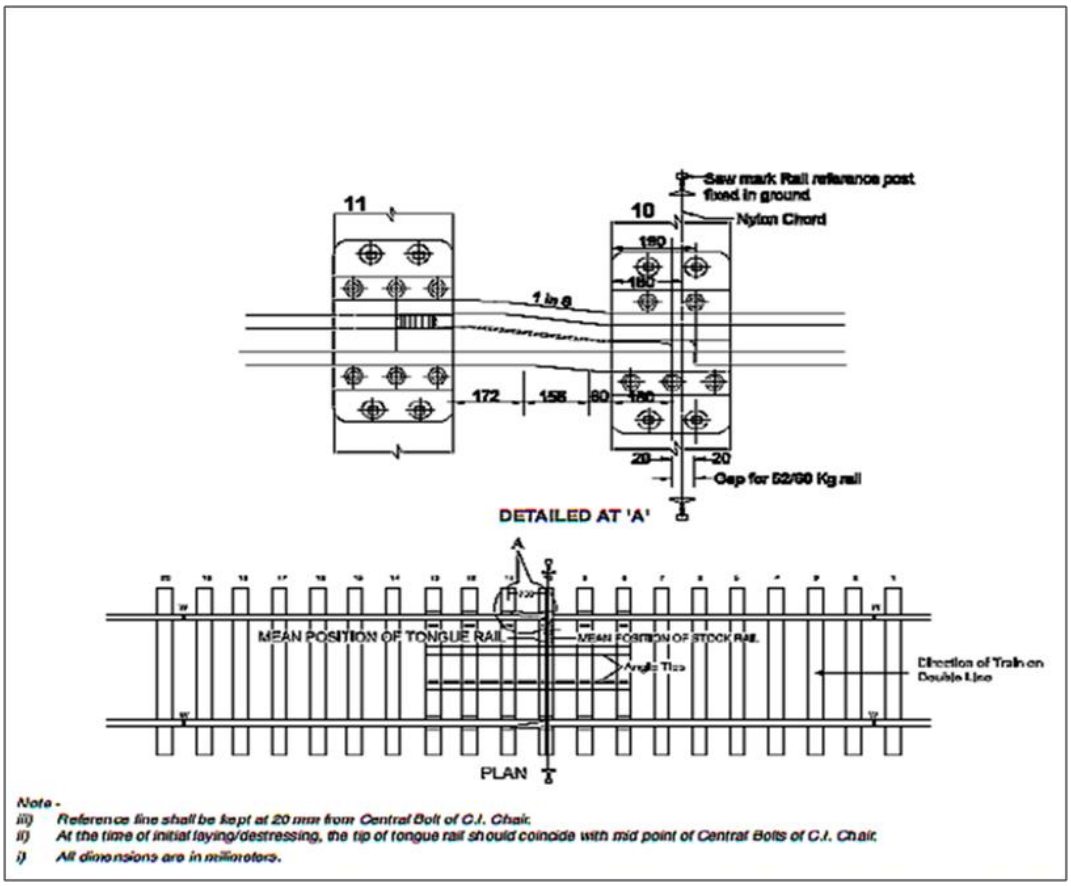
15. Gaps at SEJ *{Ref: Para 338 (1)(b) of IRPWM}*

(1) Gaps at SEJ shall be adjusted at the time of de-stressing of LWR/ CWR for Rail section laid 52 kg/m 60 kg/m Gap to be provided at 'td' 40 mm.

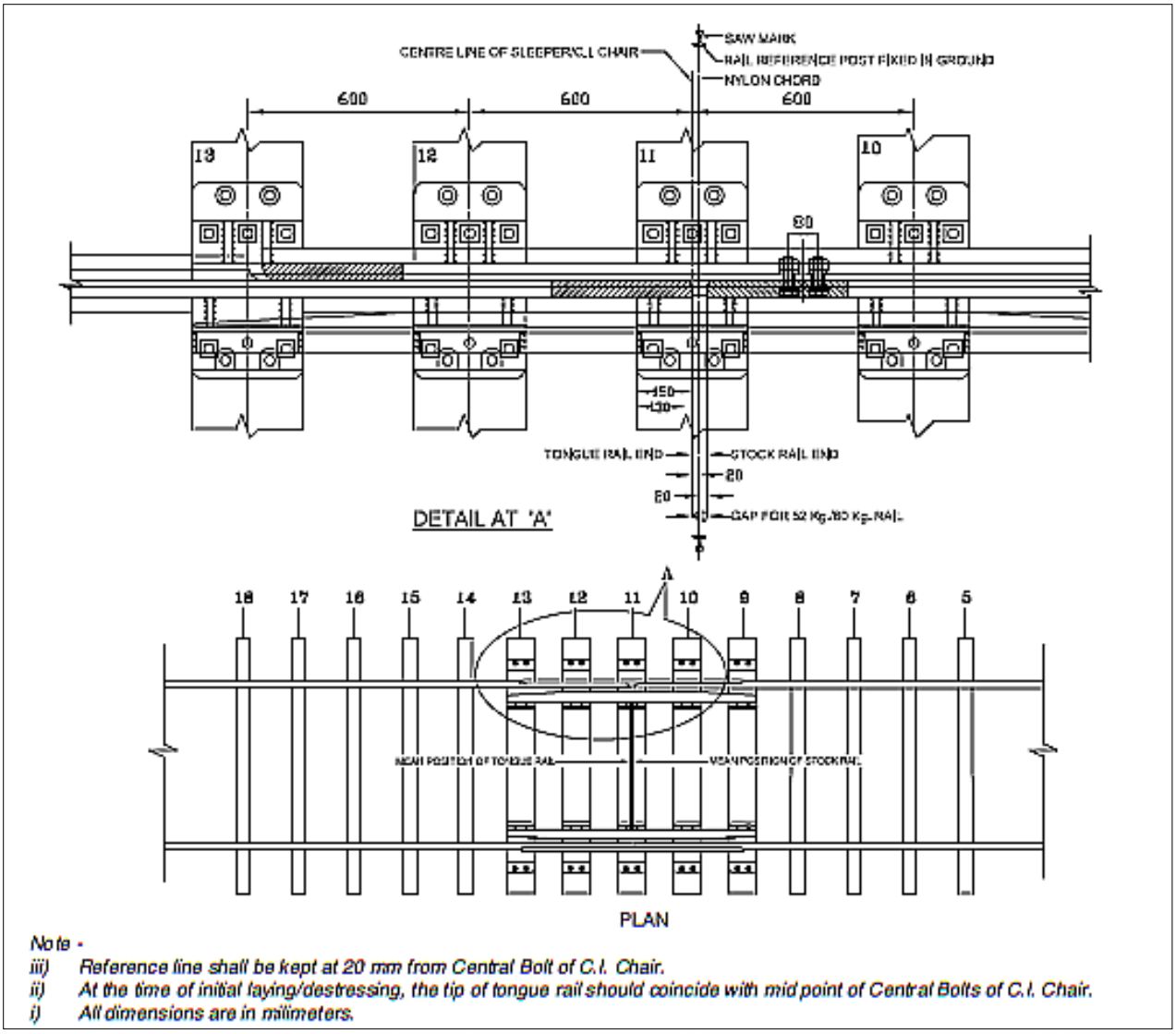
(2) Following figures are for gaps at different types of SEJ and and its laying and

measurement:-

(a) Setting of Gap at SEJ (IRS Design) to Drawing nos. RDSO/T-412, RDSO/T- 4160, RDSO/T-4165, RDSO/T-5478, RDSO/T-5586, RDSO/T-5748, RDSO/T-6257, RDSO/T-6782 at De-stressing temperature (t_d)



(b) Setting of Gap at Improved SEJ with double gap of max. 65mm each (DG 65 Design) to Drawing no. RDSO/T-6922 (60 Kg) & RDSO/T-6930 (52 Kg) (Applicable for both rails) at De-stressing temperature (t_d)



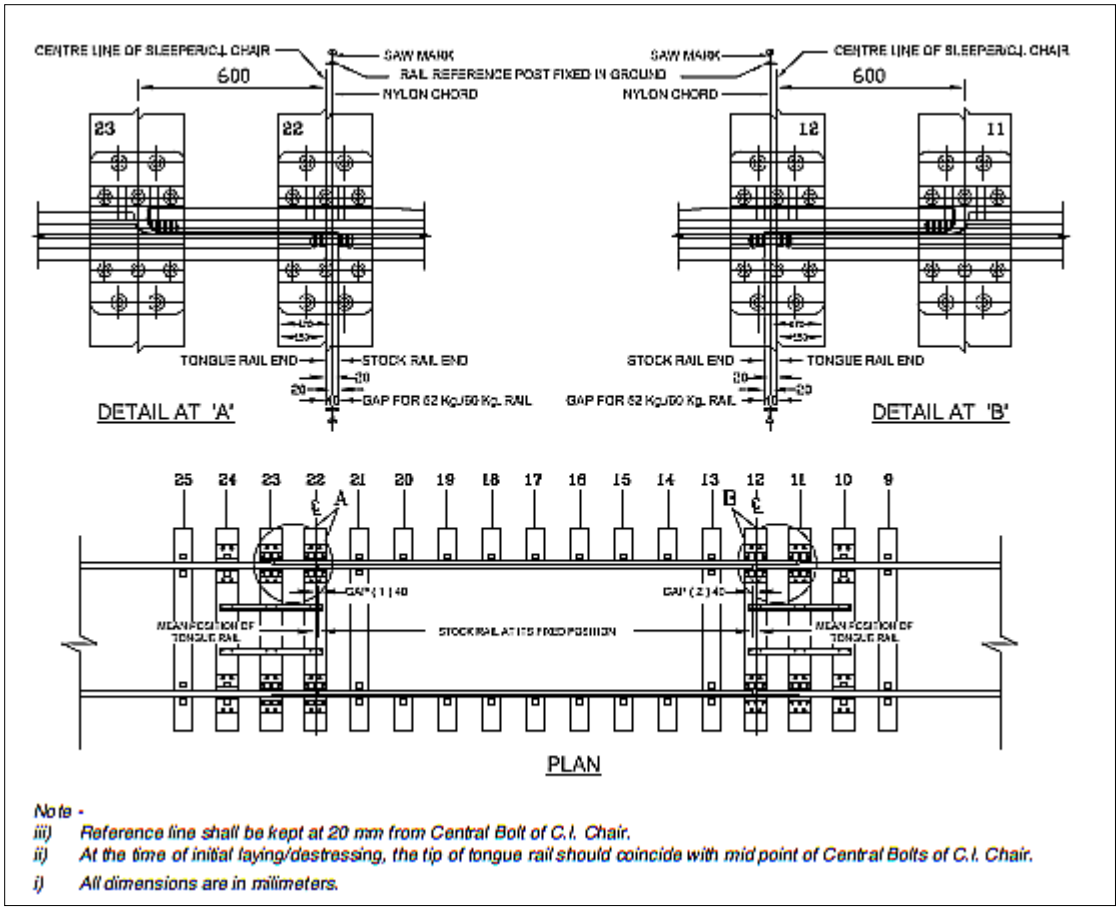
Note -

iii) Reference line shall be kept at 20 mm from Central Bolt of C.I. Chair.

ii) At the time of initial laying/destressing, the tip of tongue rail should coincide with mid point of Central Bolts of C.I. Chair.

i) All dimensions are in millimeters.

(c) Setting of Gap at Improved SEJ with Single gap of max. 80mm (SG 80 Design) to Drawing no. RDSO/T-6902 (60 Kg) & RDSO/T-6914 (52 Kg) (Applicable for both rails) at De- stressing temperature (td)



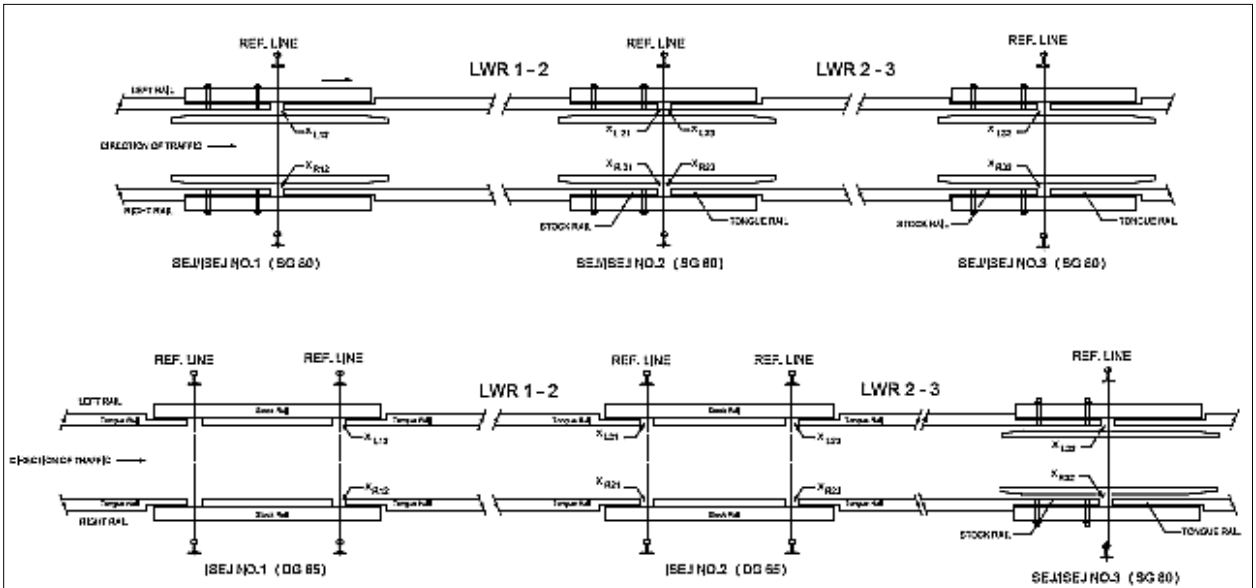
Note -

iii) Reference line shall be kept at 20 mm from Central Bolt of C.I. Chair.

ii) At the time of initial laying/destressing, the tip of tongue rail should coincide with mid point of Central Bolts of C.I. Chair.

i) All dimensions are in millimeters.

(d) Illustration for measurement of gap at SEJ for observation of movement of LWR/CWR



	LWR No. 1 - 2		LWR No. 2 - 3	
LEFT/RIGHT RAIL	DISTANCE BETWEEN TONGUE/STOCK RAIL & REF. LINE AT SEJ No. 1 (COLUMN No. 5)	DISTANCE BETWEEN TONGUE/STOCK RAIL & REF. LINE AT SEJ No. 2 (COLUMN No. 7)	DISTANCE BETWEEN TONGUE/STOCK RAIL & REF. LINE AT SEJ No. 2 (COLUMN No. 5)	DISTANCE BETWEEN TONGUE/STOCK RAIL & REF. LINE AT SEJ No. 3 (COLUMN No. 7)
L/R R/R	X_{L12} X_{R12}	——	X_{L23} X_{R23}	——
L/R R/R	——	X_{L21} X_{R21}	——	X_{L32} X_{R32}

SEJ - IRS DESIGN/CONVENTIONAL SEJ

ISEJ (SG 60) – IMPROVED SEJ WITH SINGLE GAP OF MAX. 60 mm

ISEJ (DG 65) - IMPROVED SEJ WITH DOUBLE GAP OF MAX. 65 mm EACH

(e) Gaps at SEJ specified for various Rail Temperatures and Conventional PSC Sleeper (RDSO/T-2495 & 2496) Track in mm

ZONE - I

Rail	**60 kg/m**		**52 kg/m**	
Sleeper Density	**1660**	**1540**	**1660**	**1540**
Ballast Resistance (kg/cm/rail)	12.98	11.76	12.98	11.76
t_d + 25°	15	14	16	15
t_d + 20°	15 to 17	14 to 17	16 to 18	15 to 17
t_d + 15°	15 to 19	15 to 19	16 to 19	15 to 19
t_d + 10°	16 to 21	15 to 21	16 to 21	16 to 21
t_d + 05°	16 to 22	16 to 23	17 to 22	17 to 22
t_d	17 to 24	17 to 24	18 to 23	18 to 24
t_d - 05°	19 to 25	18 to 25	19 to 24	19 to 25
t_d - 10°	20 to 26	20 to 26	20 to 25	20 to 26
t_d - 15°	21 to 27	22 to 27	21 to 26	21 to 26
t_d - 20°	23 to 27	24 to 28	23 to 26	23 to 27
t_d - 25°	25 to 27	26 to 28	24 to 26	25 to 27
t_d - 30°	27	28	26	27

ZONE-II

Rail	**60 kg/m**		**52 kg/m**	
Sleeper Density	**1660**	**1540**	**1660**	**1540**
Ballast Resistance (kg/cm/rail)	12.98	11.76	12.98	11.76
td + 30°	13	12	14	13
td + 25°	13 to 15	12 to 15	14 to 16	13 to 15
td + 20°	13 to 18	12 to 17	14 to 18	13 to 18
td + 15°	13 to 20	13 to 20	14 to 20	14 to 20
td + 10°	14 to 22	14 to 22	15 to 22	14 to 22
td + 05°	15 to 24	15 to 24	16 to 23	15 to 23
td	16 to 25	16 to 26	17 to 24	16 to 25
td - 05°	18 to 26	17 to 27	18 to 26	18 to 26
td - 10°	19 to 28	19 to 28	19 to 27	19 to 27
td - 15°	21 to 28	21 to 29	21 to 27	21 to 28
td - 20°	23 to 29	23 to 30	22 to 28	23 to 29
td - 25°	25 to 30	26 to 31	24 to 28	25 to 29
td - 30°	27 to 30	28 to 31	26 to 29	27 to 30
td - 35°	30	31	28 to 29	29 to 30
td - 40°	-	-	-	-

ZONE-III

Rail	**60 kg/m**		**52 kg/m**	
Sleeper Density	**1660**	**1540**	**1660**	**1540**
Ballast Resistance (kg/cm/rail)	12.98	11.76	12.98	11.76
td + 35°	10	9	11	10
td + 30°	10 to 13	9 to 12	11 to 14	10 to 13
td + 25°	10 to 16	9 to 15	12 to 16	11 to 16
td + 20°	11 to 18	10 to 18	12 to 19	11 to 18
td + 15°	12 to 21	11 to 21	13 to 21	12 to 21
td + 10°	12 to 23	12 to 23	13 to 22	13 to 23
td + 05°	14 to 25	13 to 25	14 to 24	14 to 25
td	15 to 27	14 to 27	16 to 26	15 to 26
td - 05°	16 to 28	16 to 29	17 to 27	17 to 28
td - 10°	18 to 30	18 to 31	18 to 28	18 to 29
td - 15°	20 to 31	20 to 32	20 to 29	20 to 30
td - 20°	22 to 32	23 to 33	22 to 30	22 to 31
td - 25°	25 to 32	25 to 34	24 to 31	25 to 32
td - 30°	27 to 33	28 to 34	26 to 31	27 to 32
td - 35°	30 to 33	31 to 35	29 to 31	30 to 33
td - 40°	33	34 to 35	31	32 to 33
td - 45°	-	-	-	-

ZONE-IV

Rail	**60 kg/m**		**52 kg/m**	
Sleeper Density	**1660**	**1540**	**1660**	**1540**
Ballast Resistance (Kg/cm/rail)	12.98	11.76	12.98	11.76
td + 33°	11	10	12 to 13	11 to 12
td + 30°	11 to 13	10 to 13	12 to 14	11 to 14
td + 28°	11 to 15	10 to 15	12 to 16	12 to 15
td + 25°	11 to 17	10 to 17	12 to 17	12 to 17
td + 20°	12 to 20	11 to 20	13 to 20	12 to 20
td + 15°	12 to 23	12 to 23	13 to 22	13 to 23
td + 10°	13 to 25	12 to 26	14 to 24	14 to 25
td + 05°	14 to 27	14 to 28	15 to 26	15 to 27
td	15 to 30	15 to 31	16 to 28	16 to 29
td - 05°	17 to 31	17 to 33	17 to 30	17 to 31
td - 10°	19 to 33	18 to 34	19 to 31	19 to 32
td - 15°	21 to 35	21 to 36	20 to 33	20 to 34
td - 20°	23 to 36	23 to 37	22 to 34	22 to 35
td - 25°	25 to 37	25 to 39	24 to 35	25 to 36
td - 30°	27 to 38	28 to 40	26 to 35	27 to 37
td - 35°	30 to 38	31 to 40	29 to 36	29 to 37
td - 40°	33 to 39	34 to 41	31 to 36	32 to 38
td - 43°	34 to 39	36 to 41	32 to 36	34 to 38
td - 45°	36 to 39	37 to 41	33 to 36	35 to 38
td - 48°	37 to 39	39 to 41	35 to 36	37 to 38

Note: *The above values have been calculated with initial setting of gaps at SEJ as 40 mm.*

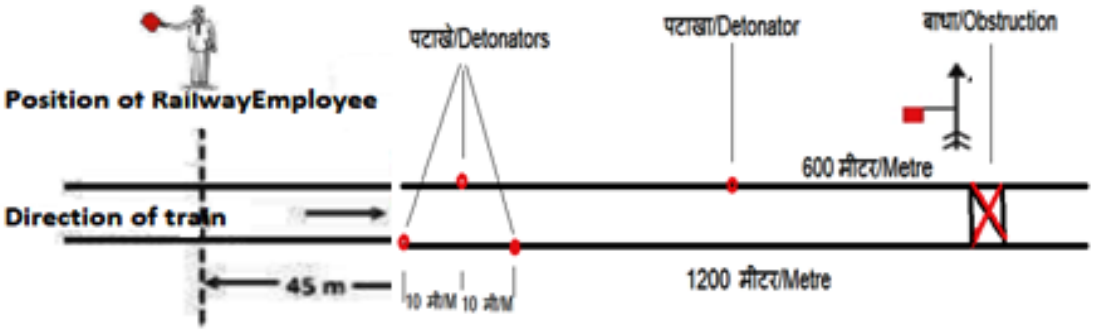
Annexure-I

I. Temporary Signals in Emergency *(Ref: Para 812 of IRPWM)*

A. Whenever in consequence of an obstruction of a line or for any other reason a railway servant must stop an approaching train he shall plant a danger signal at the spot and proceed with all haste in the direction of an approaching train with a danger signal (red flag by day and red light by night) to a point 600 meters from the obstruction and place one detonator on the line after which he shall proceed further for not less than 1200 meters from the obstruction and place three detonators on the line 10 meters apart. He should then take a stand at a place not less than 45 meters 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 three detonators on the line and pick up the intermediate detonator on his way back, continuing to show the danger signal.

B. On a single line the line must be protected on each side of the obstruction.

C. Where there are adjacent lines and it is necessary to protect such lines, action should be taken on each line similarly.



Annexure-II

I. Works of Short Duration *(Ref: Para 806 of IRPWM)*

Protection in block section and procedure for passing of trains – Before commencing any work of such category the JE/SSE/P.Way or authorised Railway servant should issue a notice to the Station Master/Block-hut in-charge at each end of the Block section and obtain their acknowledgment. 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)

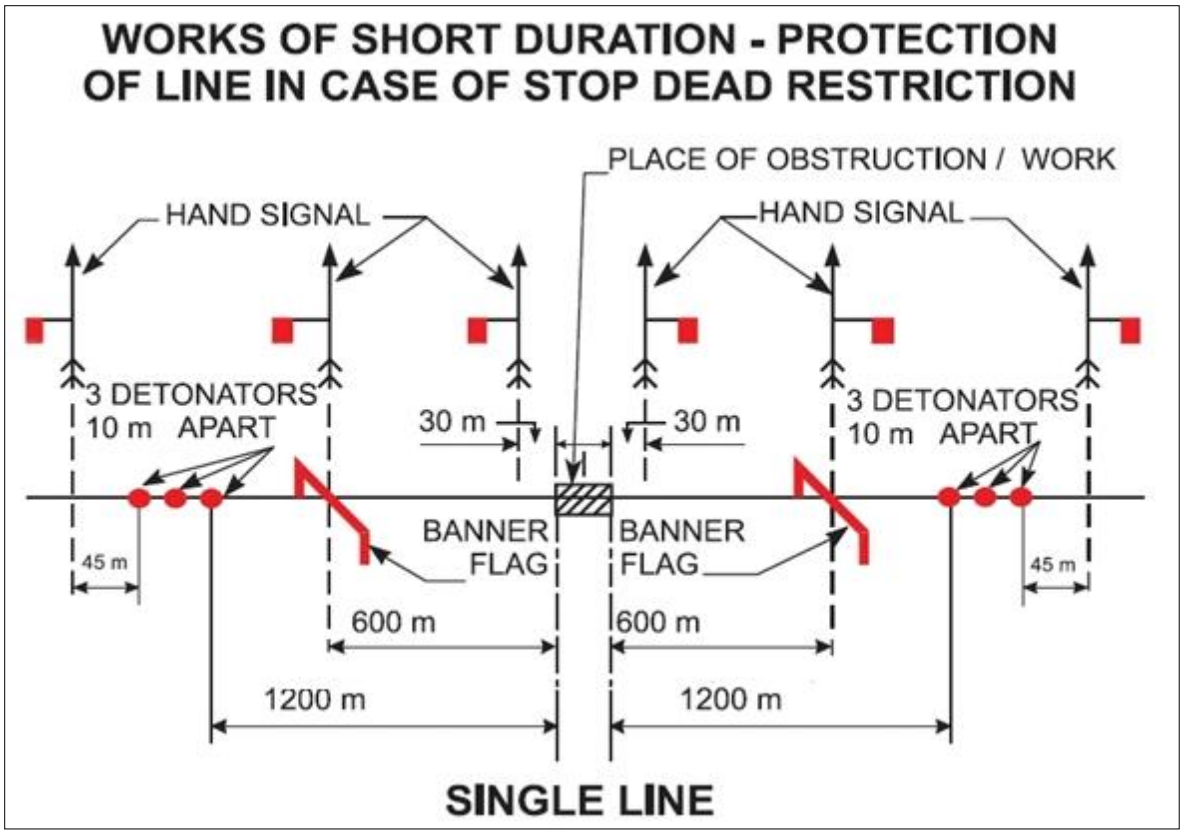
a. Post a flagman with hand signals at a distance of 30 metres in rear of the place of obstruction, to show stop hand signals.

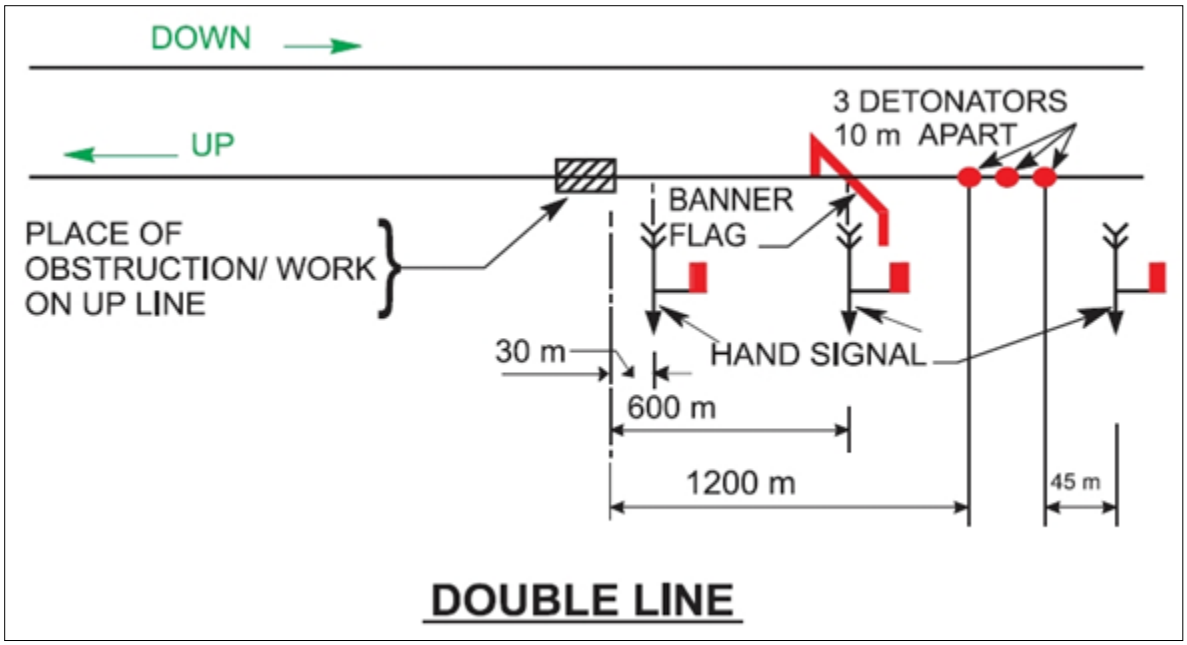
b. Post a flagman with hand signals and place a banner flag across the track at a

a. distance of 600 metres in rear of the work. The flagman will show stop hand signals.

c. 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.

d. The man at the site of obstruction shall give proceed hand signal to indicate to the Loco Pilot, when he may resume normal speed after the train has been hand signaled past the obstruction. *(Ref: Annexure - 8/1of IRPWM).*





B. When the train can pass over the work spot at restricted speed in Block section

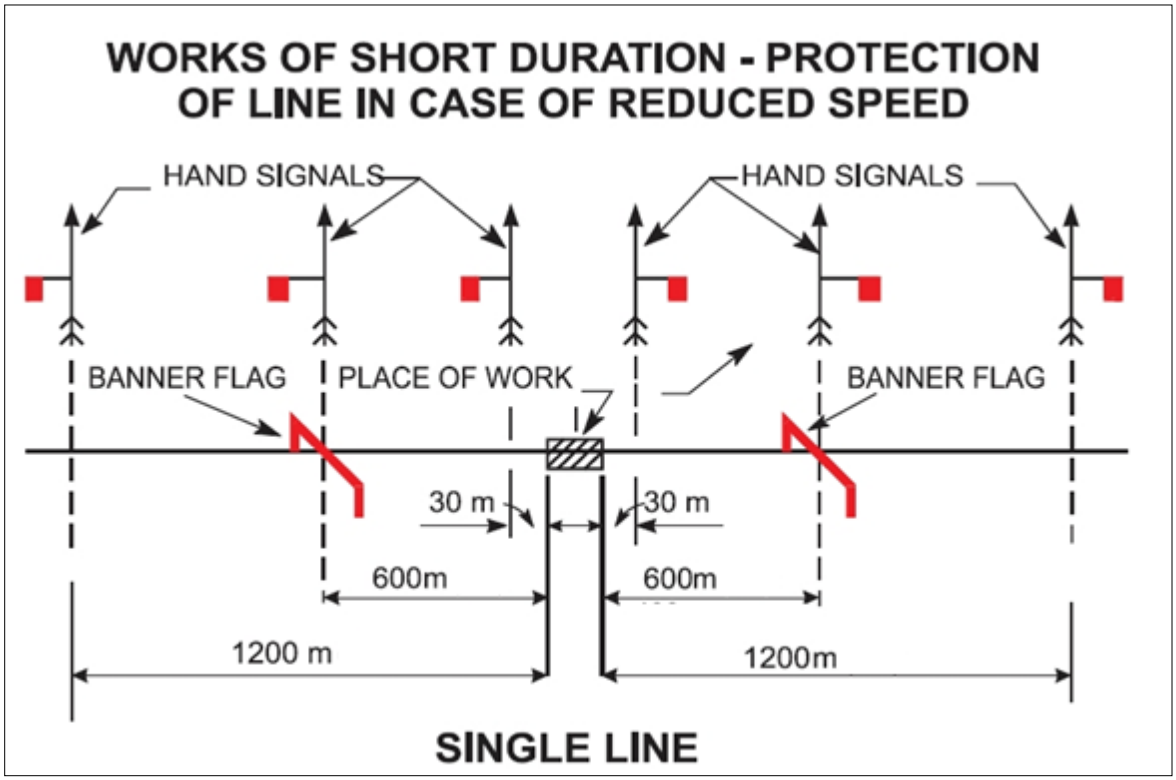
The following protections should be adopted in the above cases

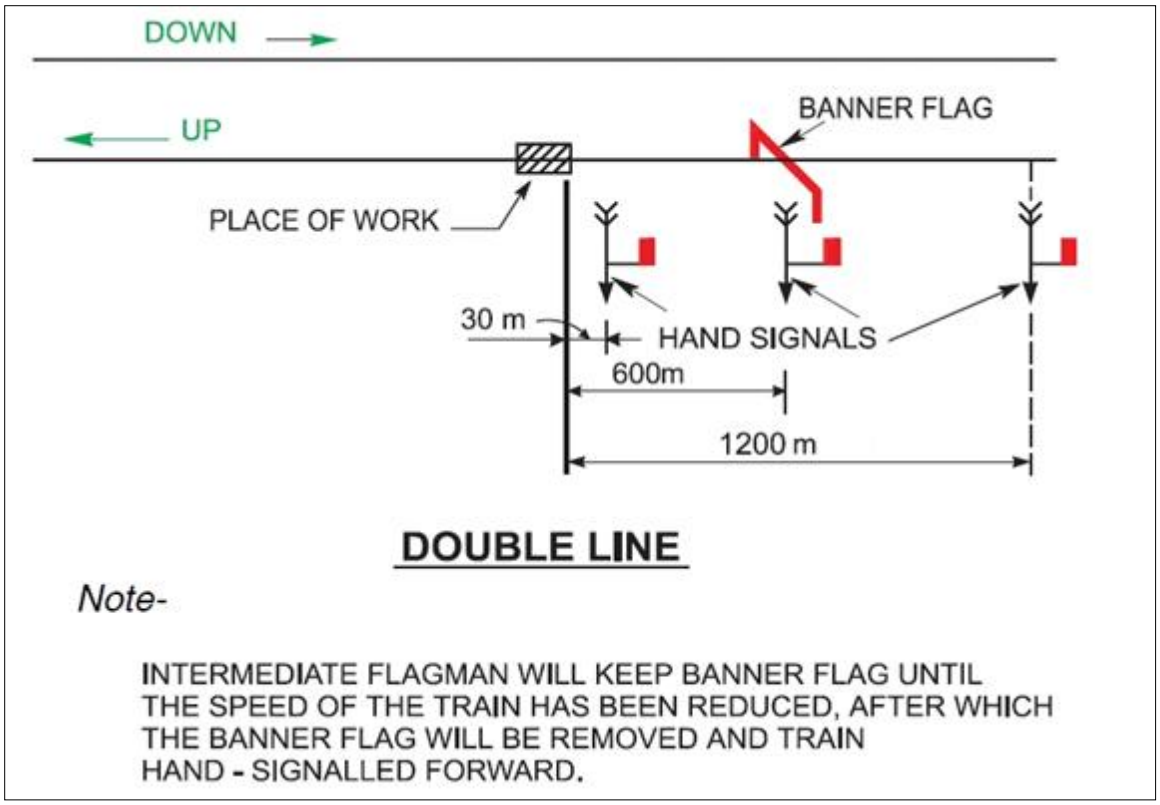
a. Post a flagman exhibiting caution hand signals at a distance of 30 metres from the place of obstruction.

b. Post a flagman exhibiting caution hand signals at a distance of 1200 metres for Broad Gauge from the place of obstruction.

c. Post an intermediate flagman with hand signals at a distance of 600 metres for Broad Gauge 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.

d. The railway servant 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- *(Ref: Annexure - 8/2of IRPWM).*





C. The following points should be kept in view, while protecting the track in the cases mentioned in sub-Para A. and B. –

a. On single line, the line must be so protected on both sides of the work.

b. 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.

c. The location of the banner flag, detonators and hand signals should be so selected as to avoid stopping of trains, as far as possible, on continuous steep rising gradients.

d. 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.

e. In an Emergency, when it is necessary on considerations of safety, the JE/SSE/P.Way, or authorised railway servant 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.

GR 15.08 *Precautions before commencing operations which would obstruct the line*

(1) No person employed on the way or works shall change or turn a rail, disconnect points or signals, or commence any other operation which would obstruct the line until Stop signals

have been exhibited and where prescribed detonators used; and if within station limits, he has also obtained the written permission of the Station Master and all necessary signals have been placed at 'on':

Provided that the exhibition of Stop signal may be dispensed with, if such operations are performed or carried out after the necessary signals, other than Automatic Stop signals, have, in addition to being placed in the 'on' position, been disconnected, so that such signals cannot be taken 'off' again until it is safe to do so and the corresponding adequate distance beyond such signals is kept clear:

Provided further that when the area of work is controlled by Automatic signals, the railway servant in charge of the work shall post a competent railway servant at an adequate distance in rear of the site of the work to stop and warn any train approaching the affected area.

(2) No work involving removal of any rail from the track shall be undertaken without traffic block, except as provided in sub- rule (3) below.

(3) In emergent cases, the Engineering official not below the rank of JE/..PayI, undertaking such operations shall first bring the train to a stop and advise the Loco Pilot of the train about the need to stop the train through a written memo. The Engineering official shall simultaneously arrange to send a message to the Station Master for the need to block the track and obtain written confirmation of the same. In such emergent cases work may be commenced only after bringing the train to a stop and the Loco Pilot has been advised.

GR 15.09 Showing of signals

(1) *Whenever due to lines being under repair or due to any other obstruction it is necessary to indicate to the Loco Pilot that he has to stop or proceed at a restricted speed, the following signals shall be shown and, where prescribed, detonators used, if on a double line in the direction from which trains approach, and if on a single line in each direction –*

(a) ***When the train is required to stop and the restriction is likely to last only for a day or less***

A banner flag shall be exhibited at a distance of 600 metres on the Broad Gauge and at a distance of 1200 metres three detonators shall be placed, 10 metres apart, on the Broad Gauge from the place of obstruction. In addition, Stop hand signal shall be shown at a distance of 30 metres from the place of obstruction, at the banner flag and at a distance of 45 metres form the three detonators. The railway servant at the place of obstruction shall give Proceed hand signal to indicate to the Loco Pilot when he may resume normal speed after the train has been hand-signalled past the place of obstruction.

(b) ***When the train is required to stop and the restriction is likely to last for more than a day***

A stop indicator shall be exhibited at a distance of 30 metres from the place of obstruction and a caution indicator at 1200 metres on the Broad Gauge from the place of the obstruction. In addition, termination indicators shall be provided at the place where a Loco Pilot may resume normal speed.

(c) ***When the train is not required to stop and the restriction is likely to last only for a day or less***

Proceed with caution hand signals shall be exhibited at a distance of 30 metres and again at a distance of at least 800 metres from the place of obstruction. The distance of 800 metres shall be suitably increased by special instructions, where required. The railway servant at the place of obstruction shall give Proceed hand signal to indicate to the Loco Pilot when he may resume normal speed after the train has been hand-signalled past the place of obstruction.

(d) ***When the train is not required to stop and the restriction is likely to last for more than a day***

A speed indicator shall be exhibited at a distance of 30 metres from the place of obstruction and again a caution indicator at a distance of at least 800 metres from the place of obstruction. The distance of 800 metres shall be suitably increased by special instructions, where required. In addition, termination indicators shall be provided at the place where a Loco Pilot may resume normal speed.

(2) ***In case the place of obstruction is within station limits***

(a) *The provision of sub-rule (1) 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 Stop signal or signals, and*

(b) *Approach signals 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 a Caution Order at a station in rear, informing him of the obstruction and the details thereof.*

(3) *If the place of work is situated in Automatic Signalling territory, and if the distance between the place of obstruction and the Automatic signal controlling the entry of train in the signalling section concerned is less than 1200 metres on the Broad Gauge and provided the Automatic signal has been secured at 'on'—*

(a) The banner flag and three detonators referred to in clause (a) of sub-rule (1) may be provided at 90 and 180 metres respectively; and

(b) The caution indicator referred to in clause (b) of sub-rule (1) may be dispensed with.

(4) *The shapes and sizes of the indicators referred to in clauses (b) and (d) of sub-rule (1) may be prescribed by special instructions.*

D. Works to be carried out in station limits

(1) No work should be commenced on running line at a station without the written permission of the Station Master and until the relevant signals have been placed at 'ON'.

(2) Before commencing a work on a line which can be isolated from the other running lines, the JE/SSE/P.Way should ensure that the line has been isolated and retain the keys of locking device in his possession. Where isolation is effected by the setting of points, they must be locked by means of clamps or bolts and cotters.

(3) Before commencing work on a line which cannot be isolated from other running lines as provided for above, the JE/SSE/P.Way should provide the prescribed handsignals, detonators and banner flags.

E. Works in Automatic Territory

Para 15.09 (3) (a) of *General Rules 1976 as as detailed above* – 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.

***

RBE No. 03/2024

भारत सरकार Government of India
रेल मंत्रालय Ministry of Railways
(रेलवे बोर्ड) (Railway Board)

No. E (MPP)/2019/03/46 **New Delhi, dated: 09.01.2024**

The General Manager,
All Zonal Railways/PUs
Metro Railway, Kolkata
CORE, Allahabad
DG/RDSO/Lucknow
CAO/DMW/ Patiala
CAO/COFMOW/New Delhi
ED/CAMTECH/Gwalior

DG/NAIR/Vadodara
DG/IRITM/Lucknow
DG/IRIEEN/Nasik
DG/IRICEN/Pune
DG/IRISET/Secunderabad
DG/IRIMEE/Jamalpur
DG/ IRIFM/ Secunderabad
DG/ JRRPF/ Lucknow

Sub: Revised Training Modules of Non- Gazetted Staff of Civil Engineering Department.

Vide Board's letter no. E (MPP) 2019/03/46 dt. 24.12.2021 (RBE no. 94/2021), revised training module of non- gazetted staff of civil engineering department was circulated to all Zonal Railways/ PUs and uploaded on railnet under heading **MPP Training Circulars**.

2. IRICEN has now submitted the revised training module for Induction & Refresher training course of Track Maintainers, which has been reviewed in Board's office and the same has been approved by Board (Member/Infrastructure).

3. Accordingly, the revised training modules for Induction & Refresher training of Track Maintainers, have been scanned and uploaded under **MPP Training Circulars** and can be viewed or downloaded from **Railnet/Indian Railways website.**

4. This disposes of NR's letter no.1-WO/Training of Non-Gazetted P Way Staff dated 05.09.2022

5. Kindly acknowledge receipt.

Encl. : (Revised Training Modules – 05 pages)

अमित
9/1/24

(Amit Singh Mehra)
Director/Man Power Planning

No. E (MPP)/2019/03/46 **New Delhi, dated: 09.01.2024**

Copy to:

1) The General Secretary, NFIR, 3 Chelmsford Road, New Delhi for information (Copy may be downloaded from E(MPP) Training Circulars/Railnet/Internet).

2) The General Secretary, AIRF, 4 State Entry Road, New Delhi for information (Copy may be downloaded from E(MPP) Training Circulars/Railnet/Internet).

3) The Secretary General, FROA, R.No.256-A, Rail Bhavan, New Delhi for information (Copy may be downloaded from E(MPP) Training Circulars/Railnet/Internet).

4) The Secretary General, IRPOF, R.No.268, Rail Bhavan, New Delhi for information (Copy may be downloaded from E(MPP) Training Circulars/Railnet/Internet).

5) All Members, Department Council & Secretary Staff side National Council 13-C, Ferozeshah Road, New Delhi (Copy may be downloaded from E(MPP) Training Circulars/Railnet/Internet).

6) The Secretary General, AIRPF Association, Room No.256-D, Rail Bhavan, New Delhi (Copy may be downloaded from E(MPP) Training Circulars/Railnet/Internet).

7) General Secretary, All India SC & ST Railway Employees Association, 171/B-3, Basant Lane Railway Colony, New Delhi (Copy may be downloaded from E(MPP) Training Circulars/Railnet/Internet).

For Principal Executive Director (IR) /Railway Board

No. E (MPP)/2019/3/46 **New Delhi, dated: 09.01.2024**

Copy to:

i) PS & ED(PG) to MR, MoSR (D) & MoSR (J)

ii) PSO/Sr.PPS to CRB, MF, M(Infra.), M(TRS), M(O&BD), DG(HR), DG(RHS) & DG(RPF)

iii) Sr.PPS/PPS/PS to AM(Budget), AM(CE), AM(C&IS), AM(Comml.), AM(Traction), AM(Fin), AM(Mech.), AM(Plg.), AM(Project), AM(PU), AM(Sig.), AM(Staff), AM(RS), AM(T&C), AM(Tele), AM(TT), AM(Works), PED(Vig.), PED(Safety), PED(Coaching) LA,

iv) ED(Plg.), ED(Accts.), EDCE(B&S), EDCE(G), EDCE(Plg.), ED(CHG), ED(CC), ED(C&IS), ED(E&R), EDEE(Dev), EDEE(G), EDE, ED(RRB), EDE(N), EDE(Res), EDF, EDF(B), EDF(X)I, EDF(X)II, ED(H), JS(C), EDME(Chg.), EDME(Fr.), ED(PC)I, ED(PC)II, EDRE, ED(Safety), ED(Safety)-II, IG./RPF(Hqs), ED(Sig.), ED(SP), EDRS(G), EDRS(S), ED(TD), EDTC(R), EDCE(P), ED(PM), ED(FM), EDPG, EDTT(F), EDTT(S), EDV(E), EDV(Elect), EDV(T), EDVE(S), ED(W).

v) Chief Commissioner of Railway Safety, Lucknow.
vi) E(Trg.), E(NG)I, E(NG)II, E(G), F(E)I, F(E)II, F(E)III, E(SCT)I, E(SCT)II branches of Railway Board.

*****

Room No. 27A, Ground Floor, Rail Bhawan, New Delhi-110001

TRAINING MODULE FOR INDUCTION COURSE (T-9) (Revised)

CATEGORY: TRACK MAINTAINER **DURATION: 30 DAYS (240 PERIODS)**

TOPIC	TOPIC DETAILS	Periods	
		Existing	Revised
	PART – I INTRODUCTION	**6**	**6**
1.1	Railway's Organizational Structure, Role of Track-maintainer in Railways.	2	2
1.2	Classification of Routes.	1	1
1.3	Duties & Responsibilities of Track-maintainer (IRPWM Para 149). Duties of Trackman as per para 2.11 of GR.	3	3
	PART – II PERSONAL SAFETY	**21**	**29**
1.1	Precaution during work on running lines, **including Double / Multiple lines, vicinity of LCs, important major yards, shunting / marshalling lines etc.**	1	**2**
1.2	Precaution during routine maintenance activity, handling/ transporting materials **including while working in Block, Speed Restriction etc**	1	**2**
1.3	Precaution during Track machine working **including pre, post and during tamping, BCM working, sharp look out on adjoining lines etc**	2	**4**
1.4	Precaution during working on sharp Curves/Curves with poor visibility. Precaution during working at accident spots, congested locations like bridge, tunnel. in High speed locations, **Use of Rakshak and other such warning systems**	1	3
1.5	Precautions in track circuited areas, electrified areas, **including working with Cranes, JCBs, earth moving equipment etc.**	2	**3**
1.6	Precaution while working during heavy rain, Safety against Snake/Insect Bite Precautions during night working **at Monsoon Patrolling / Hot / Cold weather Patrolling etc**	1	**2**
1.7	Safety during working in Ghat sections. Personal safety- Dos & Don'ts	1	1
1.8	**Hands on**: Repairs to Trolley Refuges/ Man refuges	4	4
1.9	**Hands on**: Exchange of hand signals. Fixing detonators	4	4
1.1	**Field visit** for demonstration of various safety drills.	4	4
	PART – III RAILS, SLEEPERS, FASTENINGS & BALLAST	**23**	**23**
1.1	Types of rails, Fish plates, Fish bolts.	1	1
1.2	PSC sleepers for main line and other locations viz. level crossing, SEJ, bridge and its approach, turnout, sharp curves, etc.	2	2
1.3	Elastic Fastenings: Types of ERC – ERC mark III, ERC mark V, zero toe load, GJ clip. Rubber pads: Different types. Liners : Different types, GFN liners, metal liners, combination liners Modern elastic fastenings viz. Vossloh, Nabla etc.	2	2
1.4	Glued joints, Block Joint, SEJs, Points & Crossing.	2	2
1.5	**Model room** showing different types of rails, sleepers, elastic fastenings, SEJ, Glued joint, block joint, points and crossing.	2	2
1.6	**Field visit** for showing items mentioned at 1.5 above.	8	8
1.7	Ballast profile at different location, Steps to prevent Pedestrian/ Cattle Crossing	2	2
1.8	**Hands on** Ballast Handling, adjustment of ballast in profile, measurement of ballast cushion	4	4
	PART – IV LUBRICATION OF RAIL JOINTS	**14**	**14**
1.1	Lubrication of Rail Joints (IRPWM Para 241)	1	1
1.2	**Hands on**: Lubrication of Rail Joints	4	4
1.3	Greasing of ERCs, sealing of liners.	1	1
1.4	Painting of Rails and Welds.	1	1
1.5	Lubrication of gauge face of outer rail on curves, turnouts, SEJ etc.	1	1
1.6	**Hands on**: Lubrication of ERC, Curves, Turnouts, SEJ.	6	6
	PART – V TRACK MAINTENANCE ACTIVITIES	**57**	**57**
1.1	Through Packing (IRPWM Para 224), Slack Picking (IRPWM Para 229),	2	2
1.2	**Hands on**: Manual through packing.	8	8
1.3	Systematic Overhauling of Track(IRPWM Para227)	1	1
1.4	**Hands on**: Systematic Overhauling	4	4
1.5	Mobile Maintenance Units (IRPWM Para228)	1	1
1.6	Introduction to Small Track Machines. Safe operation of Small Track Machines available on Indian Railways on running track.	2	2
1.7	Basic knowledge regarding consumables being used in Small Track Machines.	1	1
1.8	**Hands on:** Repair & maintenance of Small Track machines, troubleshooting of Small Track machines.	4	4

TRAINING MODULE FOR INDUCTION COURSE (T-9) (Revised)

CATEGORY: TRACK MAINTAINER **DURATION: 30 DAYS (240 PERIODS)**

TOPIC	TOPIC DETAILS	Periods	
		Existing	Revised
1.9	**Hands on** training for operation of small Track Machines including weld trimmer, grinder, rail cutting, hole drilling, chamfering, etc.	4	4
1.1	Works involved in the maintenance of Points &Crossings, Curves, Level crossings and Bridges.	2	2
1.11	**CREEP**: Creep and its effect, pulling back of creep, fixing of anchors, recoupment of missing fittings, renewal of ineffective fittings.	1	1
1.12	Attention to SEJ, Glued Joints, insulated block joints.	1	1
1.13	Observance of Sleepers under passage of Traffic(IRPWM Para 230)	1	1
1.14	Observance of train for seized bearings/hot axles, hanging parts of rolling stock.		
1.15	**Technical films/ video clips/ photographs** showing various Track Maintenance activities.	1	1
1.16	**Hands on**: Casual rail renewal	4	4
1.17	**Hands on**: Casual sleeper renewal	4	4
1.18	**Hands on**: Measurement of Gauge, Cross level, Check-Rail Clearance, Versine, Cant.	2	2
1.19	**Hands on**: Change of Crossing and Switches in yards.	4	4
1.2	Welding of Rails.	2	2
1.21	**Hands on**: Assisting in welding of rail joint.	4	4
1.22	**Technical films/ video clips/ photographs** on use of weld trimmers &Grinders, Rail cutting machine, Rail drilling Machine, Chamfering machine, Impact Winch for bolt tightening, Toe load measurements.	2	2
1.23	**Hands on**: Maintenance in Electrified territories: precautions involved during maintenance of Track-Circuited sections, Felling/ Cutting/ Pruning of trees close to OHE	2	2
	PART – VI LONG AND SHORT WELDED RAILS (LWR/SWR)	**24**	**24**
1.1	Introduction to LWR/SWR track.	1	1
1.2	Rail temperature-types of Rail Thermometers, measurement of temperature and working range.	1	1
1.3	**Hands on**: Measurement of Rail temperature	1	1
1.4	Competency to carry out various Maintenance and Repair works in LWR.	1	1
1.5	Do's and Don'ts for LWR and SWR track.	2	2
1.6	Hot and Cold Weather Patrolling	1	1
1.7	Action to be taken in case of rail/weld failures.	1	1
1.8	**Hands on** : for attending emergency repair of rail/weld fracture	4	4
1.9	Action to be taken in case of buckling	1	1
1.1	De-stressing of LWR.	2	2
1.11	Different types of SEJ – Inspection and Maintenance	1	1
1.12	**Hands on**: Cold / Hot Weather Patrolling, Monsoon Patrolling.	8	8
	PART – VII RAIL FRACTURES AND WELD FAILURES	**7**	**7**
1.1	Introduction to Rail/ weld failures.	1	1
1.2	Marking of USFD Flaws, Action for protection / removal of defective welds/rails	2	2
1.3	**Hands on**: Attention to various types of USFD Flaws	4	4
	PART – VIII TRACK RENEWALS	**21**	**21**
1.1	Scope, activities involved & method for execution of Through Rail Renewal, Through Sleeper Renewal, Through Bridge Timber Renewal, Through Fittings Renewal, Through Turnout renewal	3	3
1.2	Deep Screening (IRPWM Para 238), Lifting/Lowering of track, **Working of Track machine such as BCM, SBCM, DTS, Unimat, T-28**	3	3
1.3	Working of Ballast Train / DMT working	2	2
1.4	**Hands on**: Ballast train/ EUR unloading.	8	8
1.5	**Technical films/ video clips/ photographs** of various types of Track machine on Railway	1	1
1.6	**Hands on**: Pre & Post tamping activities, Attention during Track-Machine tamping	4	4
	PART – IX LEVEL CROSSINGS	**10**	**10**
1.1	Classification of Level Crossing, Equipment at LC.	2	2
1.2	Visibility at LC, Speed breakers, Road sign boards and W/L boards at level crossings, Location of various LC Boards	1	1
1.3	Introduction to working of gateman, competency, Refresher & medical Examination.	1	1
1.4	Action during Gate failures, Height Gauge damage, Breakdown of vehicle at LC	1	1

TRAINING MODULE FOR INDUCTION COURSE (T-9) (Revised)

CATEGORY: TRACK MAINTAINER **DURATION: 30 DAYS (240 PERIODS)**

TOPIC	TOPIC DETAILS	Periods	
		Existing	Revised
1.5	**Technical films/ video clips/ photographs** showing operation of Level Crossing and its components.	1	1
1.6	**Hands on**: Visit to nearest level crossing	4	4
	PART – X PATROLLING OF TRACK (Ch-X of IRPWM)	**16**	**12**
1.1	Types of Patrolling	2	2
1.2	Duties of Patrolman, Equipment of patrolman. Reporting of unusual. Understanding of patrol chart and diary.	2	2
1.3	Action to be taken during emergency by Patrolman.	1	1
1.4	Duties of Stationary watchman at vulnerable location	1	1
1.5	**Hands on**: rainfall reading with rain gauge	2	2
1.6	**Hands on:** Patrolling Duty	8	**4**
	PART – XI Rail Dolly/Trolley/Dip Lorry Working	**15**	**11**
1.1	Working of Trolley, Lorry and Rail dolly.	2	2
1.2	**Technical films/ video clips/ photographs** on working of Rail Dolly/Dip Lorry.	1	1
1.3	**Hands on**: working of Trolley, Lorry, Rail dolly and Protection	4	4
1.4	**Tutorial on** preparation on various memo viz. track unsafe memo, caution order, track safe memo with caution order, etc.	8	4
	PART – XII BASICS OF SIGNALLING & PROTECTION OF TRACK	**13**	**13**
1.1	Various types of Signals& Their Aspects	2	2
1.2	Station limit, block sections, different types of territory (absolute/automatic).	1	1
1.3	Various method of protections: HS Flags, banner flags, HS lamp, detonator, tri-color torches, hooters etc.	1	1
1.4	Protection during short duration/long duration works.	2	2
1.5	Engineering Indicator boards for various speed restriction/ stop dead, Location of boards at work site.	2	2
1.6	**Hands on** for Fixing of Indicator Boards at Work site	4	4
1.7	Training on disaster management including fire safety.	1	1
	PART – XIII ESTABLISHMENT MATTER	**5**	**5**
1.1	Leave & Pass Rules	1	1
1.2	DAR	1	1
1.3	HOER	1	1
1.4	Avenues of career progression in Railways	1	1
1.5	Introduction to Civil defense organization in Railways	1	1
	PART – XIV FIRSTAID	**4**	**4**
1.1	Knowledge on medicines provided in first aid box. Training and demonstration on first aid to be given to injured having bone fractured/ dislocation, precaution while carrying injured staff in absence of stretcher.	4	4
	PART – XV MISCELLANEOUS	**4**	**4**
1	Exam, Viva-Voce, Reporting/Relieving etc.	4	4
2	**Self-development (physical & emotional)**		
2.1	Jogging/ yoga exercise one hour daily in morning session (7am to 8am).		
2.2	Breathing exercise, meditation, relaxation daily one hour in evening session (5.30pm to 6.30pm).		
	Grand Total	**240**	**240**
	NOTE: 30 days= 30 x 8 pds = 240 pds of 45mins each		

SUMMARY

A	**CLASSROOM LECTURES**	**95**	**103**
B	**TECHNICAL FILMS/ VIDEO CLIPS/ PHOTOGRAPHS**	**6**	**6**
C	**FIELD VISITS**	**12**	**12**
D	**HANDS ON**	**113**	**109**
E	**MODEL ROOM**	**2**	**2**
F	**TUTORIAL**	**8**	**4**
G	**MISCELLANEOUS**	**4**	**4**
GRAND TOTAL		**240**	**240**

Note: *The aspect of personal safety is covered in Part-II- of both (Induction and Refresher) course modules, however to cover more safety aspects some additional topics are also added in the existing module like, working in Double / Multiple lines. safety during machine working, use of Rakshak and other such warning systems. safety during patrolling, safety while transporting materials and working with Cranes, JCBs, earth moving equipment etc For which the time period for personal safety in Induction Course has been increased from 21 periods to 29 periods (each duration 45 minutes) by suitably modifying the time allotted to other topics keeping total training duration unchanged as 30 days.*

It is also recommended that after completion of 30 days institutional training, newly recruited track maintainers, should also be given a 3 days practical safety training by the concerned JE/SSE P.Way supervisor before allowing them for field work. The same should be advised by divisions to SSE (P.Way) incharge.

REFERENCES

S.N.	Description
1.	Railway Board letter vide RBE 3/2024 letter No. E(MPP)2019/3/46 dated 09.01.2024
2.	IRPWM
3.	E-Learning material, Diploma Course in Railway Engineering, Institution of Permanent Way Engineers (India)
4.	IRICEN Handbook for Track Maintenance
5.	ZRTI track module of IRICEN
6.	IRICEN-Digital Model Room
7.	Document No.TD-M-4.2.4-1, Master List of Drawings issued by Track Design Directorate, RDSO
8.	RDSO/track/drawings/point_crossing
9.	Drawing no. RDSO/T - 6902 for improved SEJ
10.	Drawing no. RDSOT - 6914 for improved SEJ
11.	Drawing no. RDSO/T - 6922 for improved SEJ
12.	Drawing no. RDSO/T - 6930 for improved SEJ
13.	Drawing no. RDSO/T - 4160 for Conventional SEJ
14.	Drawing no RDSO/T - 4165 for Conventional SEJ
15.	Drawing no T-4218 for Conventional SEJ
16.	Drawing no T-4967 for Conventional SEJ

NOTES

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	

CAMTECH is continuing its efforts in the documentation and up-gradation of information on maintenance practices of civil engineering assets. Over the years a large number of publications on civil engineering have been prepared in the form of handbooks, pockets books, pamphlets and video films, etc. These publications have been uploaded on the internet as well as rail net.

Link for downloading CAMTECH publications:

On internet visit: https://indianrailways.gov.in/

Or

On Railnet visit Railway Board website at http://10.1.2.21/

Go to Indian Railways → Directorates → Efficiency & Research → CAMTECH, Gwalior → Publications for download

Or

Link for directly download the Publications:

https://indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1,304,366,538,2713,2718,2722

Disclaimer

The contents of this handbook are for guidance only & are not statutory. It also does not supersede any instructions from Railway Board, RDSO, and Zonal Railways & the provisions of IRWM, BIS Codes/Reports on the subject.

If at any point contradiction is observed, then Indian Standards, regulations issued by Government bodies, Railway Board/RDSO guidelines shall be referred.

हमारा उद्देश्य

अनुरक्षण प्रौद्योगिकी और कार्यप्रणाली को उन्नयन करना तथा उत्पादकता और रेल्वे की परिसंपत्ति एवं जनशक्ति के निष्पादन में सुधार करना जिससे अन्तर्विषयों में विश्वसनीयता, उपयोगिता और दक्षता प्राप्त की जा सके।

यदि आप इस संदर्भ में कोई विचार और सुझाव देना चाहते हों तो कृपया हमें इस पते पर लिखें।

संपर्क सूत्र	:निदेशक / सिविल
पत्राचार का पता	: भारतीय रेल उच्च अनुरक्षण प्रौद्योगिकी केन्द्र महाराजपुर, ग्वालियर (म.प्र.) पिनकोड - 474005
टेलीफोन	: 0751-2470869
फैक्स	: 0751-2470841
ई-मेल	: dircivilcamtech@gmail.com

Our Objective

To upgrade Maintenance Technologies and Methodologies and achieve improvement in productivity and performance of all Railway assets and manpower which inter-alia would cover Reliability, Availability, and Utilisation.

If you have any suggestion & comments, please write to us:

Contact person	**:**	**Director (Civil)**
Postal Address	**:**	**Indian Railway Centre for Advanced Maintenance Technology, Maharajpur, Gwalior (M.P.) Pin code – 474 005**
Phone	**:**	**(0751) - 2470869**
Fax	**:**	**(0751) – 2470841**
Email	**:**	dircivilcamtech@gmail.com