केवल कार्यालय उपयोग हेतु
For Official Use Only

सत्यमेव जयते

भारत सरकार - Government of India

रेल मंत्रालय - Ministry of Railways

रेलपथ संरचना और घटकों का आधारभूत

Basics of Track Structure and Components

केमटेक/2023/सि/टीएससी/1.0

CAMTECH/2023/C/WR-CESS/1.0

सितम्बर - 2023

September – 2023



An ISO 9001-2015 Certified Organisation

उत्कृष्ट अनुरक्षण प्रौद्योगिकी केन्द्र

Excellence In Maintenance

Indian Railways

Centre for Advanced Maintenance Technology

महाराजपुर, ग्वालियर - 474005

Maharajpur, Gwalior – 474005

✆ : 0751 - 2470869 & Fax : 0751 - 2470841

रेलपथ संरचना और घटकों का आधारभूत

Basics of Track Structure and Components

Foreword

Most of the routes of Indian Railways are quite busy. The speed & axle load of traffic is also in increasing trend. The track as designed so is to suit the operation of the fastest train and the running of heavier axle loads on the routes. Selection of the right components of the track to maintain/ or assemble the desired track structure is a very important part of the working of P. Way staff.

This handbook so prepared by CAMTECH is to disseminate the knowledge of track structure required for specific speed & axle load on Indian Railways routes. This handbook also delivers knowledge about track components to choose the right track fittings & fastenings for the routine working of P.Way man.

I hope that this handbook will be of significant help to Civil Engineering personnel involved in the maintenance and construction activities of permanent ways in Indian Railways.

CAMTECH/Gwalior ***Jitendra Singh***

30 September, 2023 ***Principal Executive Director***

Preface

The Track structure is determined based on the speed and axle load of the train. The shape of the track structure has achieved by joining the various components of the track. The dimensions and drawing numbers of track fittings & fastenings provided by RDSO are also specific for different combinations of track components.

As far as P. Way staff is concerned to use the appropriate fittings & fastening, it is necessary that the information available on various platform is to be produced in concise form to upkeep the knowledge as desired in the field.

Almost all the relevant provisions available in various codes, Manuals, etc. and instructions issued by Railway Board have been taken in to account while preparing this handbook.

This handbook is prepared with the objective of knowledge dissemination to Track maintainers, JE/SSE (P. Way) involved in maintenance & construction activities in Indian railways. This handbook does not supersede any existing instructions from the Railway Board, RDSO & Zonal Railways and the provisions of IRPWM. For more in-depth information, the relevant manual and instructions on the subject may be referred to.

Since this handbook provides direct access to relevant information regarding Track Structure & its components, it is expected that it will be of immense use to the P. Way personnel and thereby help them in day-to-day work.

I am grateful for the assistance given by Shri S.S. Pathak, SSE (P.Way), CAMTECH who is involved in collecting data, data entry, going through the complete text/ graphics, text editing work, and special thanks to Shri R.P. Singh, SSE/P. Way/BLM, MB division, Nothern Railway for providing photographs on track components.

We welcome any suggestions from readers for further improvement.

CAMTECH/Gwalior ***Deepak Mehra***

30 September, 2023 ***Director/Civil***

CONTENTS

Foreword *(i)*

Preface *(ii)*

Contents *(iii)*

Correction Slip *(iv)*

1.0 INTRODUCTION 1

2.0 TRACK STRUCTURE 1

2.1 The track structure for operation of Passenger train for speeds beyond 110 Kmph and up to 160 Kmph on Indian Railway routes- 1

2.2 The track structure for operation of 25T axle loads train for speeds up to 100 kmph on Indian Railway routes 2

2.3 Track structure for existing loop lines and sidings for operation of higher axle loads the following minimum track structure for rail, sleeper and ballast cushion to be followed in existing loop lines and sidings for running of CC, CC+4, CC+6+2T/CC+8+2T & 25T loaded wagons:- 2

3.0 TRACK COMPONENTS 3

3.1 RAILS 3

3.1.1 52 Kg/m Rail 4

3.1.2 60 Kg/m Rail (UIC 60) 5

3.1.3 60 Kg/m rail (60 E1) 6

3.1.4 136 RE rail 7

3.1.5 Marking of Rails 8

3.1.6 Identification of Different Qualities of Rails in the Field 8

3.1.7 Longer rails 9

3.1.8 Recommended Rail Section 9

3.2 Rail Fastenings 10

3.2.1 Fish Plates 10

3.2.2 Joggled fish Plates 11

3.2.3 Combination Fish-Plates 11

3.3 Sleepers 12

3.3.1 Types of Sleepers 12

3.3.2 Concrete Sleepers 12

3.3.3 Sleeper Density 13

3.4 Fastenings on PSC sleepers 15

3.4.1 Elastic Rail Clip (ERC) 15

3.4.2 Plate Screw 16

3.4.3 Grooved Rubber Sole Plate (GRSP) 16
3.4.4 Liner 18
3.4.5 Generally used Combination of fittings on PSC sleepers 19
3.5 Insulated Rail joints 23
3.5.1 Nylon Insulated Rail Joints (Block Joints) 23
3.5.2 Glued Insulated Rail Joints 24
3.6 Switch Expansion Joint 25
3.7 Position of Approach Sleepers on Turn outs & their Fittings 27
3.8 Position of Exit Sleepers on Turn outs & their Fittings 28
3.9 Position of Fish plates and Bolts in 1 in 12 CMS crossing B.G. for 60 Kg 29
3.10 Position of Fish plates and Bolts in 1 in 8.5 CMS crossing B.G. for 60 Kg 31
3.11 Ballast 32
3.11.1 Ballast Profile 32
3.11.2 Depths of Ballast Cushion 34
3.12 Spacing of tracks 35
3.12.1 For existing works 35
3.12.2 For new works/ addition to existing works 35
3.13 Formation 35

References 37

Note 38

Publication Downloading Link and Disclaimer 39

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/2023/सि/टीएससी/1.0/सीएस# XX दिनांक_____

CAMTECH/2023/C/TSC/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**

1.0 INTRODUCTION

The recommendations of the track structure on IR routes are available in different documents of IR. Here we have compiled almost all the relevant provisions available in various codes, Manuals, and instructions issued by Railway Board. The track fittings are meant for different combinations of track components and are being discussed here with the objective to provide adequate information to field staff. Field staff will gain the Knowledge about track fittings and fastenings to use them at right place. This will be helpful to them in day-to-day maintenance and construction work.

2.0 TRACK STRUCTURE

A railway track, also known as a permanent way, is the structure on a railway consisting of the rails, sleepers, fastenings, ballast and the underlying formation.

The track structures and their components are laid for operation of

- **High-speed passenger train,**
- **25T axle loads train**,
- **Existing loop lines and sidings**

2.1 The track structure for operation of Passenger train for speeds beyond 110 Kmph and up to 160 Kmph on Indian Railway routes is given as under: -

Speed	**Speed above 110 Kmph and up to 130 Kmph**	**Speed above 130 Kmph and up to 160 Kmph**
Rails	60 kg 90 UTS	60 kg 90 UTS
Sleeper/Sleeper Density	PSC at 1660	PSC at 1660*
*Note - * Wider and Heavier PSC sleeper shall be used during renewals.*		
Ballast Cushion in mm	Total 300 clean 150	
Turnout Switches	Thick Web Switches on all turnouts	Thick Web Switches on all turnouts
Turnout Crossings	CMS	Weld able CMS
SEJ *(RDSO/T-6902)*	Improved Type switch expansion joint for long welded rail (with 80 mm max: gap) B.G. 60 kg. (UIC) on PSC sleepers.	
Bridge Sleepers	H – Beam Sleepers/Composite sleepers	
Level Crossings	Interlocked	No Level crossing
Fencing	All along the track	
Curves	All the curves shall be suitably realigned and proper transition lengths shall be provided. Maximum permissible cant of 185 mm can be provided in the section so that speed potential on curves is fully exploited, however, this shall be subject to the consideration of maximum cant excess for the slowest moving train.	

2.2 The track structure for operation of 25T axle loads train for speeds up to 100 kmph on Indian Railway routes is given as under: -

S.N.	Track Component	Specification
1.	Rail	60 Kg or higher section with 110 UTS
2.	Sleeper	25T PSC Sleeper of DFC to Drg No. RT-7008 or Wider PSC Sleeper to Drg No. RT-8527 *Note: Existing PSC sleepers to Drg No. RT-2496 can continue as an interim measure, till renewal, for speed up to 60 kmph.*
3.	Rubber pad	- 10mm CGRSP to RDSO/T-7010 - 6.2mm CGRSP to ROSO/T-6618 up to 60 kmph
4.	GFN liner	- RDSO/T-6938 & 6939 - RDSO/T-3706 up to 60 kmph
5.	Metal liner	- RDSO/T-8616 & 8617 - RDSO/T-3740 up to 60 kmph
6.	Fastening	- ERC Mk-V to RT-5919 - ERC Mk-Ill to RT-3701 up to 60 kmph
7.	Point & Crossing	Thick-web curved switches & weldable CMS Crossings with 60 Kg 110 UTS rails till new design of Canted turnouts & Weldable CMS Crossings with 60 Kg 110 UTS rails is approved by IR for regular adoption. Thick-web curved switches & normal CMS crossings with gapless joints with 60 kg 110 UTS rails can be used on existing 25T routes as an interim measure until renewal.
8.	SEJ	Improved type SEJ with 110 UTS
9.	Ballast	Total 350 mm ballast cushion below sleeper of hard stone machine crushed ballast out of which at least 200 mm shall be clean cushion. For existing track having total 300 mm ballast cushion with 150 mm clean cushion, operation of 25T axle load may be permitted at speed up to 60 kmph.
10.	Sub grade and formation	New Formation - (a) Formation should conform to the specifications for 25T Axle Load in Guidelines GE: G-14 (Nov. 2009) and its amendment from time to time. (b) Formation width should be 7.85 m for BG Single line & 13.16 m for Double Line. Existing formation - Speed potential to be decided based on type of sub grade.

Railway board slacken the above specification vide Rly Bd L.No. 2019/CE-II/TS/25T dated 22.08.2022 as under,

Existing PSC (RT-2496) sleepers may be continued for the operation of 25-Ton axle load up to 100 kmph on 25-Ton axle load identified/permitted routes and feeder routes of DFC.

2.3 Track structure for existing loop lines and sidings for operation of higher axle loads the following minimum track structure for rail, sleeper and ballast

cushion to be followed in existing loop lines and sidings for running of CC, CC+4, CC+6+2T/CC+8+2T & 25T loaded wagons:-

SN	Minimum Track Structure	Maximum Permissible Speed			
		cc	CC+4	CC+6+2/ CC+8+2	25T
1.	90R (72UTS) rail, PSC sleeper (RT-2495) @M+4 sleeper density and total ballast cushion of 200 mm, which may consist of at least 75mm clean and rest in caked up condition on compacted and stable formation	15* kmph	15* kmph	15* kmph	-
2.	52kg (72UTS) rail, PSC sleeper (RT-2495) @1540 sleeper density and total ballast cushion of 250 mm, which may consist of at least 100mm clean and rest in caked up condition on compacted and stable formation	30 kmph	30 kmph	30 kmph	15* kmph
3.	52kg (90UTS) rail, PSC sleeper (RT-2495) @1540 sleeper density and total ballast cushion of 250 mm, which may consist of at least 100 mm clean and rest in caked up condition on compacted and stable formation.	60 kmph	45 kmph	45 kmph	30 kmph
4.	60kg (90UTS) rail, PSC sleeper (RT-2496) @1540 sleeper density and total ballast cushion of 250 mm, which may consist of at least 100 mm clean and rest in caked up condition on compacted and stable formation	75 kmph	75 kmph	60 kmph	45 kmph

The maximum operating speed on loop line shall be governed from turnout consideration.

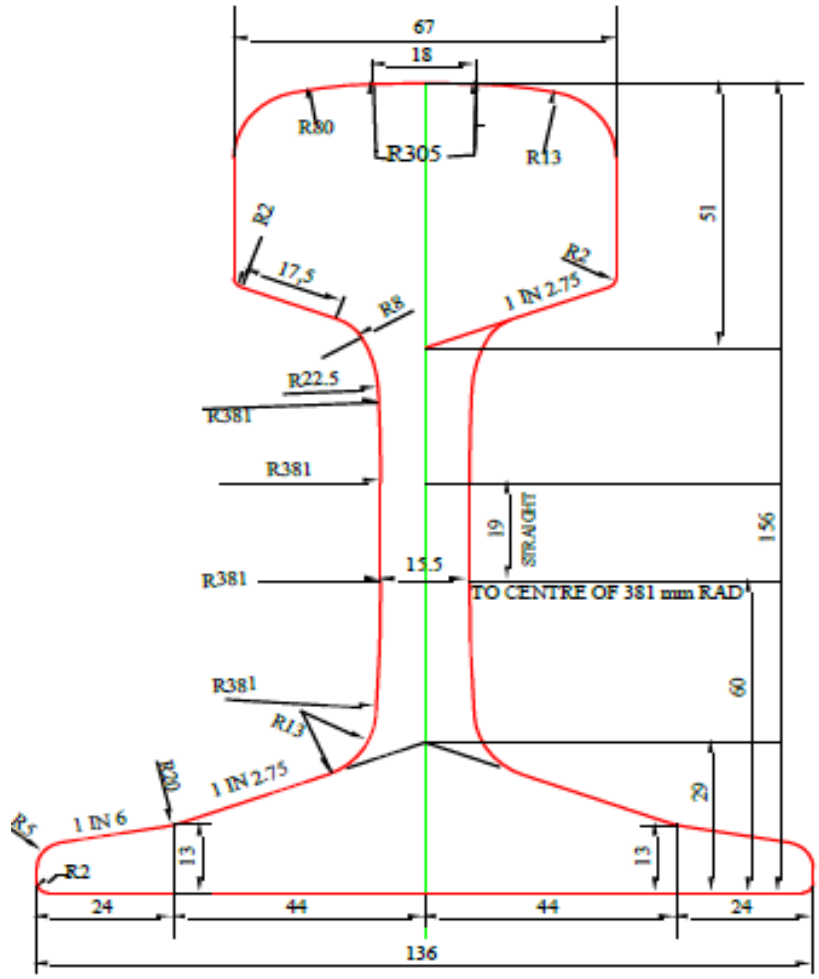
3.0 TRACK COMPONENTS

The Rail, Sleeper, Fittings & Fastenings, Ballast and Formations are components of Track Structure.

3.1 RAILS

The rails are manufactured as per the Indian Railway Standards specification for flat bottom rail (IRS-T-12). On Indian Railways, flat-footed rails of 60 Kg/m and 52 Kg/m are being used predominantly. The typical cross-section and key dimensions of these rail sections are reproduced below.

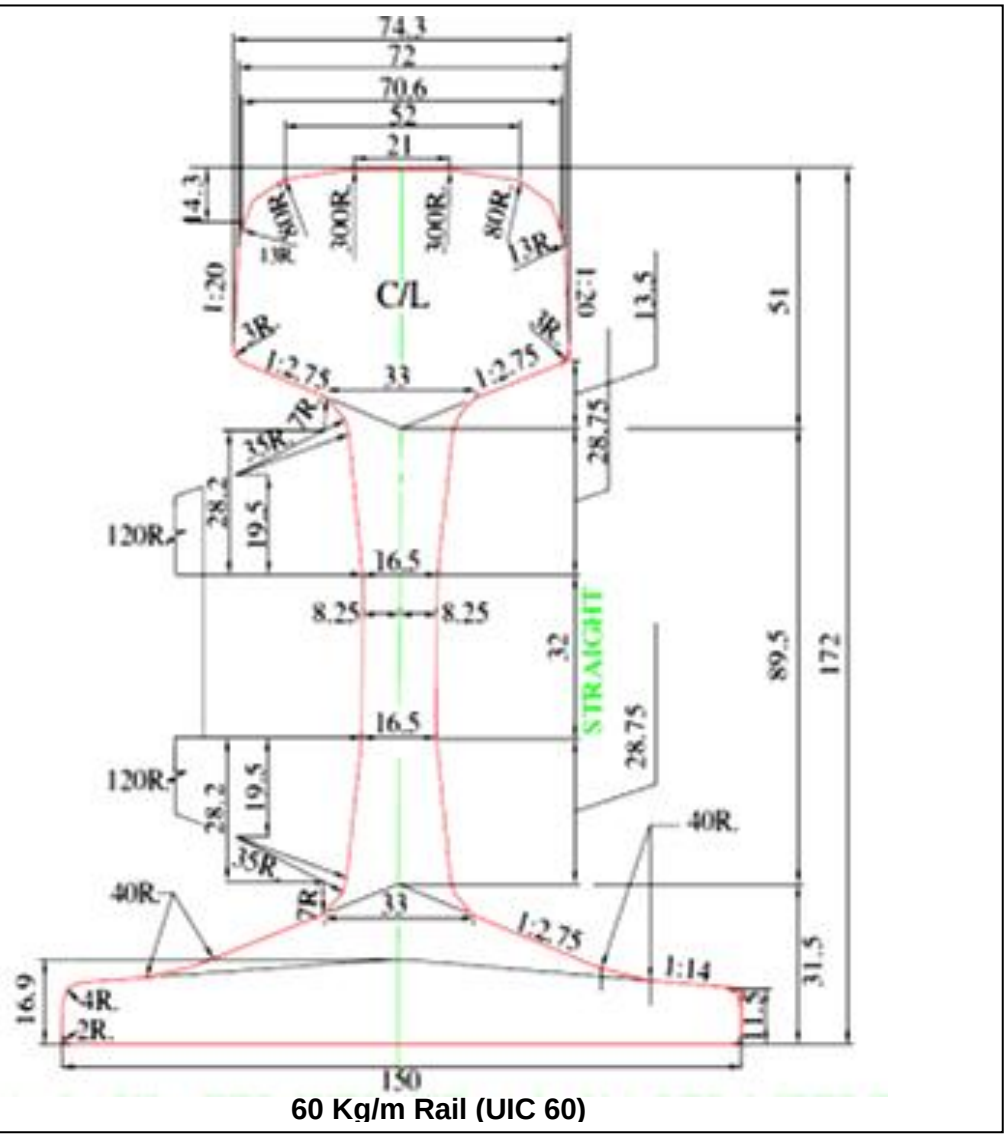
3.1.1 52 Kg/m Rail



52 Kg/m Rail

Rail Section	Cross-Section Area (cm2)	Weight per meter in Kg	Dimensions in mm				
			Rail Height	Flange Width	Head Width	Thickness of Web	Head Height
52 Kg	66.15	51.89	156	136	67	15.5	51

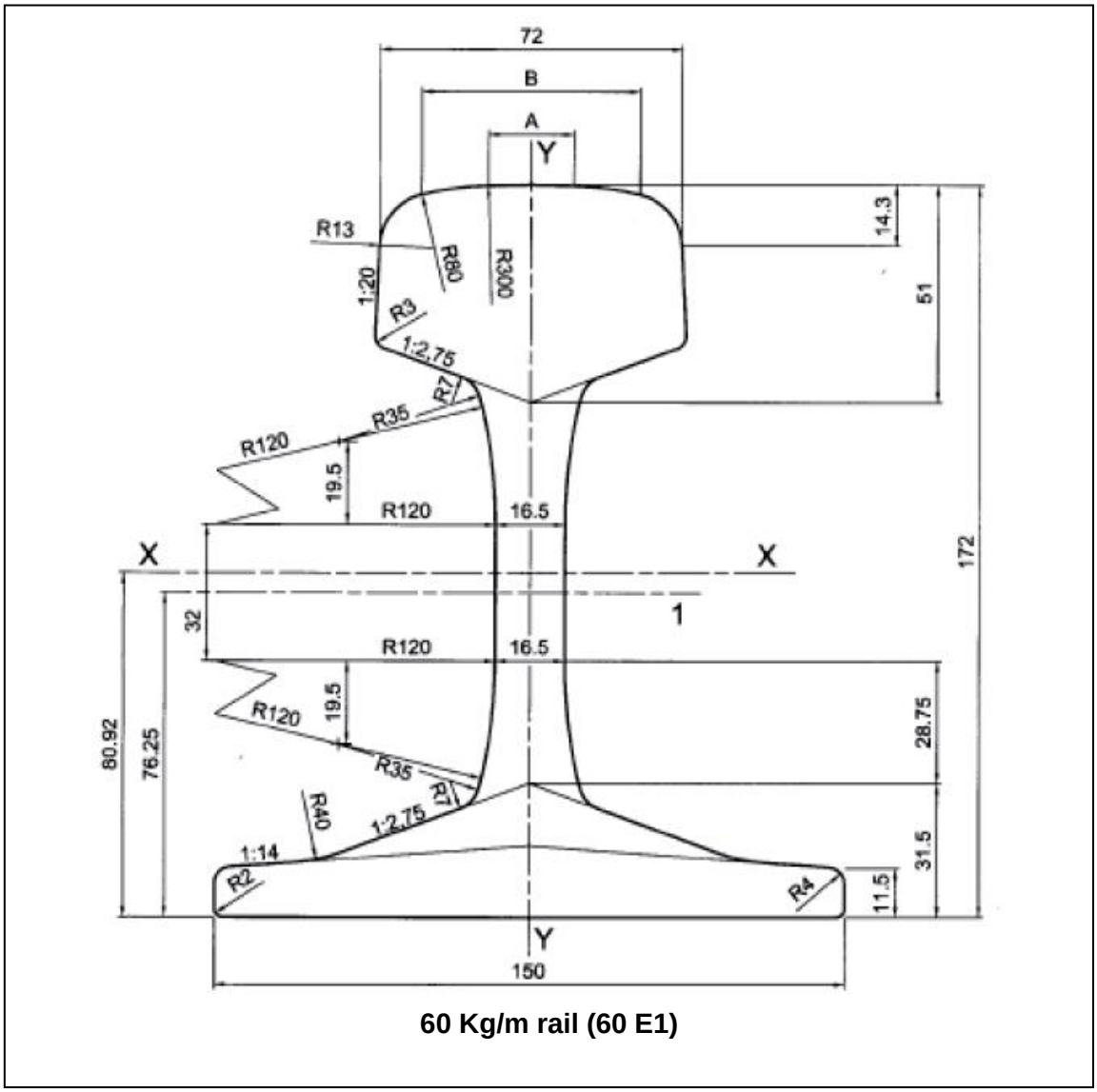
3.1.2 60 Kg/m Rail (UIC 60)



60 Kg/m Rail (UIC 60)

Rail Section	Cross-Section Area (cm2)	Weight per meter in Kg	Dimensions in mm				
			Rail Height	Flange Width	Head Width	Thickness of Web	Head Height
60 Kg (UIC 60)	76.86	60.34	172	150	74.3	16.5	51

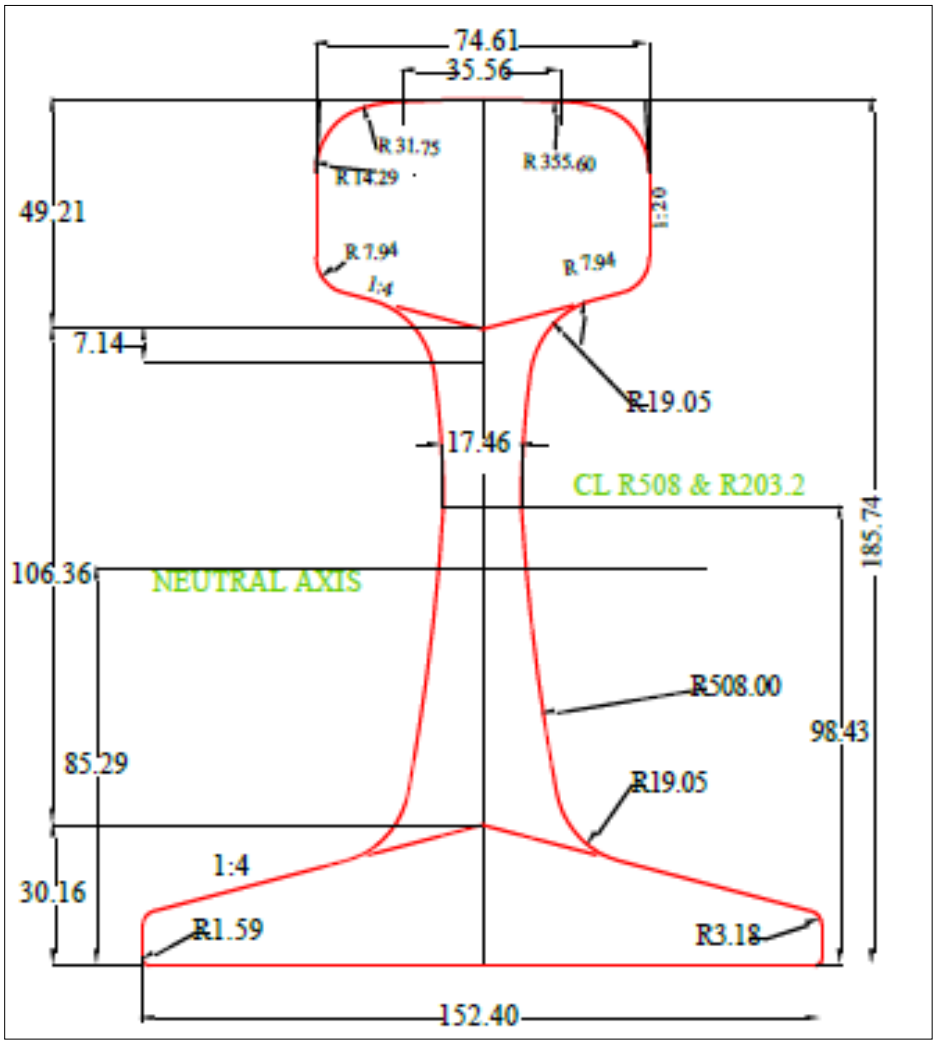
3.1.3 60 Kg/m rail (60 E1)



60 Kg/m rail (60 E1)

Rail Section	Cross-Section Area (cm2)	Weight per meter in Kg	Dimensions in mm				
			Rail Height	Flange Width	Head Width	Thickness of Web	Head Height
60 Kg (60 E1)	76.70	60.21	172	150	72	16.5	51

3.1.4 136 RE rail



Rail Section	Cross-Section Area (cm2)	Weight per meter in Kg	Dimensions in mm				
			Rail Height	Flange Width	Head Width	Thickness of Web	Head Height
136 RE	86.131	67.364	185.74	152.40	74.61	17.46	49.21

Note: These are for guidance only. For details, please refer IRS specification - T-12

3.1.5 Marking of Rails

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

(a) Rail section

(b) Grade of steel e.g. for grade 880 - "880"

(c) Identification mark of the manufacturer

(d) Month (using Roman numbers) and last two digits of year of manufacture

(e) Process of steel making: e.g. for Basic oxygen - "O", for Electric - "E" etc

(f) Rolling direction

3.1.6 Identification of Different Qualities of Rails in the Field

(a) 'Prime Quality' Rails

These rails are to suitable for use in running track at all location and are classified as Class 'A' and Class 'B' rails based on tolerance in end straightness.

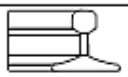
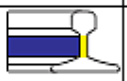
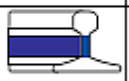
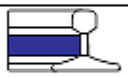
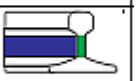
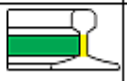
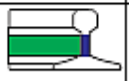
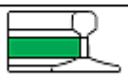
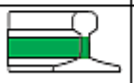
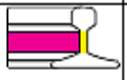
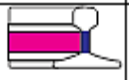
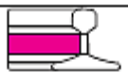
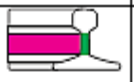
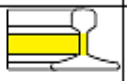
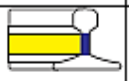
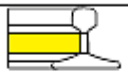
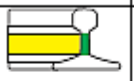
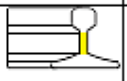
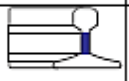
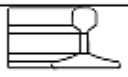
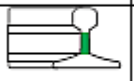
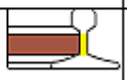
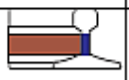
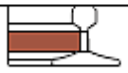
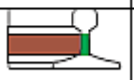
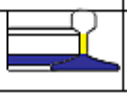
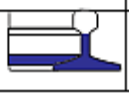
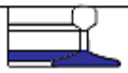
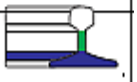
(b) Industrial Use Rails (IU rails)

- These rails can be used in industrial sidings with a speed restriction of 50 Kmph.
- IU rails can be identified by blue paint on end face of flange and both sides of flange for a distance of 500 mm from each end.
- The letter 'IU' (Industrial Use Grade) as the case may be in 15 mm size shall be stamped on both end faces of rails in addition to colour marking.

(c) Colour Code: The rails are painted with colour code.

II. Lengthwise colour code for new rails as given below:-

Colour Code for Rails

S. No.	Grade	Colour Code	13m, 26m, 130m, 260m	12m, 25m, 129m, 259m	11m, 24m	10m
1	GR 880	Only common length wise colour code and no paint on web surface				
2	GR 1080 H.H.	In addition to common length wise colour code, **Blue** paint on both sides of web surface for a distance of 500 mm from each end.				
3	GR 1080 Cr	In addition to common length wise colour code, **Green** paint on both sides of web surface for a distance of 500 mm from each end.				
4	CLASS 'A' RAIL	In addition to common length wise colour code, Grade code as 1, 2 & 3 and **Green** paint on guage/non gauge face for a distance of 500 mm from each end.				
5	NIOBIUM 880 NB	In addition to common length wise colour code, **Purple** paint on both sides of web surface for a distance of 500 mm from each end.				
6	VANADIUM 880 VN	In addition to common length wise colour code, **Yellow** paint on both sides of web surface for a distance of 500 mm from each end.				
7	Copper-Molybdenum 880 CM	In addition to common length wise colour code, **White** paint on both sides of web surface for a distance of 500 mm from each end.				
8	Nickel Chromium Copper 880 NC	In addition to common length wise colour code, **Brown** paint on both sides of web surface for a distance of 500 mm from each end.				
9	IU	In addition to common length wise colour code, **Blue** paint on end face of flange and both sides of flange for a distance of 500 mm from each end.				

- If No paint mark on gauge/non-gauge face indicates class 'B' rails.
- Yellow paint on each end face on web region indicates 13 m, 26 m, 130 m, and 260 m length.
- Blue paint on each end face on web region indicates 12 m, 25 m, 129 m, and 259 m length.
- White paint on each end face on web region indicates 11 m, 24 m length.
- Green paint on each end face on web region indicates 10 m length.

III. Colour code for second hand new rails

- Class II (a) Second hand rail fit to be re-laid in running lines – Ends to be painted with a daub of white.
- Class II (b) Second hand rail fit for use in non-running lines – Ends to be painted with a daub of yellow.

3.1.7 Longer rails

As per IRS-T-12, the standard length of rails is 13 m or 26 m. However, the manufacturer may also supply longer rails of 65 m, 130 m and 260 m length as required by purchaser.

3.1.8 Recommended Rail Section

(a) Main line – Track Renewals, Doubling, New Lines and Gauge Conversions – 60kg/m rails with minimum 90 UTS.

Note – For Gauge Conversion works & new line works having projected traffic of less than 5 GMT, 60kg/m (SH) rails, if available with Railways, can be used depending upon future projected extension of lines etc.

(b) Loop Lines – Renewal of loop lines is to be done with 60 kg/m (SH) or 52 kg/m (SH) rails. The new rails can also be used for these rail renewals with prior approval of Railway Board.

(c) Private and other sidings

(1)	Sidings taking off from DFC or feeder routes to DFC or 25T axle load routes.	60 kg/m
(2)	Sidings other than (1) above; With permissible speed up to 50 Kmph.	52 kg/m (SH); or 52 kg/m (IU)
(3)	Sidings other than (i) above; With permissible speed more than 50 Kmph.	60 kg/m

3.2 Rail Fastenings

3.2.1 Fish Plates

Fishplates are used to join the ends of rails using fish-bolts and washers.

List of commonly used Fish plates.

S. N.	Fish Plate		Bolt & nut			Single coil spring washer
	DRG No	For	DRG No	For Fish-plate	Length	
1.	T-5915	Fish Plate For 52 Kg Rail (1 Meter Long)	RDSO/ T-11501 Dia 25 mm	For 52 kg rail for use without single coil spring washer	130 mm	T-1899 bolt may be used with 52 Kg rail with Single coil spring washer (T-10773)
2.	T-5916	Fish Plate For 60 Kg Rail (1 Meter Long)	RDSO/ T-1899 Dia 25 mm	For UIC 60 kg. rail	140 mm	For use without single coil spring washer

3.2.2 Joggled fish Plates

Joggled fish plates with clamps or with far end bolts are used at welded joints or at rail fracture locations.

S. N.	DRG. No	For	Bolt & Nut	Remark
1.	T-5551	Use on Rail-Fracture for B.G. 52 Kg.	Four Clamps T-5552/1 to be used	For temporary joining rails without any weld ordinary fish plate may be used with clamps.
2.	T-5848	Use on Welded Joint for B.G.52 Kg.	T-11513 (180 mm long)	Single coil spring washer T-10773 shall be used
			T-11511, 160 mm long may be used	In case special washer are not used.
3.	T-5849	Use on Welded Joint for B.G. 60 Kg.	T-11513 (180 mm long)	Single coil spring washer T-10773 shall be used.
			T-11511, 160 mm long may be used	
				In case special washer are not used.
4.	EDO/T-2242 & 2243	Use on 75 mm Wide Gap A.T. Weld For 52 Kg with C.I. Block	T-11515 nearer to weld. T-11511 far end bolts	Single coil spring washer T-10773 shall be used.
5.	EDO/T-2246 & 2247	Use on 75 mm Wide Gap A.T. Weld For 60 Kg (UIC) With C.I. Block		

3.2.3 Combination Fish-Plates

(a) A set of four combination fishplates is used at rail joint of two different rail sections. The four fishplates are different from each other and are marked as under, apart from their drawing numbers.

- I.R. (Inside Right),
- O.R. (Outside Right),
- I.L. (Inside Left)
- O.L. (Outside Left)

S. N.	DRG No	Description	Bolt	
1	T-696 to 699	Fish Plate Combination For 60 Kg (UIC) And 52 Kg	T-700	Nearer to rail ends
			T-1899	Far end bolt 60 Kg rail side
			T-11501	Far end bolt 52 Kg rail side
2	T-6594 to 6597	Combination Joggled Fish Plates For 60 Kg. (UIC)/52 Kg Rails with C.I. Block for B.G.	T-11515	Nearer to rail ends
			T-11511	Far end bolt

(b) The following points should be ensured

(1) On either side of combination fishplates, full length of rail should be used.

(2) Combination rails prepared by welding two rail sections as per standard drawings should, preferably be used in place of combination fishplates.

3.3 Sleepers

Sleeper is a load distributing component of track structure which is laid transversely to hold the rail. Sleepers are also called "Ties" because they tie the rails together. Now-a-days, the sleepers used are pre-stressed concrete elements and are commonly known as Pre-Stressed Concrete (PSC) sleepers.

3.3.1 Types of Sleepers

Depending on type of Material, there are following types of sleepers:-

(a) Wooden Sleepers

(b) Cast Iron Sleepers

(c) Steel Trough Sleepers

(d) Concrete Sleepers

(e) Wooden, Cast Iron and Steel Trough Sleepers have become obsolete and at present concrete sleepers are being used widely. For certain specific locations e.g. girder bridges, points and crossings etc. composite sleepers are being gradually introduced.

3.3.2 Concrete Sleepers

(a) Amongst the mono-block and twin-block concrete sleeper types, Indian Railway uses the Mono-block Pre-stressed concrete sleepers predominantly. These PSC sleepers provide longitudinal & lateral stability required for LWR and due to the Flat bottom, these sleepers are suitable for mechanised tamping.

(b) Identification of Sleepers

(1) Concrete sleepers can be identified by the drawing no. and code of sleeper manufacturer with year of manufacture engraved on the top end surface of sleepers.

(2) All the PSC sleepers are tested for electrical resistance at the time of manufacture, and sleepers are marked by paint with “FTC” to indicate Fit for Track Circuiting and “NFTC” to indicate not fit for track Circuited location. This shall be noted while using the sleepers at site.

(c) When concrete sleepers are used in yards with fish-plated track/SWR, the sleeper spacing at fish-plated joint shall be kept uniform. In addition, 1 m long fishplates may

preferably, be provided at such joints.

3.3.3 Sleeper Density

The Sleeper density is expressed as the number of sleepers per km of track and is fixed taking into consideration the maximum permissible speed and the traffic density of the section.

(a) Minimum Sleeper Density

(1) For all track renewals (complete track renewal and through sleeper renewal), doubling, gauge conversion, new line construction works for main lines shall be 1660 nos. per km

(2) For loop lines & sidings (permissible speed up to 50 Kmph) it shall be 1540 nos. per km.

(3) For sidings with permissible speed more than 50 Kmph minimum sleeper density shall be 1660 nos. per km.

Note: Higher sleeper density may be provided with the approval of the Principal Chief Engineer.

(4) Where concrete sleepers are required to be laid in unavoidable circumstances, in SWR track, the sleeper spacing including at fish-plated joint, shall be kept uniform. In addition, 1 m long fishplates, be provided at fish plated joints.

(b) List of commonly used PSC sleepers

S. N.	Component	Drawing No.	Description
1.	Ordinary PSC sleepers	RT-2495	Prestressed Concrete Sleeper for 52 kg Rail designed for 22.9 t Axle load.
2.		RT- 2496	Prestressed Concrete Sleeper for 60kg/52 kg Rail designed for 22.9 t Axle load.
3.		RT-7008	For 25T axle load for 60kg & 136 RE Rail.
4.	Wider PSC Sleeper	RT-8527	For 25T Axle Load For 136RE & 60kg (UIC) Rails.
5.		RT-8746	For 25T Axle Load for 60 kg (UIC) / 60E1 & 52 kg RAILS
6.	Slack Gauge Sleeper	RT-4183 to 4186	PSC Sleeper on curve for 60kg UIC running rail and 52 kg check rail
7.		RT-8621 to 8624	Wider PSC Sleeper on curve for 25T Axle Load For 136 RE / 60Kg UIC Rails.
8.		RT-5738 to 5740	PSC Sleeper on curve for BG 52 Kg Running Rail and 52KG/90R Check Rail.

9.	Sleeper for LC	RT-4148/4148A	PSC Sleeper for Level Crossing with 60 Kg UIC OR 52 Kg Running Rail and 52 Kg Check Rail.
10.		RT-8671	Wider PSC Sleeper for Level Crossing with 60 Kg Running Rail and 52 Kg Check Rail for 25T Axle Load.
11.	Sleeper for SEJ	RT-4149	Prestressed concrete sleeper for switch expansion joint for long welded rails B.G. 52Kg/60Kg UIC.
12.		RT-8224	PSC Sleeper for Switch Expansion Joint for LWR for 25T Axle Load BG 1676 mm 60KG (UIC).
13.		RT-8838	Prestressed concrete sleeper for Thick Web Switch Expansion Joint for BG 60 Kg (UIC).
14.		RT-6253	PSC sleeper for SEJ (with 300 mm max: gap) for BG 60kg (UIC) rail on bridge approaches.
15.	Sleeper for P&C	RT-4786 to 4790	PSC Approach Sleepers FOR 60 Kg (UIC).
16.		RT-4512	Sleeper No. 1 & 2 are common for 1 in 8.5 & 1 in 12 T/Outs.
17.		RT- 4793 to 4844	Sleeper No. 3 to 54 for 1 in 8.5 T/out with 6400 mm O.R. curved switch for 90R, 52 Kg & 60 Kg. (RT- 4865) & (RT-6279).
18.		RT- 4514 to 4594	Sleeper No. 3 to 83 for 1 in 12 T/out with 10125 mm O.R. curved switch for 60 Kg. (RT- 4218) & (RT-6154).
19.		RT-4512 RT-4514 to 4517 & RT-5595 to 5690	Sleeper No. 1 Sleeper No. 2 to 5 for 1 in 16 T/out 11200 mm O.R. curved switch 60 Kg. (RT-5691) Sleeper No. 6 to 101 for 1 in 16 T/out 11200 mm O.R. curved switch 60 Kg. (RT-5691)
20.		RT-4793 to 4806 & RT-6770 to 6775	Sleeper Set for 6400 mm O.R. RH derailing switch B.G. for 52 Kg. (RT-5836) & 60 Kg. (RT- 6068)
21.		RT-5471 to 5474	Exit Sleepers

22.	Shallow Depth Sleeper	(RT-4852)	Shallow Prestressed Concrete Sleeper (160 mm depth at Rail Seat) for B.G. 60 Kg UIC /52 KG Rail.
23.		RT-8326	Shallow PSC sleeper (160mm depth at rail seat) for BG 60 Kg (UIC) Rail with 52 Kg Guard Rail.

3.4 Fastenings on PSC sleepers

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

3.4.1 Elastic Rail Clip (ERC)

(a) Elastic Rail Clip (ERC) is used for fastening the rails with PSC Sleepers.

(b) The Elastic Rail Clips used in Indian Railway are mostly Pandrol Type, and therefore many times they are referred as “Pandrol Clips”.

(c) Different types of ERCs are used in Indian Railway e.g. ERC MK-II, ERC MK-III, ERC MK-IV, ERC MK-V, Anti-Corrosive, Anti-theft ERC and J-Clip at Glued Joint/Fish Plated Joint/Joggled Fish Plated locations.

(d) Some of the commonly used ERCs and their salient features.

S.N.	ERC type	RDSO Drawing No.	Toe load (kg)	Dia. (mm)	Approximate Weight (kg)
1	ERC-J	RT-8258	650	20.64	1
2	Mk- III	RT-3701	850-1100	20.64	0.91
3	Mk-V	RT-5919	1200-1500	23/20.64	1.08
4	Anti-theft	RT-6254	850-1100	20.64	0.937





3.4.2 Plate Screw

Plate screws along with Rail screw are used to fasten plate/slide chairs with PSC sleepers. This plate screw is used in turnout assembly.

RDSO Drawing No.	Component
T-3912	Plate Screw
T-10773	Single coil spring washer

3.4.3 Grooved Rubber Sole Plate (GRSP)

The Grooved Rubber Sole Plate Manufactured from rubber compound, absorbs high frequency vibrations, shocks and reduces noise.

(a) Some of the commonly used GRSPs

S.N.	RDSO Drawing No.	Usage
1.	RT-3703	6 mm GRSP for 52 kg Rail and 52 kg Sleeper
2.	RT-3711	6 mm GRSP for 52/60 kg Rail and 60 kg Sleeper
3.	RT-3709	10 mm GRSP for 52/60 kg Rail and slack gauge PSC sleeper No. RT-4183-4186
4.	RT-4218, RT-4219, RT-4220	GRSP Set for Turnout 1 in 12 - 60 kg (as contained in the three drawings of Layout Assembly, Switch and Crossing)
5.	RT-4865, RT-4966, RT-4967	GRSP Set for Turnout 1 in 8.5 - 60 kg (as contained in the three drawings of Layout Assembly, Switch and Crossing)
6.	RT-6068	GRSP Set for 60 Kg for Derailing Switch (as contained in the drawing of Derailing switch)
7.	RT-5836	GRSP Set for 52 Kg for Derailing Switch (as contained in the drawing of Derailing switch)

8.	RT-4732, RT-4733, RT-4734	GRSP Set for Turnout 1 in 12 - 52 kg (as contained in the three drawings of Layout Assembly, Switch and Crossing)
9.	RT-4865, RT-4866, RT-4867	GRSP Set for Turnout 1 in 8.5 - 52 kg (as contained in the three drawings of Layout Assembly, Switch and Crossing)
10.	RT-6154, RT-6155, RT-4220	GRSP Set for Turnout 1 in 12 with Thick Web Switch (TWS) - 60 kg (as contained in the three drawings of Layout Assembly, Switch and Crossing)
11.	RT-6279, RT-6280 RT-4967	GRSP Set for Turnout 1 in 8.5 with Thick Web Switch (TWS) - 60 kg (as contained in the three drawings of Layout Assembly, Switch and Crossing)
12.	RT-4159	6 mm thick GRSP for SEJ
13.	GRSP 8292 to 8295	6 mm thick GRSP with horns for Turnouts (1 in 12 & 1 in 8.5)

(b) Composite GRSP

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

(1) **Some of the commonly used Composite GRSPs**

S.N.	Description/Usage	RDSO Drawing No.	Thickness of CGRSP
1	For 52kg / 60 kg Rail on PSC sleeper RT-2496	RT-6618	6.2 mm
2	For 52 kg Rail on PSC sleeper RT-2495	RT-8327	6.2 mm
3	For 136RE/60 kg Rail on Wider PSC sleeper RT-8527	RT-8528	10 mm

(2) The harder layer should be kept in contact of Rail, Thus, the surface of CGRSP where the manufacturer's initials are embossed should be placed on rail seat, facing up in contact with the rail bottom.

(c) Nylon Cord Reinforced GRSP

These 6 mm thick, Nylon Cord Reinforced GRSPs are specifically designed for placing beneath CMS crossing portion of Turnouts on PSC sleepers.

For 1 in 12 Turnout		For 1 in 8.5 Turnout	
RDSO Drawing No.	**Sleeper No.**	**RDSO Drawing No.**	**Sleeper No.**
RT-7014/1	65	RT-8916	43
RT-7014	66	RT-8917	44

RT-7015	67	RT-8918	46
RT-7016	68	RT-8919	47
RT-7017	69	RT-8920	48
RT-7018	70	-	-
RT-7019	71	-	-
RT-7020	72	-	-
RT-7021	73	-	-
RT-7014/2	74	-	-

3.4.4 Liner

(a) These are the fittings used in conjunction with the GRSP/ CGRSP and rail, on both sides of the rail foot to achieve the correct track gauge to provide for the correct deflection of the ERC for the designed Toe load.

(b) The combination liners allow flexibility to use lighter rail sections on the sleepers meant for heavier rail section.

(c) Liners are made of two Materials namely,

- Glass filled Nylon (GFN) liners.
- Metal Liners

(1) The GFN liners are generally used in track-circuited locations.

(2) Cut liners to be used with ERC J clip at fish plated Joint/ Glued Joint. For details of Cut liners, RDSO drawing no. RT-4322(for 52 kg rail) & RT- 4511(for 60 kg rail) may be referred.

(3) Some of the commonly used Liners,

S. N.	Rail Section	Sleepers meant for rail section	RDSO Drg. No.	Type of Liner	Colour band
1	52 kg	52 kg	RT-3738	Metal	-
2	60 kg	60 kg	RT-3740	Metal	-
3	52kg	60 kg	RT-3741(GS)	Metal	Yellow
			RT-3742 (NGS)	Metal	Green
4	52 kg	52 kg	RT-3702	GFN	Pink
5	60 kg	60 kg	RT-3706	GFN	White

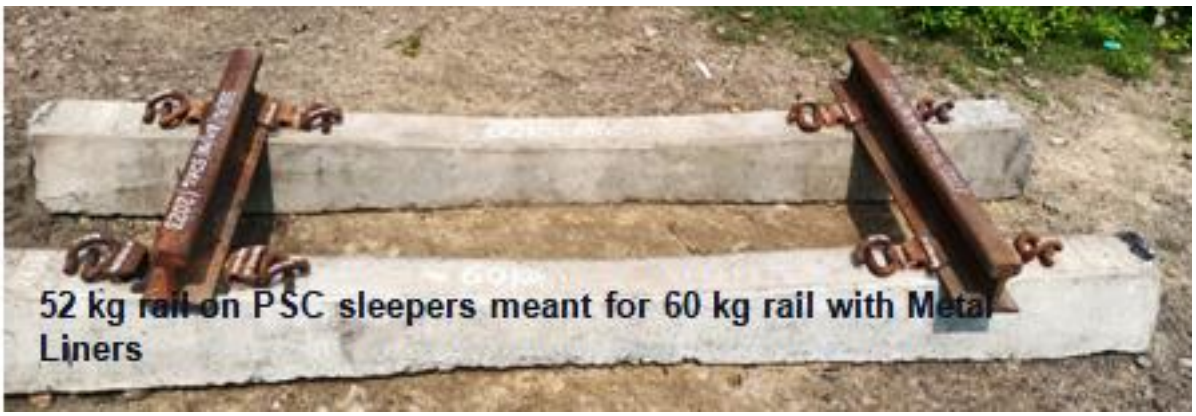
6	52kg	60 kg	RT-3707 (GS)	GFN	Yellow
			RT-3708 (NGS)	GFN	Light Green
7	60kg	136RE	RT-8616(GS)	Metal	Blue
			RT-8617(NGS)	Metal	Brown
8	60kg	136RE	RT-6938(GS)	GFN	Light Brown
			RT-6939(NGS)	GFN	Grey
9	136RE	136RE	RT-8618	Metal	-
10	136RE	136RE	RT-6937	GFN	Sky Blue

- **GS**- Stand for Gauge Side, **NGS**-Stand for Non-Gauge side

3.4.5 Generally used Combination of fittings on PSC sleepers where,

(a) 52 kg rail on PSC sleepers meant for 60 kg rail

S. N.	Sleepers meant for rail section	Rail Section	GRSP		Liners								ERC
			RDSO Drg No.	Nos.	Metal				GFN				
					Drg. No.	Position	Nos.	Color Band	Drg. No.	Position	Nos.	Color Band	
1.	60 Kg *RT-2495 & 2496*	52 Kg	RT-3711 *6 mm Thick*	2	RT-3741	Gauge face side	2	Yellow	RT-3707	Gauge face side	2	Yellow	RT-3701/ 5919
					RT-3742	Non-Gauge face side	2	Green	RT-3708	Non-Gauge face side	2	Light Green	



52 kg rail on PSC sleepers meant for 60 kg rail with Metal Liners







(b) 60 kg rail on PSC sleepers meant for 60 kg rail

S.N.	Sleepers meant for rail section	Rail Section	GRSP		Liners							ERC
			RDSO Drg No.	Nos.	Metal			GFN				
					Drg. No.	Position	Nos.	Drg. No.	Position	Nos.	Color Band	
1.	60 Kg *RT-2495 & 2496*	60 Kg	RT-3711 *6 mm Thick*	2	RT-3740	All four side	4	RT-3706	All side	4	White	Mk-V RT-5919



60 kg rail on PSC sleepers meant for 60 kg rail with Metal Liners





60 kg rail on PSC sleepers meant for 60 kg rail with GFN Liners



(c) 60 kg rail on PSC sleepers meant for 136 RE rail

S.N.	Sleepers meant for rail section	Rail Section	GRSP		Liners								ERC
			RDSO Drg No.	Nos.	Metal				GFN				
					Drg. No.	Position	Nos.	Color Band	Drg. No.	Position	Nos.	Color Band	
1.	136 RE *RT-7008 for 25 T Axle Load*	60 kg	RT-7010 *10 mm Thick composite*	2	RT-8616	Gauge face side	2	Blue	RT-6938	Gauge face side	2	Light Brown	Mk-V RT-5919
					RT-8617	Non-Gauge face side	2	Brown	RT-6939	Non-Gauge face side	2	Grey	



60 kg rail on PSC sleepers meant for 136 RE rail with GFN Liners

(d) 136 RE rail on PSC sleepers meant for 136 RE rail

S.N.	Sleepers meant for rail section	Rail Section	GRSP		Liners							ERC
			RDSO drawing No.	Nos.	Metal			GFN				
					Drg. No.	Position	Nos.	Drg. No.	Position	Nos.	Color Band	
1.	136 RE *RT-7008 for 25 T Axle Load*	136 RE	*RT-7010* *10 mm Thick composite*	2	RT-8618	All four side	4	RT-6937	All side	4	Sky Blue	Mk-V RT-5919

(e) 60 Kg rail on Wider PSC sleeper

S.N.	Sleepers meant for rail section	Rail Section	GRSP		Liners								ERC
			RDSO Drg No.	Nos.	Metal				GFN				
					Drg. No.	Position	Nos.	Color Band	Drg. No.	Position	Nos.	Color Band	
1.	Wider PSC sleeper RT-8527 *for 25 T Axle Load*	60 Kg	RT-8528 *10 mm Thick composite*	2	RT-8616	Gauge face side	2	Blue	RT-6938	Gauge face side	2	Light Brown	Mk-V RT-5919
					RT-8617	Non-Gauge face side	2	Brown	RT-6939	Non-Gauge face side	2	Grey	

(f) 136 RE rail on Wider PSC sleeper

S.N.	Sleepers meant for rail section	Rail Section	GRSP		Liners								ERC
			RDSO drawing No.	Nos.	Metal				GFN				
					Drg. No.	Position	Nos.	Color Band	Drg. No.	Position	Nos.	Color Band	
1.	Wider PSC sleeper RT-8527 *for 25 T Axle Load*	136RE	Rt-8528 10 mm Thick composite	2	RT-8618	All four side	4	-	RT-6937	All side	4	Sky Blue	Mk-V RT-5919

3.5 Insulated Rail joints

To ensure that the flow of current is restricted to a particular section, insulated joints are provided at both ends of the section.

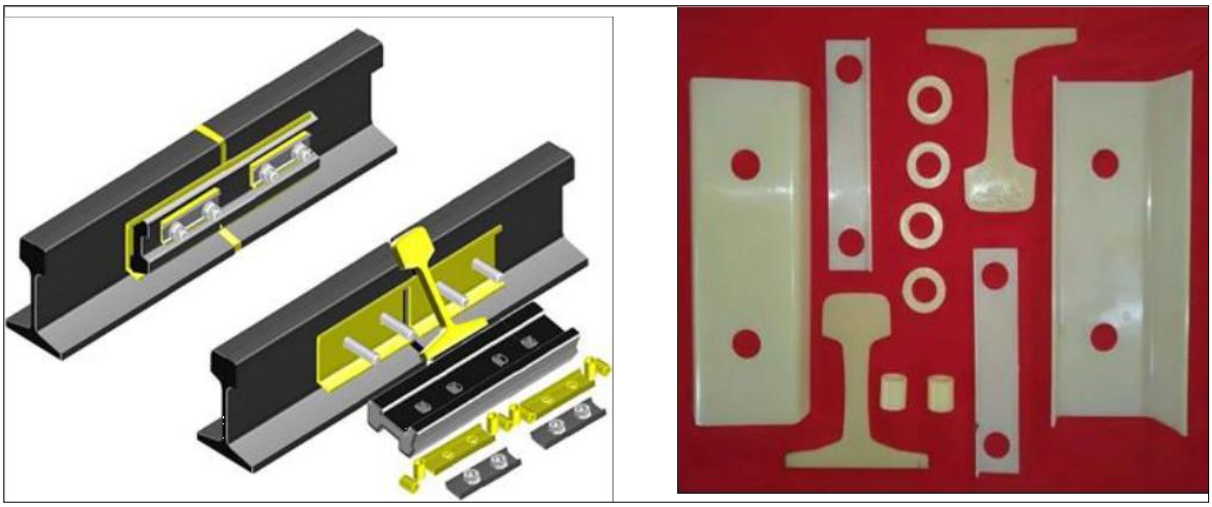
Two types of these joints are presently in use.

3.5.1 Nylon Insulated Rail Joints (Block Joints)

(a) The standard insulated joint in normal use, is made out of ordinary fishplates duly planed on the fishing planes for accommodating channel type insulation between rails and fishplates with ferrules/ bushes over the fish bolts and end posts between the rail ends.

(b) In this type, the metallic components of the rail joints as supplied by the Civil Engineering Department for this purpose are not the usual ones. The fish bolts have to be of 140 mm length. Also, four steel backing plates have to be provided for support over the nylon backing plates held by fish bolts.

(c) The insulation components are supplied by the S&T department, which have to be inserted in the rail joint when Track Circuit is being installed and also whenever they get crushed resulting in insulation failure.



3.5.2 Glued Insulated Rail Joints

(a) Glued insulated joints have been developed using resin adhesives. These joints consist of web-fitting fishplates glued to the rails with a high polymer adhesive and bolted with high tensile steel bolts. The insulation is provided by special type of insulating side channels, bushes and end posts made of fiberglass cloth roving.



(b) There are two kinds of glued joints,

- G3L (with six bolts) for usage in LWR/CWR
- G3S (with four bolts) for usage in SWR/FR track

(c) Marking of Glued Joints: - The details of glued joint number, month, year of manufacturing and the code of the manufacturer is embossed on the gauge and non-gauge face sides of the head of the rail as per provision of the Manual for Glued Insulated Rail Joints.

(d) List of commonly used Glued Joints

S. N.	RDSO Drawing No.	Description
1	T-2572	Glued Insulated Rail Joint for B.G. 60kg (UIC)-G3(L)

2	T-2576	Glued Insulated Rail Joint for B.G. 60kg (UIC)-G3(S)
3	T-671	Glued Insulated Rail Joint for B.G. 52kg G3(L)
4	T-1259	Glued Insulated Rail Joint for B.G. 52kg G3(S)

(e) Glued Joints are weak link in track as their life is substantially lower than rails and its failure rates are also much higher Insertion of Glued joints require AT welds, which are also weak joints and need attention/testing & replacements from time to time.

In order to enhance safety and service life of rails along with reduction of asset failures, Railway Board (ME, MT.R and MS&T) has decided that: For all future works in Block sections, glued joints shall be avoided by providing digital axle counters with design redundancy for Block Proving Application (BPAC), Intermediate Block Signalling (IBS) Application and Automatic Block Signalling (ABS) Applications. ***(Ref: Rly Bd Letter No. 2018/CE-11/TK/S&T/AGJ & DH dated 20.08.2020.)***

3.6 Switch Expansion Joint

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



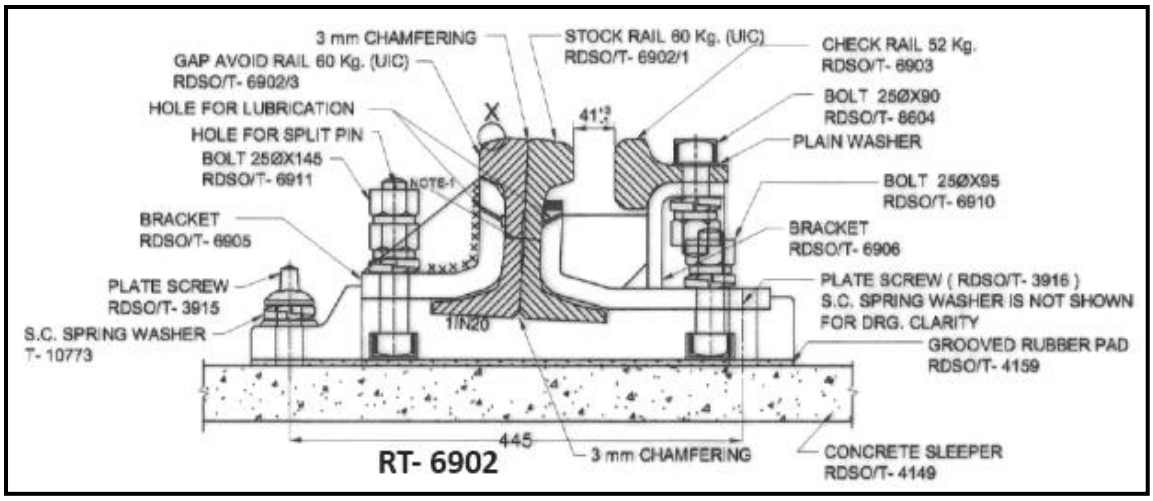
(b) Normally, SEJ are provided for same rail sections. In case SEJ is required to be provided between the junction of two different rail sections such as 52 Kg rail and 60 Kg rail, Combination SEJ as per standard RDSO drawing No. RT-6782 with 80 mm gap shall be provided between the junction of 52 Kg rail and 60 Kg rail.

(c) List of commonly used Switch Expansion Joint on concrete sleepers,

S. N.	RDSO Drawing No.	Rail section	Maximum Design Gap	Type
1	RT-4160	52 Kg/m	80 mm	Conventional
2	RT-4165	60 Kg/m	80 mm	Conventional
3	RT- 6902	60 Kg/m	80 mm (Single Gap)	Improved SEJ
4	RT- 6914	52kg/m	80 mm (Single Gap)	Improved SEJ

5	RT- 6922	60 Kg/m	65 mm (Double Gap)	Improved SEJ
6	RT- 6930	52kg/m	65 mm (Double Gap)	Improved SEJ

(d) The following fittings shall be provided to the 60Kg Switch Expansion Joint (RT-6902).



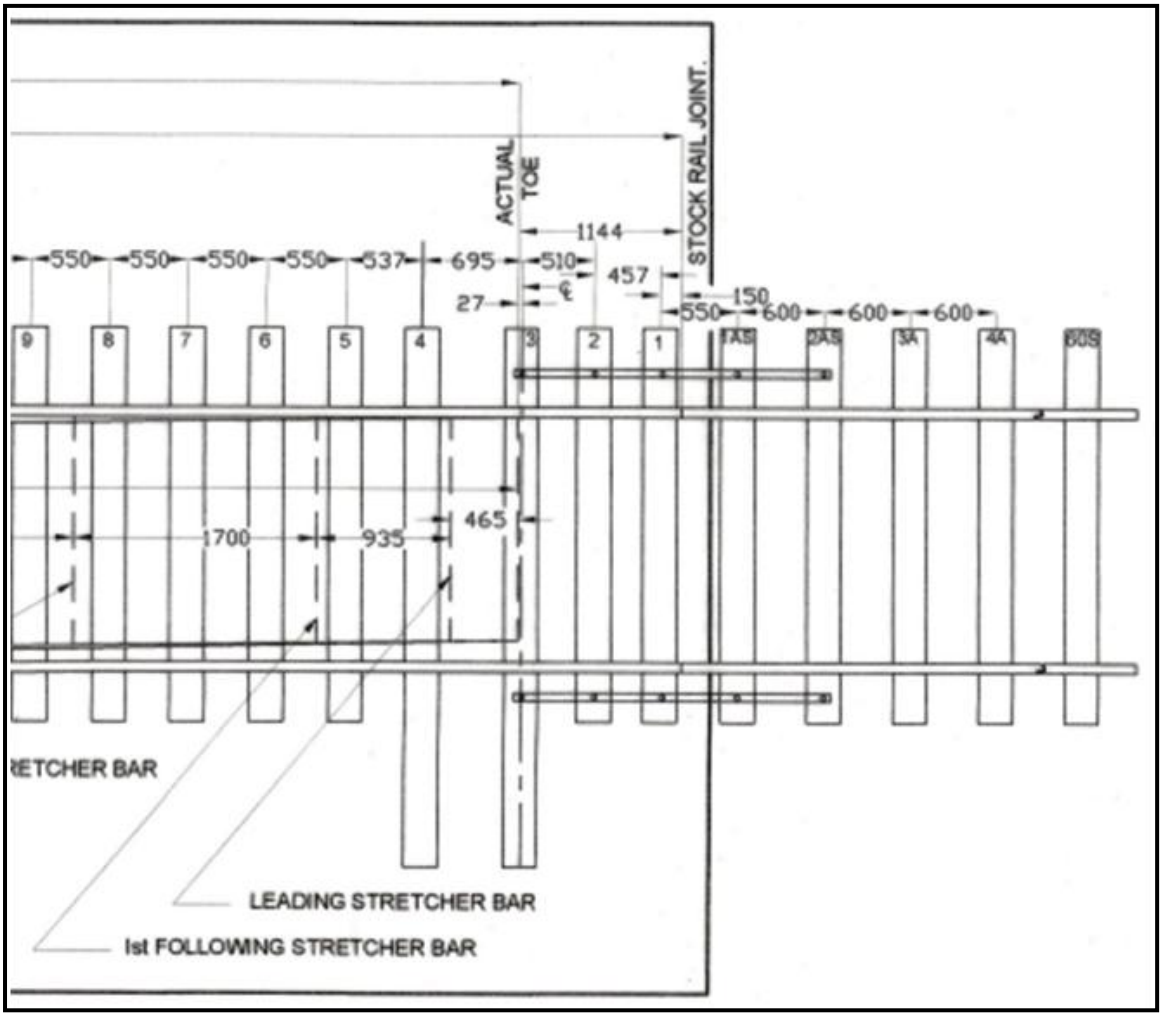
(e) The quantities of fitting required per SEJ are indicated in the table below,

S.N.	RDSO DRG No.	Component	Numbers
1.	T-4168	C.I. Chair	4
2.		Split Pin dia 6.3 X 40 mm long	40
3.		Plain washer for 25 mm dia bolt	10
4.	T-8817	Unified Hardened washer	4
5.	T-8818	Unified Hardened washer	4
6.	T-10773	Single coil spring washer	56
7.	T-3915	Plate Screw	36
8.	T-3916	Plate Screw	20
9.	T-4159	Grooved Rubber Sole Plate	14
10.	T-3711	Grooved Rubber Sole Plate	34
11.	T-6911	Bolt size dia 25x145 mm long with single coil spring washer	30
12.	T-6910	Bolt size dia 25x95 mm long with single coil spring washer	20
13.	T-8604	Bolt size dia 25x90 mm long with single coil spring washer	10
14.	T-8816	High Strength Friction Grip Bolt with Nut	8

		27X150 mm	
15.	T-6908	M.S. Bracket (Sleeper No.8/9) NGF side	2
16.	T-6907	M.S. Bracket(Sleeper No.12/13) NGF side	2
17.	T-6906	M.S. Bracket (Sleeper No.8/9, 12/13, & 9,10, 11/10, 11, 12) GF side	10
18.	T-6905	M.S. bracket (Sleeper No.9, 10, 10/11,11, 12) NGF side	6
19.	T-6904	C.I. Chair	10

3.7 Position of Approach Sleepers on Turn outs & their Fittings

The approach sleeper in advance of switch portion should be provided without fail, they are for gradual elimination of slope of rail top (1 in 20).



Fittings on Approach Sleepers					
Sleeper No.	**Nylon cord Reinforced GRSP RT-8889**	**Insulating Liners RT-3706**	**ERC RT-3701**	**MS Plate RT-3902**	**Plate Screw RT-3912**
60S	2	4	4	1	6
60-4A	2	4	4	1	6
60-3A	2	4	4	1	6
60-2AS	2	4	4	1	6
60-1AS	2	4	4	1	6

Indications:-

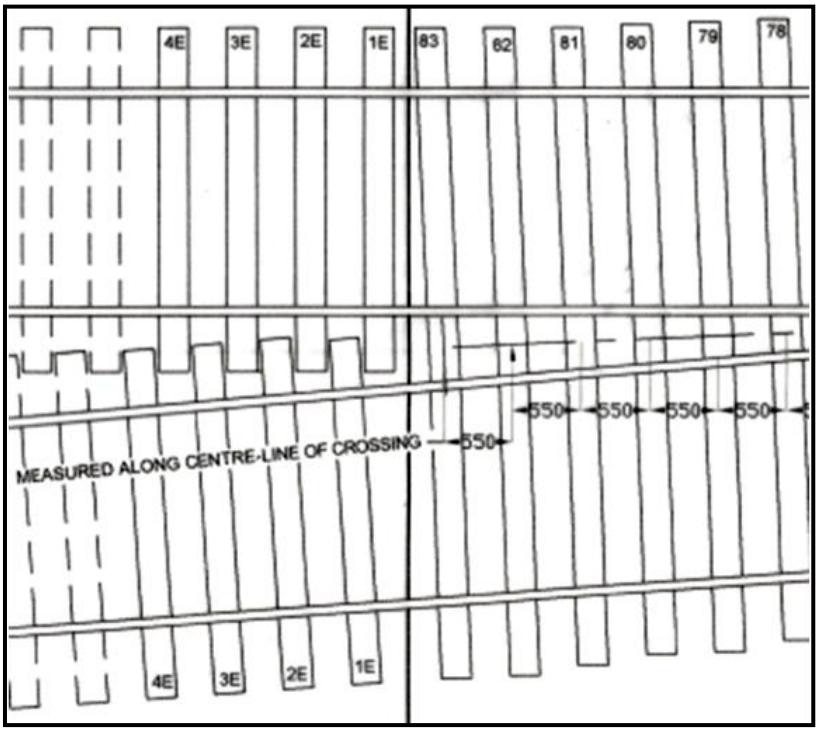
60 60Kg rail section

S Sleepers with signal fittings

A Approach sleepers

3.8 Position of Exit Sleepers on Turn outs & their Fittings

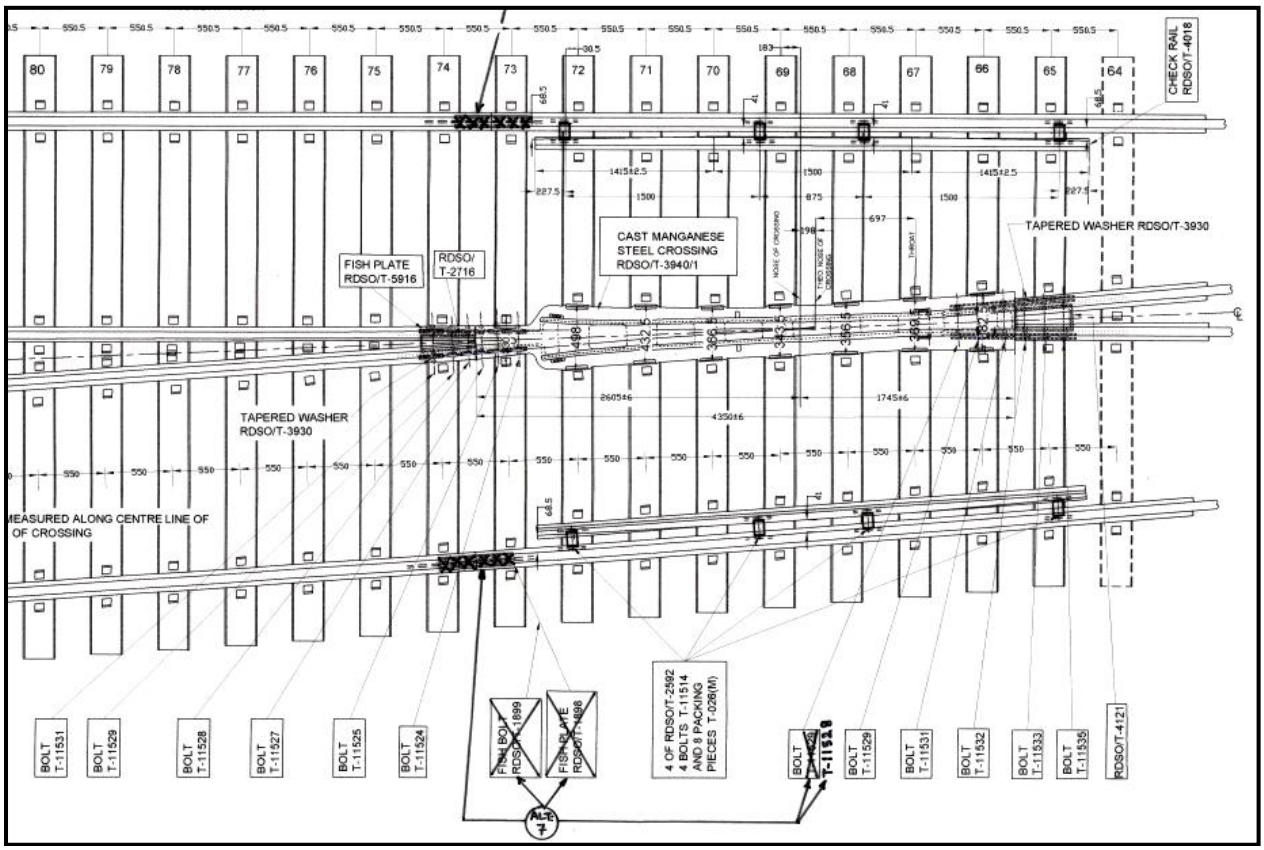
The exit sleepers behind the crossing portion should also be provided for gradual introduction of rail slope (1 in 20).



Fittings on Exit Sleepers			
Sleeper No.	**Nylon cord Reinforced GRSP RT-8889**	**Insulating Liners RT-3706**	**ERC RT-3701**
1E x 2	4	8	8
2E x 2	4	8	8
3E x 2	4	8	8
4E x 2	4	8	8

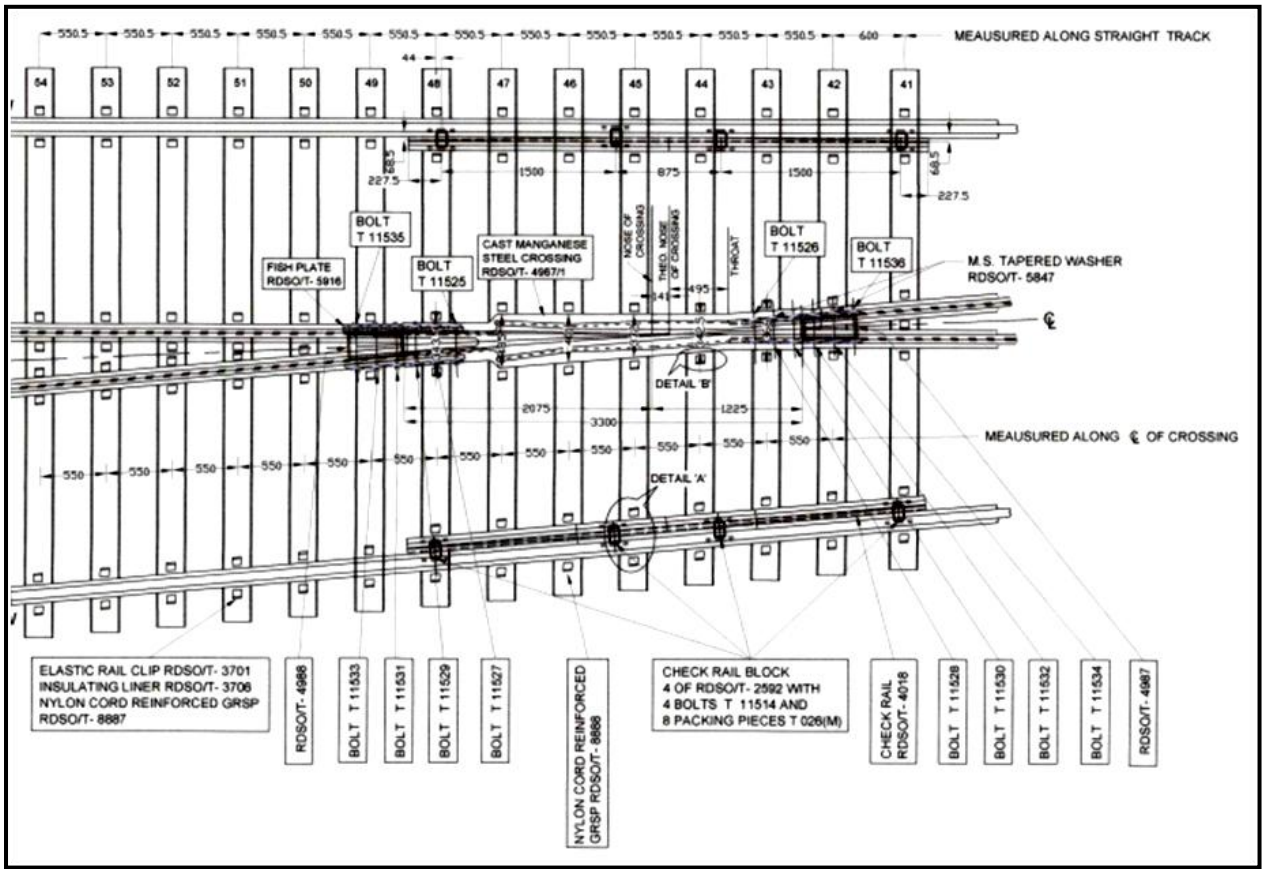
Where, E - Exit sleepers

3.9 Position of Fish plates and Bolts in 1 in 12 CMS crossing B.G. for 60 Kg



RDSO Drg No.	Component	Length	Nos.
RT-5916	Fishplates	1 m Long	4
T-11535	25 mm dia Bolt	400 mm	1
T-11533	25 mm dia Bolt	380 mm	1
T-11532	25 mm dia Bolt	370 mm	1
T-11531	25 mm dia Bolt	360 mm	2
T-11529	25 mm dia Bolt	340 mm	2
T-11528	25 mm dia Bolt	330 mm	2
T-11527	25 mm dia Bolt	320 mm	1
T-11525	25 mm dia Bolt	300 mm	1
T-11524	25 mm dia Bolt	290 mm	1
T-11514	25 mm dia Bolt	190 mm	8
T-3930	Tapered washer	To be used with crossing bolts	24

3.10 Position of Fish plates and Bolts in 1 in 8.5 CMS crossing B.G. for 60 Kg



RDSO Drg No.	Component	Length	Nos.
RT-5916	Fishplates	1 m Long	4
T-11536	25 mm dia Bolt	410 mm	1
T-11535	25 mm dia Bolt	400 mm	1
T-11534	25 mm dia Bolt	390 mm	1
T-11533	25 mm dia Bolt	380 mm	1
T-11532	25 mm dia Bolt	370 mm	1
T-11531	25 mm dia Bolt	360 mm	1
T-11530	25 mm dia Bolt	350 mm	1

T-11529	25 mm dia Bolt	340 mm	1
T-11528	25 mm dia Bolt	330 mm	1
T-11527	25 mm dia Bolt	320 mm	1
T-11526	25 mm dia Bolt	310 mm	1
T-11525	25 mm dia Bolt	300 mm	1
T-11514	25 mm dia Bolt	190 mm	8
T-5847	Tapered washer	To be used with crossing bolts	24

3.11 Ballast

It is used to bear the compression load of the sleepers, rails, and rolling stock and to facilitate drainage. Ballast also physically holds the track in place as the trains roll over it.

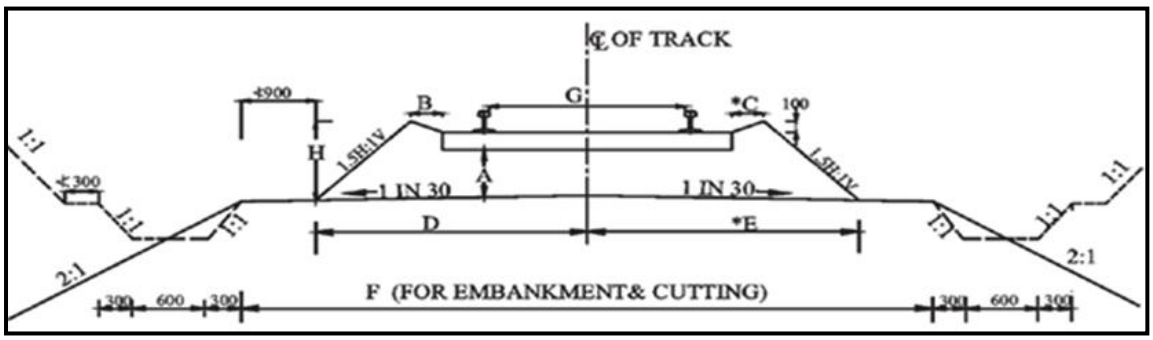
Crushed Stone ballast to be used on all lines including points and crossings shall be conforming to RDSO specifications for Track Ballast No. IRS -GE -1, June 2016 with latest amendments.

3.11.1 Ballast Profile

(a) Ballast profile: -The following ballast profiles shall be provided for the various groups of track for LWR/CWR and other than LWR/CWR as given in the sketch below.

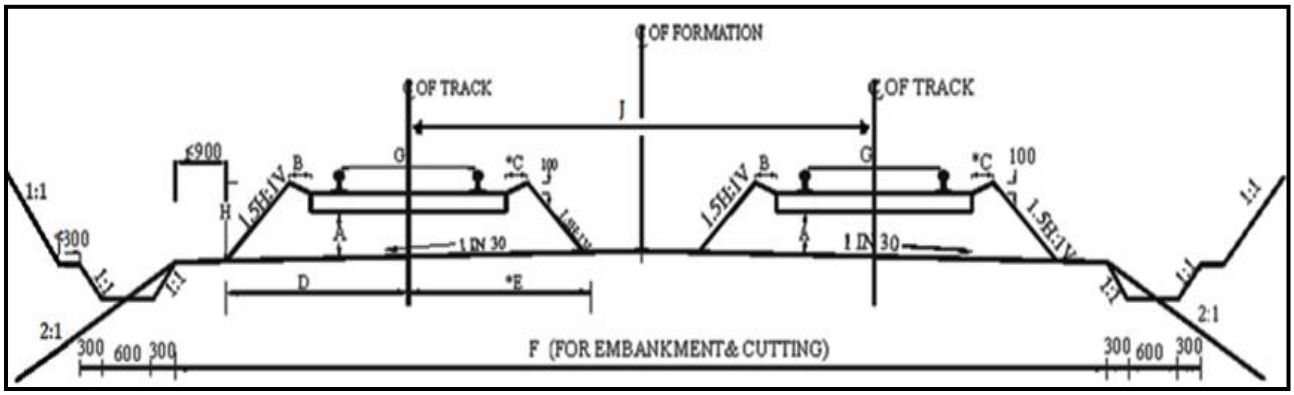
(b) The approximate quantity of ballast required per metre run of track for standard ballast sections is indicated in the table below.

(1) Ballast Profile for LWR Track (Single Line BG) for PRC Sleepers



G Gauge	Type of Sleeper	A	B	C*	D	E*	F	H	Quantity of Ballast per meter in	
									Straight Track (M^3)	Curved Track (M^3)
1676 mm	PRC	250	350	500	2693	2851	7850	646	2.030	2.120
		300	350	500	2772	2930	7850	698	2.304	2.401
		350	350	500	2851	3009	7850	751	2.585	2.690

(2) Ballast Profile for LWR Track (Double Line BG) for PRC Sleepers

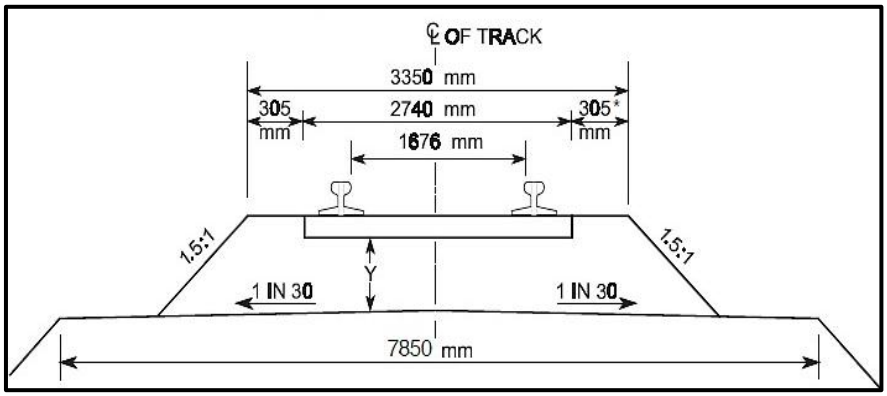


G Gauge	Type of Sleeper	A	B	C*	D	E*	F	H	Quantity of Ballast per meter in	
									Straight Track (M^3)	Curved Track (M^3)
1676 mm	PRC	250	350	500	2785	2943	13160	707	2.030	2.120
		300	350	500	2864	3022	13160	760	2.304	2.401
		350	350	500	2943	3101	13160	812	2.585	2.690

Note:

- *Suitable dwarf walls shall be provided in case of cuttings, if necessary for retaining ballast.*
- ***On outer side of curves only.***
- *Super elevation has not been considered in calculation of ballast quantity for curved track.*
- *All dimensions are in mm.*

(3) Standard Ballast Profile for BG (Other Than LWR/CWR)



S. N.	Depth of Ballast Cushion	Quantity of Ballast per Meter	
		On Straight and Curves of Radius flatter than 600 M	Curves of Radius sharper than 600 M
1	250 mm	1.769 M^3	1.820 M^3
2	300 mm	2.022 M^3	2.078 M^3
3	350 mm	2.282 M^3	2.344 M^3

Note :

- *In the case of ordinary fish plated track: * To be increased on the outside of curves to 400 mm in the case of curves sharper than 600 M radius.*
- *In short welded panel Track* To be increased to 400 mm on outside of all curves, flatter than 875 M radius and to 450 mm, in the case of curves sharper than 875 M radius.*
- ** To be increased to 550 mm on the outside of turn in curves of turnouts in passenger yards.*
- *Super elevation has not been considered in calculation of ballast quantity for curved track.*

3.11.2 Depths of Ballast Cushion *(Para 212 (2) of IRPWM)*

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

In case of	Minimum depth of the ballast cushion for all routes
Track Renewals (complete track renewals and through sleeper renewals)	300 mm (Where possible 350 mm shall be provided)
All Doubling, Gauge Conversion & New Line construction works	350 mm
Loop Lines	250 mm

(b) For higher speed, table in Para 2.1 above would also be referred.

(c) Sidings

Private and Other Sidings	For permissible speed up to 50 Kmph.	300 mm
	For permissible speed more than 50 Kmph	350 mm

(d) Minimum depth of clean ballast cushion at all times for mechanised maintenance under the rail seat of the PSC sleepers shall not be less than 150 mm.

3.12 Spacing of tracks

Minimum distance centre to centre on straight tracks

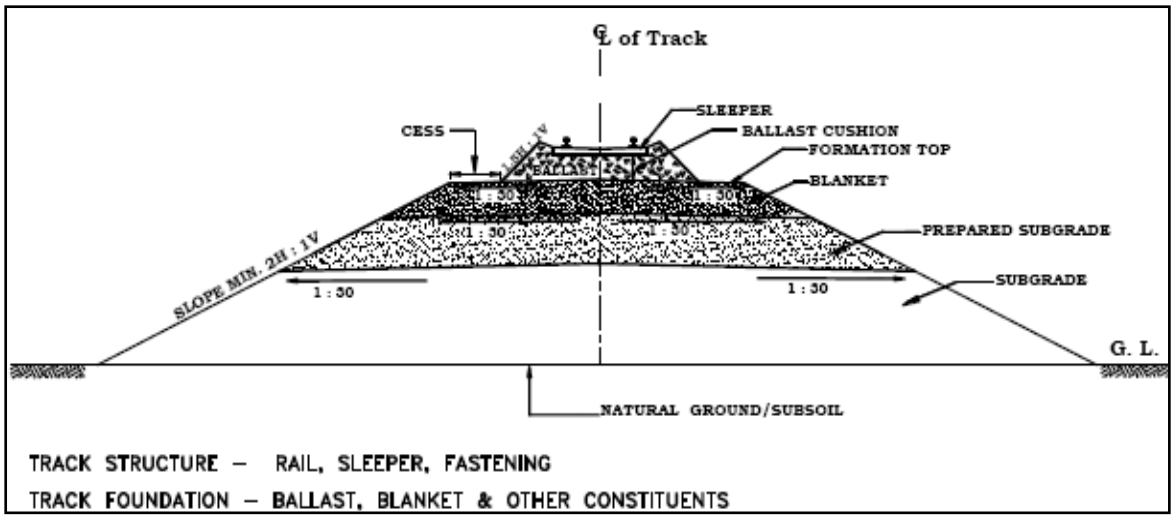
3.12.1 For existing works 4265 mm

3.12.2 For new works/ addition to existing works 5300 mm



3.13 Formation

The formation is the ground surface prepared to support the track surface. It is the top layer of the extended subsoil. A subgrade protection layer applied to the formation is an integral part of track construction. The formation is an important constituent of the track, as it supports the entire track structure.



As per latest provisions of IRSOD (Para 16 & Para 17 of Chapter 1 of Schedule 1)/ IRPWM (Para 212), the top width of formations for straight tracks is as follows:

Type of work	Minimum Top width of formation in mm		Cutting/ Embankment
	For single line track	For double line track	
For new works/ alteration to existing works	7850	13160	In both cutting (excluding side drains) & embankment
For existing works	6850	12150	In embankment
	6250	11550	In cutting (excluding side drains)

Note: -

(a) On curves, additional formation width is Increased due to extra widening of ballast shoulder on outer side of curves in both single/double line, and due to effect of super-elevation to requirement of extra clearances on double line on curves.

(b) Minimum Cess width of 90 cm is provided for both straight track & on curves.

(c) In doubling work of existing lines, cross-slope of 1 in 40 in existing old formation need not be disturbed.However, the cross slope of 1 in 30 shall be provided in widened formation width, newly constructed for doubling.

(d) All dimensions are in mm.

****

REFERENCES

S. No.	Description
1.	Indian Railways Permanent Way Manual, June 2020 (Corrected up to ACS-7)
2.	Indian Railways Schedule of Dimensions, 1676 Gauge, BG, Revised, 2022
3.	IRS-T-12-2009 incorporated up to ACS 5, corrigendum 1 of ACS no 1 and 5
4.	Master list of drawing Bridge & Structure, RDSO
5.	Master List of Drawings by Track Design Directorate, RDSO (Document No.: TD-M-4.2.4-1)
6.	Master List of Drawings of Bridges & Structures Directorate, RDSO (Document No: BS-M-8.3.6-1)
7.	Track Manual
8.	RDSO specifications for Track Ballast No. IRS -GE -1, June 2016 with latest amendments
9.	Steel Channel sleepers (Ref: RDSO Document No: BS-M-8.3.6-1, Aug-2022)
10.	H-Beam steel sleeper (Ref: RDSO Document No: TD-M-4.2.4-1, Jul-2017)
11.	RDSO Document No: BS-M-8.3.6-1, Aug-2022)
12.	Teaching material from IRICEN
13.	Website http://10.100.2.19/track/drawings/drawings.htm

NOTES

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

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 Railnet.

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

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

अस्वीकरण /Disclaimer

The document prepared by CAMTECH is meant for the dissemination of the knowledge/ information mentioned herein to the field staff of Indian Railways. This document is not statutory & instructions given in it are for the purpose of guidance only. While reasonable care and effort has been taken to ensure that information given is at the time believed to be fare and correct and opinion based thereupon are reasonable. In case of any doubt, the reader/user is supposed to refer the relevant codes/ manuals available on the subject before actual implementation in the field. The information contained in this pamphlet does not supersede any existing provisions laid down in G & SR, instructions issued by Railway Board and RDSO.

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**