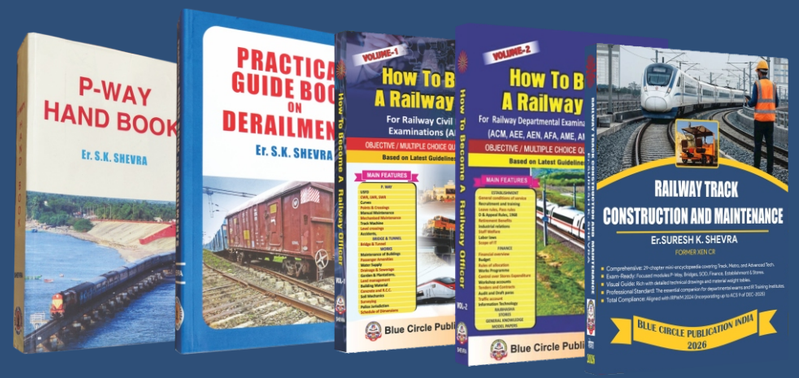
Er SURESH K SHEVRA

Indian Railways Executive Engineer, Civil (Retd.)

Author

Indian Railway Technical Books

Shevra's Books Series at a glance



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RAILWAY TRACK CONSTRUCTION AND MAINTENANCE

Er.SURESH K. SHEVRA

BLUE CIRCLE PUBLICATION INDIA

शेवरा

2026

RAILWAY TRACK CONSTRUCTION AND MAINTENANCE

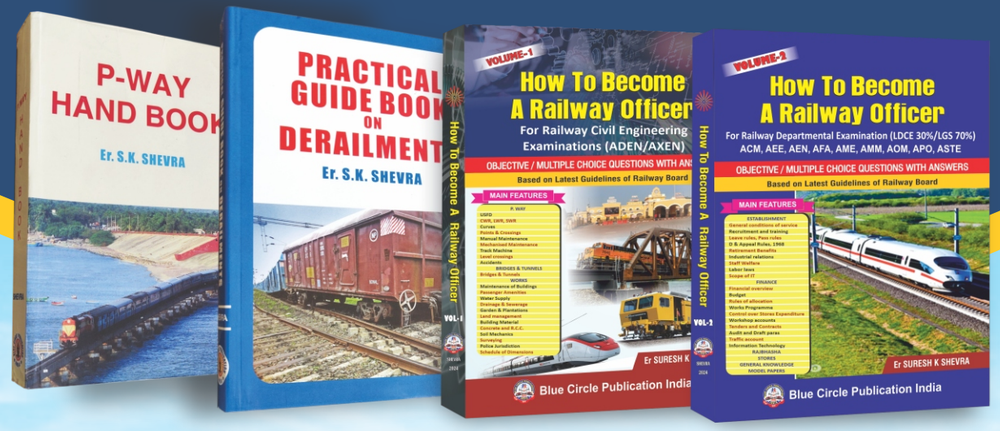
Er.SURESH K. SHEVRA

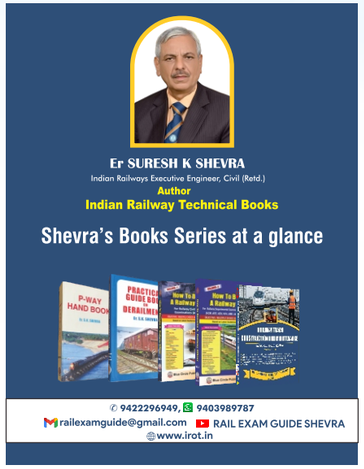
- Comprehensive: 29-chapter mini-encyclopaedia covering Track, Metro, and Advanced Tech.
- Exam-Ready: Focused modules P-Way, Bridges, SOD, Finance, Establishment & Stores.
- Visual Guide: Rich with detailed technical drawings and material weight tables.
- Professional Standard: The essential companion for departmental exams and IR Training Institutes.
- Total Compliance: Aligned with IRPWM 2024 (incorporating up to ACS 10 of DEC-2025)

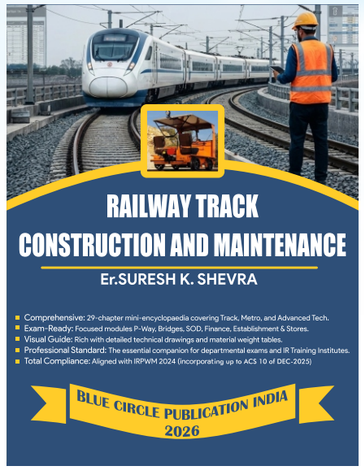
BLUE CIRCLE PUBLICATION INDIA

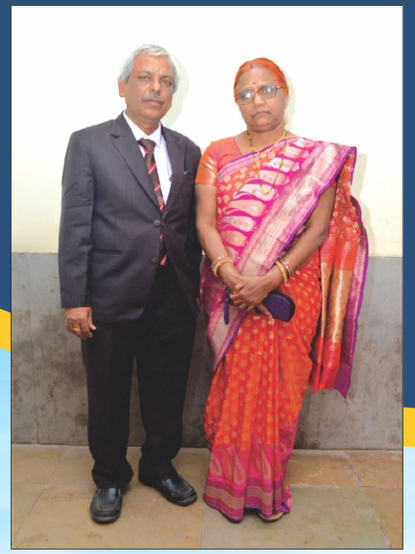
2026

Shevra's Book Series at A Glance









-: AUTHOR :-

Er. Suresh Kumar Shevra

Mrs. Shyama Devi Shevra

RAILWAY TRACK CONSTRUCTION & MAINTENANCE KEY HIGHLIGHTS OF THE 2026 EDITION:

Recommended by top Railway officials of India.

- **Current Standards:** Meticulously updated to December 2025, incorporating the IRPWM 2024 (up to ACS10) and recent Railway Board circulars of another department also.
  This isn't just a textbook; it's a comprehensive mini-encyclopaedia designed to bridge the gap between classroom learning at training institutes and daily field operations.
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RAILWAY TRACK CONSTRUCTION & MAINTENANCE

MINI-ENCYCLOPAEDIA
FOR
INDIAN RAILWAYS CIVIL ENGINEERING OFFICIALS

Includes Permanent Way, Bridges, Metro Track, Establishment, Finance, Stores, Traffic, S&T and SOD

AUTHOR

Er. SURESH K SHEVRA

INDIAN RAILWAYS
EXECUTIVE ENGINEER, CIVIL (RETD.)

BLUE CIRCLE PUBLICATION
SHEVRA
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सुरक्षा
सेवा
ज्ञान

A SOLUTION OF HIGHER ENGINEERING VERSION FOR RAILWAY ACADMEY

2026

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Fourth Edition 2026

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Indian Railways Executive Engineer, Civil (Retd.)

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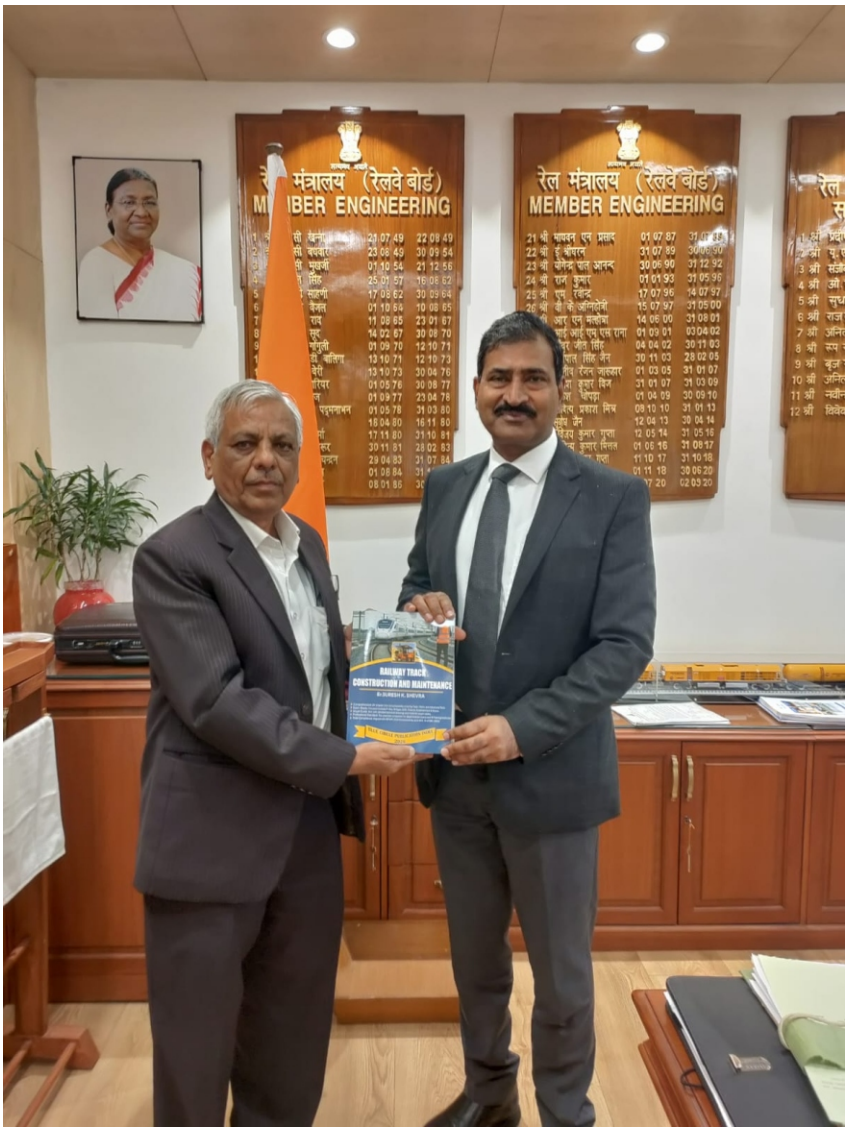
TO
SMT BENI BAI & SHRI CHHAKKI LAL SHEVRA
MOTHER & FATHER
WITH
LOVE & RESPECT

शुभ संकल्प

अन्नदानं परं दानं विद्यादानमतः परम् ।
अन्नेन क्षणिका तृप्तिर्यावज्जीवं च विद्यया ।।

अन्न दान परम दान है, पर विद्या दान उससे बडा है क्योंकि ।
अन्नसे क्षणभरकी तृप्ति होती है, और विद्यासे आजीवन ।।

Hon'able Shri A.P. Mishra, Member Engineering Rly. Board & Ex-officio secretary to Government of India (In center) along with Shri A.K. Gupta, Addl. Member-CE (Right) releasing P-Way Hand Book written by Shri S.K. Shevra, Author (Left) in his chamber at Railway Board, New Delhi on 07-06-2011



Proud Moment:

Launch of the 4th Edition of "Railway Track Construction and Maintenance"

"The launch of the 4th edition of my 6th book, **Railway Track Construction and Maintenance,** was graciously unveiled by **Hon'ble Shri Vivek Kumar Gupta Ji**, **Member Infrastructure (Railway Board),** in his chamber on February 18, 2026."

विवेक कुमार गुप्ता
Vivek Kumar Gupta

सदस्य इन्फ्रास्ट्रक्चर, रेलवे बोर्ड
एवं पदेन सचिव, भारत सरकार
रेल मंत्रालय

**MEMBER INFRASTRUCTURE,
RAILWAY BOARD & EX-OFFICIO SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

FOREWORD

As Indian Railways embarks on a transformative journey towards fast-track connectivity, heavy-haul corridors, and world-class station re-development, the role of civil engineers has become increasingly pivotal. We are no longer merely maintaining tracks; we are building the backbone of a modern economy.

I am pleased to introduce "Railway Track Construction and Maintenance" by Er. Suresh K. Shevra, former Executive Engineer (Civil) of Indian Railways. This book is a comprehensive guide meticulously aligned with the IRPWM 2024 and the latest Railway Board circulars. Covering essential aspects of P-way maintenance, materials, bridges, buildings, and construction, it serves as an invaluable resource for both practicing railway civil engineers and aspirants.

This book provides critical insights into specialised topics such as Long Welded Rail (LWR), Track Machines, Ultrasonic Flaw Detection (USFD), and Rail Sleeper Fastening Systems. Its structured approach makes it an ideal preparation guide for LDCE, LGS, and other departmental examinations.

Beyond the technicalities of ballast and rail, the author's inclusion of Establishment, Finance, and Stores reflects the multi-faceted reality of a modern railway executive- balancing technical excellence with administrative efficiency.

Recognizing the burgeoning landscape of urban transit, the insights into Metro systems make this a versatile resource for the broader rail sector.

Safety, reliability, and punctuality are the three pillars of our infrastructure goals. I am confident that this book will serve as an indispensable guide for our engineering fraternity in upholding these standards.

I congratulate Er. Shevra on this significant contribution to Railway literature.

18/2/2026
(Vivek Kumar Gupta)

Date: 18-02-2026
Place: New Delhi

Room No. 223, Rail Bhawan, New Delhi-110 001.
Tel.: 011-23383879, Fax: 011-23385114, Email: mi@rb.railnet.gov.in

हरि शंकर वर्मा
HARI SHANKAR VERMA

सत्यमेव जयते

महानिदेशक (संरक्षा)
भारत सरकार
रेल मंत्रालय (रेलवे बोर्ड)
रेल भवन, नई दिल्ली–110001
DIRECTOR GENERAL (SAFETY)
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)
RAIL BHAWAN, NEW DELHI-110001

FOREWORD

I congratulate the author Shri Suresh K. Shevra for putting in wonderful job of compiling this book **"Railway Track Construction&Maintenance "** which is in tune with the IRPWM & other related manuals including latest technical circulars, correction slips issued by Government of India, Ministry of Railways (Railway Board).

The author has been publishing this book since 2010 under the title "P-Way Hand Book" which has now been enlarged and renamed as **"Railway Track Construction& Maintenance ".** It will be of immense help to railway engineers and ground level staff in having an in-depth understanding of maintenance of P-Way, bridges, tracks and related works.

Date: 27 -10-2025
New Delhi

27.10.2025

(Hari Shankar Verma)

अनिल कुमार खंडेलवाल
ANIL KUMAR KHANDELWAL

सदस्य इन्फ्रास्ट्रक्चर, रेलवे बोर्ड
एवं पदेन सचिव, भारत सरकार
रेल मंत्रालय

MEMBER INFRASTRUCTURE, RAILWAY BOARD
& EX-OFFICIO SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

FOREWORD

I feel both pleasure and pride in being write the Foreword to this book "**RAILWAY TRACK CONSTRUCTION & MAINTENANCE**"which is bring it in tune with the IRPWM and other related manuals including latest technical circulars, correction slips issued by Government of India, Ministry of Railways (Railway Board).

This author is publishing in the name of "P-WAY HAND BOOK "since 2010 now enlarged and renamed as **"RAILWAY TRACK CONSTRUCTION & MAINTENANCE** "which is contains enough study material to revolutionize the readers knowledge it is like a mini -encyclopedia of maintenance of P-Way, Bridge, Building and construction of Track, also their related works

This is 4th edition which is being published by Author **Shri Suresh K Shevra former Executive Engineer Central Railway**, will be revolutionize the knowledge of railway Civil Engineers being comprehensive to deal practical issues of railway track on Indian Railways also helpful to aspirants of appearing LDCE/LGS and other departmental examinations including at the grass root level of construction and open line staff and Engineers.

I wish and congratulate **Shri Suresh K Shevra** Author of **"RAILWAY TRACK CONSTRUCTION & MAINTENANCE"** for his tireless efforts and I am sure that all the railway engineers will benefit from this book being focused on in depth understanding of subjects at basic and advance level of P-Way, Bridge, Establishment, Finance, Store etc.

Date: 3--6-2024
Place: New Delhi

(Anil Kumar Khandelwal)

विश्वेश चौबे
Vishwesh Chaube

सत्यमेव जयते

स्वच्छ भारत
एक कदम स्वच्छता की ओर

सदस्य इंजीनियरिंग, रेलवे बोर्ड
और पदेन सचिव,
भारत सरकार
रेल मंत्रालय
रेल भवन, नई दिल्ली–110001

MEMBER ENGINEERING, RAILWAY BOARD
&
EX-OFFICIO SECRETARY,
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
RAIL BHAVAN, NEW DELHI-110001

FOREWORD

I am happy to learn that Shri S.K. Shevra, Retired Executive Engineer, Central Railway is going to publish new edition of **P. Way Handbook** with latest correction slips of Indian Railways Civil Engineering manuals.

The author has compiled all practical and theoretical aspect related with track maintenance. It is quite comprehensive book which also highlights the important measures necessary for improving safety and maintenance: standards of Indian Railways.

I wish to congratulate the author for success and enormous efforts.

(Vishwesh Chaube)

New Delhi,
4th October, 2019

भारत सरकार
नागर विमानन मंत्रालय
(रेल संरक्षा आयोग)
GOVERNMENT OF INDIA
MINISTRY OF CIVIL AVIATION
(COMMISSION OF RAILWAY SAFETY)

रेल संरक्षा आयुक्त
मध्य परिमंडल
2री मंजिल, चर्चगेट स्टेशन उप भवन,
एम. के. रोड, मुंबई – 400020
टेली. फैक्स : 022 - 22056058

Commissioner of Railway Safety
Central Circle
2nd Floor, Churchgate Stn. Bldg.
Annexe, M. K. Road, Mumbai - 400020
Tele Fax : 022 - 22056058

It is with great pride and pleasure that I pen this Foreword for the book **"Railway Track Construction & Maintenance."** This comprehensive volume arrives, fully updated to align with the IRPWM 2024, latest technical circulars, and essential railway manuals.

There are few officers who have extensive knowledge of field working along with theoretical background and I consider **Er Suresh K Shevra** to be one of those. **The author, a retired Executive Engineer (Civil) of the Indian Railways**, served under my supervision during my tenure as Sr. DEN/Co-ordination/Bhusawal CR. Having observed his dedication firsthand, it is no surprise that his initial work-the "P-Way Handbook" (first published in 2010)-has evolved into this expansive resource.

This book offers deep technical insights into track construction alongside practical maintenance strategies. It is an invaluable companion for field engineers in their daily operations. It may also help to aspirants preparing for LDCE, LGS, and other departmental examinations. Beyond core civil engineering, the inclusion of Establishment, Finance, Stores, and Metro systems ensures a holistic understanding of the modern railway landscape.

Place: Mumbai
Date: 28-01-2026

28/1/2026

(Manoj Arora)
Commissioner of Railway Safety
Central Circle

रविलेश कुमार, IRSEE-1986
महानिदेशक, इरीन

Ravilesh Kumar, IRSEE-1986
Director General, IRIEEN

भारत सरकार, रेल मंत्रालय
भारतीय रेल विद्युत इंजीनियरिंग संस्थान,
नाशिक रोड - 422 101

Indian Railways Institute of Electrical
Engineering, Nashik Road - 422 101

FOREWORD

It gives me immense pleasure to note that Shri Suresh K. Shevra, Former XEN/CR is publishing 4th Edition of "P-WAY HAND BOOK" with revised name **"Railway Track Construction & Maintenance "** with additional study material of other departments, I.e. Electrical, S&T, Traffic, Establishment and Account etc. This is a very unique and comprehensive book containing enough study material to revolutionise the reader's knowledge and is useful not only for P-Way Engineers but also for other departments, since the Author has covered so many topics related to Electrical, S&T, Traffic, Establishment and Account etc.

Therefore, I am fully confident that the efforts of the Author will help in upgrading the knowledge of Railway Engineers as information contained in the book is very comprehensive to deal with practical issues of railway track on Indian Railways. It is also helpful to aspirants appearing in LDCE/LGS and other departmental examinations.

I congratulate Shri Suresh K. Shevra for his endeavours.

8/10/24

(Ravilesh Kumar)
Director General,
Indian Railways Institute of Electrical Engineering,
Nashik Road

Place: Nashik Road
Date: 08.10.2024

शोभन चौधुरी
महाप्रबन्धक
SHOBHAN CHAUDHURI
General Manager

सत्यमेव जयते

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NORTHERN RAILWAY
BARODA HOUSE, NEW DELHI-110001
☎ : 011-23387227 & 23384548 (Off.)
011-23384503 (Fax)

FOREWORD

The author is publishing "P-WAY HAND BOOK" since 2010 Now, in its rechristened form, **"RAILWAY TRACK CONSTRUCTION AND MAINTENANCE ",** the book has become more interesting like a Novel but yet contains enough study material to update the reader's knowledge. It is like a mini-encyclopaedia for maintenance of P-Way, Bridge, Building and Construction of Track, as also other related works.

About 24 years ago during my tenure at Bhusawal, the author of **"RAILWAY TRACK CONSTRUCTION AND MAINTENANCE "**, Shri Suresh K Shevra, Former XEN, Central Railway, had worked with me and I am fully confident that efforts of the author will revolutionize the knowledge of Railway Civil Engineers, being comprehensive to deal with practical Issues of P-Way and will be helpful to aspirants appearing for LDCE/LGS and other departmental examinations.

I wish Shri Suresh K Shevra all the very best for this endeavour.

28.6.2024.

Date: 28-06-2024

(Shobhan Chaudhuri)

डी.अंजनेयुलु रेड्डी, आई. आर.एस.ई
D. ANJANEYULU REDDY, IRSE
प्रमुख मुख्य इंजीनियर
PRINCIPAL CHIEF ENGINEER
दक्षिण मध्य रेलवे
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सिकंदराबाद, Secunderabad - 500 025.

FOREWORD

I am happy to learnt that the author **Shri Suresh K Shevra** former Executive Engineer Central Railway was publishing in the name of "P-WAY HAND BOOk" since 2010 now enlarged and renamed as **"RAILWAY TRACK CONSTRUCTION&MAINTENANCE"** which is contains enough study-material in tune with the IRPWM 2024 and other related manuals including latest technical circulars, correction slips issued by Ministry of Railways (Railway Board). In other words, it is just like a mini encyclopedia of maintenance & Construction of Track including Metro track, Establishment, Finance, Store, G&SR, SOD & S&T related Chapters.

Being a quite a comprehensive book, I have fully confident this 4TH edition **"RAILWAY TRACK CONSTRUCTION & MAINTENANCE"** will continue to be a valuable as a reference guide for departmental Examinations as well as useful as a reference in day-to-day work in the field.

I wish and congratulate Author **Shri Suresh K Shevra** former Executive Engineer Central Railway for his enormous efforts, and hope for his success.

Place: SECUNDRABAD
Date: 02 -12-2025

(D.ANJANYULU REDDY)
PCE SCR
2/12/2025

ए. के. सिंघल
मुख्य प्रशासनिक अधिकारी / निर्माण
A K. Singhal
Chief Administrative Officer/Const.

उत्तर रेलवे/Northern Railway
प्रधान कार्यालय/ निर्माण/ HQ Office/Const.
कशमीरी गेट/Kashmere Gate
दिल्ली/Delhi-110006
दूरभाष संख्या(D.O.T.) 011-23863661
(Railway) 030-77338

No. CAO/C/Misc/2024

Dated: 20.05.2024

FOREWORD

"P-Way Hand Book "written by Shri **Suresh K Shevra** former Executive Engineer Central Railway in 2010 now enlarged and renamed the book **"RAILWAY TRACK CONSTRUCTION AND MAINTENANCE"** is bring it in tune with the IRPWM and other related manuals including latest technical circulars, correction slips issued by Government of India, Ministry of Railways (Railway Board).

BLUE CIRCLE PUBLICATION covers, in a very comprehensive manner Railway track and construction technology, to cater better exchange of knowledge and experience about the latest technological developments associated with design, construction and maintenance of permanent way and bridges staff including Engineers.

"**RAILWAY TRACK CONSTRUCTION AND MAINTENANCE"** Hand book is a unique book in which enough study-material to revolutionize the readers' knowledge on maintenance of P-Way, Bridge, Building and Construction of Track, also helpful to aspirants of appearing LDCE/LGS and other departmental examinations.

I wish and congratulate Author **Shri Suresh.K. Shevra** former Executive Engineer Central Railway for his enormous efforts for his work. and I am sure Engineers at all levels find handy edition to their library and technical institution.

Date: 20 -5-2024

New Delhi

(A.K.Singhal)
CAO -C NDLS

Dr. Tushaba Shinde, IRPS
Director

Ministry of Personnel, Public Grievances & Pensions
Government of India
Sardar Patel Bhawan, Sansad Marg New Delhi-110001
Tel: 011-23401407, Mob: 8411083000
Email: tushaba2000@yahoo.co.in,

FOREWORD

I am delighted to note that **Shri Suresh K. Shevra**, Former Executive Engineer, Central Railway, is releasing the 4th edition of his work, now titled "**Railway Track Construction and Maintenance** (formerly the "P-Way Hand Book").

This comprehensive volume is a unique asset for Track Engineers and staff. The author has expertly covered technical subjects related to the Permanent Way, alongside crucial administrative topics such as Accounts, Establishment, and Stores. By consolidating authentic references from various manuals into one single resource, this book will serve as an essential guide for all P-Way officials as well as other department.

I am confident that Railway Civil Engineers will benefit immensely from this book, ultimately aiding in the improvement of safety and maintenance standards across Indian Railways.

I extend my heartiest congratulations to Shri Suresh K. Shevra for his enormous efforts.

Date: 9-12 2025

Dr Tushaba Shinde, IRPS,
Director, DARPG,
Ministry of Personnel, Public Grievances and Pensions,
New Delhi

बृजेन्द्र कुमार
BRIJENDRA KUMAR
प्रमुख मुख्य वाणिज्य प्रबन्धक
Principal Chief Commercial Manager

उत्तर मध्य रेलवे
NORTH CENTRAL RAILWAY

Office of the
Principal Chief Commercial Manager
Ground Floor "E" Block
Subedarganj
Prayagraj-211015

Date: 08.12.2025

FOREWORD

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It is a pleasure to see the evolution of the 'P-WAY HAND BOOK' into this comprehensive volume: **'RAILWAY TRACK MAINTENANCE AND CONSTRUCTION.'**

Shri Suresh K. Shevra worked with me nearly two decades ago when I served as Principal at ZRTI Bhusawal CR . Even then, his dedication was evident. Today, as a former XEN (CR), he has compiled a resource that is nothing short of a mini-encyclopaedia, covering critical topics like G & SR, P-Way, and Bridge works. I am confident that his practical approach will be of immense value to Civil Engineers across Indian Railways.

I congratulate Shri Shevra for his enormous efforts in bringing this book to fruition.

"Date: 08 -12-2025

BRIJENDRA KUMAR

PCCM ,PRAYGRAJ NCR

PREFACE TO THE 4th EDITION 2026

RAILWAY TRACK CONSTRUCTION & MAINTENANCE

The journey of the "P-WAY HAND BOOK" began in 2010. For this Fourth Edition (2026), the book has been significantly enlarged, renamed as " RAILWAY TRACK CONSTRUCTION & MAINTENANCE," and meticulously updated to serve as a mini-encyclopaedia for Indian Railways Civil Engineering officials.

This edition contains extensive study material aligned with the IRPWM 2024 up to ACS 10 and other related manuals. It incorporates the latest technical circulars and correction slips, issued by the Ministry of Railways (Railway Board).

Key Features:

Comprising 29 chapters organised into 8 distinct sections, the book follows a logical, hierarchical order for learning railway engineering concepts.

Designed for the modern railway professional, this exam-oriented textbook is the definitive guide for trainees at IRICEN, and ZRTIs. Refined through years of guest lectures and practical application, it transforms complex concepts into interactive classroom discussions and streamlined revision modules. Whether you are preparing for examinations or advancing your technical career, this book provides the clarity and confidence needed to navigate the challenges of the Indian Railways and achieve your professional goals.

The book is carefully crafted with clear illustrations, headings, and subheadings to facilitate quick understanding. The information provided is updated up to December 2025.

Section-wise Salient Features:

Section	Focus Area	Description
A	Permanent Way	Provides step-by-step guidance on laying, and maintaining railway track.
B	Bridges	Covers all syllabus points with necessary photos and guidance for bridge staff.
C	Metro Track	A focused study on the basics of Metro track construction and maintenance.
D	Establishment	Dealing with service matters like leave, passes, and Disciplinary & Appeal Rules (DAR).
E	Finance	Covers essentials like budget, estimates, contracts, and tenders.
F	Stores	Details procedures for MAS accounts, stock verification,
G	Traffic & S&T	Provides basic knowledge of General and Subsidiary Rules (G&SR), Signalling,
H	Reference Tables	Includes tables of track material weight along with relevant drawings.

I am deeply grateful to the top railway officials who encouraged and appreciated this publication, making this edition possible:

Shri Vishwesh Chaube Former Member Engineer Railway Board, New Delhi, Shri Anil Kumar Khandelwal, Former Member (Infrastructure), Railway Board, New Delhi, Shri Chetan Bakshi Former CRS Central Circle Mumbai. Shri H.S. Verma, DG (Safety), Railway Board, New Delhi, Shri Shobhan Chaudhuri Former GM NR New Delhi, Shri R.K. Yadav, Former GM, Central Railway. Shri Ravilesh Kumar, Former DG, IREEN, Nashik. Shri D. Anjaneyulu Reddy PCE SCR Secundrabad, Shri A.K. Singhal Former CAO-C NR NDLS, Shri H.K. Bhagoriya Chief Engineer (Construction), South Central Railway, Secundrabad, Dr. Shri Tushaba Shinde, Director Ministry of Personnel, Public Grievances & Pensions NDLS, Shri Brijendra Kumar PCCM, Prayagraj NCR, Shri Amit Jain sec to AGM BH New Delhi.

My sincere gratitude also goes to the to all these deserving Railway Engineers whose suggestions have been invaluable in making this book ,S/Shri BB Garg XEN NDLS BH NR , Shri Niraj Srivastav XEN TM KOTA WCR , Shri Mahthara Saravana Pavan AEN SR, Shri Jogaram SSE TD BRC WR, Shri NK Mishra Prof. IRICEN Pune CR , Shri P. Srinivas Rao Inst. ZRTI LGD SCR , Shri Kuldeep Singh Solanki SSE Vapi WR , Shri Shailendra Sr Instructor ZRTI UDZ NWR, Shri Deepankar Chatterji Ex SSE P-W GHY NFR, Shri V Trinadh, ADSO VSKP SHRI Viswajit Mandal SSE HWH ER and Shri Rahul Ramesh Sansare SSE MMR CR, Shri Sanjay Dubey SSE VGLJ NCR .

Every effort has been made to eliminate the mistakes and misprints that may have appeared in the previous editions. While difficult to claim perfection, every care has been taken to check the text. We are fortunate to have so many readers who continue to support us despite the digital invasion, showering us with love and encouragement

A deep debt of gratitude is owed to my late parents, Sri C. Lal and Smt. Benibai, for cultivating the habit of early rising, without which the writing of this book would never have been possible. Finally, my deepest thanks to my family my wife Shyama D. Shevra, and my sons and their wives and daughters who remain the pillar of support and cooperation essential for the creation of this volume.

We sincerely welcome any errors, omissions, or suggestions for the improvement of this volume brought forth by our readers. They will be gratefully acknowledged and incorporated into the next edition.

Nashik Road
11 JANUARY 2026

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PREFACE TO THE THIRD EDITION

The book entitled P.WAY HAND BOOK has been designed to meet the requirements on various subject to serve as a ready reference (compendium) for day-to-day work problems confront the Railway Civil Engineers.

The response to earlier edition of this book has been encouraging because of self-authenticity especially there is a constant demand for this book from all the section of civil engineering officials throughout the Indian Railways.

A new 30TH chapter PIPE LINE TRACK CROSSING has been incorporated, also efforts has been made to include all corrections slips of civil engineering manuals with details of HAND BOOK OF TRACK MAINTENANCE recently published by IRICEN Pune. My grateful thanks are due to my numerous officers, colleagues and friends for the valuable help given me in making available the various details required for my book

The mistakes, which had crept in, have been eliminated in this edition. Every care has been taken to check mistake and misprints however, it is difficult to claim perfection any errors, omission and suggestions for the improvement of this volume, gratefully acknowledged and incorporated in the next edition and requested to send their valuable the same on my email sk.shevra11@gmail.com if any, which will be accepted gratefully

I am extremely grateful to Shri S.K. Kulshrestha PCE CR and Shri M.K. Gupta CAO/C CR CSTM who have encouraged for publication of this 3rdedition, without his co-operation book was not possible to come out.

The author expresses his gratitude to his wife Smt Shyama Shevra Daughter of Shri. Ganesh Prasad and also pay his kind regards to respected Late Parents Shri Chhakki Lal for their kind blessings. The book is dedicated to them in their memory and deep respect.

Nasik Road **S.K. SHEVRA**

13 January 2017 **Executive Engineer, (Retired) Central Railway**

Preface to the Second edition 2013-14

The object of this book is to present, the subject matter is most concise, compact, to the point and lucid manner, because of matter has been collected from different 12 Engineering and other Manuals.

The response to earlier edition of this book has been encouraging because of self-authenticity. Especially there is a constant demand for this book from all the section of civil engineering railway officials of Indian Railways.

The mistakes, which had crept in, have been eliminated in this edition. Every care has been taken to check mistakes and misprints however, it is difficult to claim perfection any errors, omissions. suggestions for the improvement of this volume gratefully acknowledged and incorporated in the next edition.

In this edition a new chapter on signal & telecommunication data's have been incorporated at the end of existing chapter "important table" by which Civil Engineering official may able to solve the field problem in a simplest manner.

The author expresses his gratitude to his wife Smt. Shyama Shevra Daughter of Shri. Ganesh Prasad and also pay his kind regards to respected Late. Parents Smt. Benibai & Shri. Chhakkilal for their kind blessing. The book is dedicated to them in their memory and deep respect.

The author expresses his gratitude to Shri. A.P. Mishra ME Rly Board and ex. Officio secretary to Govt. of India & Shri. A.K. Gupta AM CE for giving their valuable time for inauguration of 1st edition also Shri. S.K. Jain GM,C. Rly, Shri.P.K. Saxena/PCE, C. Rly, Shri. A.K. Lahoti/ED, Rly Bd New Delhi, Shri. M.M. Aganwal former CE/N.Rly New Delhi, Shri. Shivkumar former GM NEF Rly, Shri. S.K. Malik, Former /AM CE. Rly Bd New Delhi. Who have blessed my efforts with encouraging forward.

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Place: Kurdwadi **S.K Shevra,**

Date: 13.01.2013 **Asst. Divisional Engineer, Central Railway /Ahmednagar**

Preface to first edition

An attempt has been made to bring in this P.way diary an authentic compendium, brief using simple language and up-to-date for the benefit of civil engineers of Indian railway. There was a demand from my colleagues for compilation of such hand book which would not only be useful to LDCE/LGS examination but also day to day working

This book has been compiled primarily for the practical men and should prove a most useful work of reference to the P.Way engineers of Indian railways, The object of this volume is to give a fairly complete but concise account of the various subject to serve as a ready reference for every day work problems constantly confront the engineers, whether in the office or in the field without having to wade through numerous books and notes. My grateful thanks are due to my numerous colleagues and friends for the valuable help given me in making available the various details required for my book.

I am extremely grateful to Shri Rajesh Kumar for assisting in the whole matter in a form of book without his co-operation book is not possible to come out. Readers are requested to send their valuable suggestions for improvement and rectification of errors and omissions, if any, which will be accepted gratefully. I sincerely hope this P.Way hand book will serve as a good guide to all level of P.Way Engineers.

I sincerely acknowledge the valuable guidance rendered to me by Shri M.M. Agarwal former Chief Engineer (Northern Railway) New Delhi in enabling to encourage me for this book.

Place: Ahmednagar **S.K Shevra**

Date: 15.08.2010 **Asst. Divisional Engineer, Central Railway /Ahmednagar**

Acknowledgment

This book has been compiled primarily for the practical P.way men. All possible efforts have been made to make the book comprehensively and handling in any situation, elucidatingin simple and plain language.

My grateful thanks are due to my numerous officers and staff who were the main inspiration in authoring this book during and making available the various details required for my work during foundation course and the most valuable help rendered by IRICEN PUNE and shri MM Agrawal former Chief Engineer, New Delhi for preparing the publication.

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I shall gratefully appreciate the readers who will kindly call attention to any errors of omission or give valuable suggestion for improvement of the book to enhance its usefulness.

Place: Ahmednagar **S.K SHEVRA**

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CHAPTER 1

INTRODUCTION

1.1 Various gauge in world Railways

Sr.No.	Type of gauge	Gauge in mm	Name of countries
01	Broad Gauge	1676 1670	India, Pakistan, Brazil, Ceylon, Argentina
02	Broad Gauge	1600 1524	Rusia, Finland
03	Standard Gauge	1435	England, USA, China, Canada, Turkey, Persia
04	Cape Gauge	1067	Newzealand & Java
05	Meter Gauge	1000	India, France, Argentian & Switzerland
06	Narrow Gauge Light Gauge	762 610	India and other countries

1.2 Organization of Indian Railway

1.2.1 Railway Board

1.2.2 Zonal Railway

Sr.No	Railway	Zonal Head Qtr	Division
1	CR	Mumabi CST	Bhusawal, Mumbai, Nagpur, Pune, Solapur
2	ECR	Hazipur	Danapur, Dhanbad, Mugasarai
			Samastipur, Sonpur
3	E Co R	Bhuvneshwar	Khurda Road, Sambalpur
4	ER	Kolkata	Asansol, Howrah, Malda, Sealdha
5	NCR	Pryagraj	Agra, Jhansi, Prayag Raj
6	NER	Gorakhpur	Ijatnagar, Lucknow City, Varanasi
7	NFR	Maligaon (Guhati)	Alipurdwar, Katihar, Lumding, Rangia, Tinsukia
8	NWR	Jaipur	Jaipur, Ajmer, Bikaner, Jodhpur
9	NR	New Delhi	Ambala, Delhi, Firojpur, Lucknow, Jammu, Muradabad
10	SCoR	Visakhapatnam	Waltair, Vijayawada, Guntur, Guntkal
11	SCR	Secundrabad	Hyderabad, Nanded, Secundrabad
12	SER	Kolkata	Adra, Chardharpur, Kharagpur, Ranchi
13	SECR	Bilaspur	Bilaspur, Nagpur, Raipur
14	SWR	Bengaluru (Hubli)	Bengaluru, Hubli, Mysore

CHAPTER 2

RAILS

2.1 Classification of lines

Broad Gauge

Group-'A' : Speed up to 160km/hour
Group-'B' : Speed up to 130km/hour
Group-'C' : Suburban section of Bombay, Delhi, Chennai and Kolkata
Group-'D' : Speed up to 110kmph

Meter Gauge

Q Routes - Speed is more than 75km/hour Traffic density more than 2.5G.M.T
R Routes – Speed is 75km/hour and Traffic density is more than 1.5G.M.T. in R1,R2,R3 routes where traffic density less than 5 ,between 2 to 5 , &1.5 to 2.5 GMT respectively.
S Routes - Speed is less than 75km/hour and Traffic density is less than 1.5GMT

2.2 Recommended Rail Section to be used according to Lines

Sr	Lines	BG				MG		
		A	B	C	D	Q	R	S
i	Main lines, Track renewal, New Lines, Gauge conversion & doubling	60 Kg with min. 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.				52 Kg/m (SH)	52 Kg/m (SH)/90 R	52 Kg/m (SH) or 75 Kg/m (SH)
ii	Passenger running Loop lines and laying of new Passenger running looplines	new 60 kg rails						
	Other Loop lines	60 Kg/m (SH) or 52 Kg/m (SH) New rails can also be used for these rail renewals with the prior approval of Principal Chief Engineer						
iii	Siding taking off from DFC or 25 T azle load routes	60 Kg/m						
iv	Siding other than above (iii) above speed upto 50 KMPH	52 Kg/m (SH) or 52 KG/m (U)						
v	Siding other than above (iii)above > 50 KMPH	60 Kg/m						

CHAPTER 3

SLEEPERS

3.1 Main Function of Sleepers

- Holding Rails to correct Gauge & alignment
- Firm and even support to rails
- Transferring the load even in from rails to wider area of ballast.
- Elastic medium between rails & ballast

3.2 Laying of Sleepers

- Sleepers shall be laid square to rail on straight and radically on curve
- The sleeper spacing should be marked on outer rail in case of curve track
- Closer spacing should be provided at joint sleepers of fish plated joint & between joint sleeper and shoulder sleeper.

3.3 Sleeper Density

- The sleeper density is the number of sleeper used per rail length
- Described as M+1, M+2, M+3 etc. Where M is the length of the standard rail in mtrs.
- In case of LWR /CWR , this is expressed in number of sleeper per km of track.
- Sleeper density depends upon max. Permissible speed & traffic density.

3.3.1 Type of Track Sleeper Density

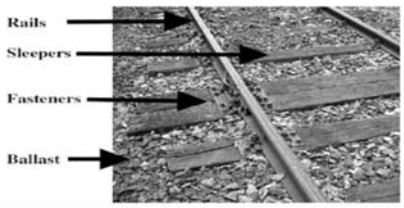
Type of track	Sleeper Density
complete track renewal ,through sleeper renewal, doubling, gauge conversion, new line construction works for main lines	1660 nos. per km
loop lines & sidings (permissible speed up to 50 Kmph)	1540 nos. per km
sidings (permissible speed more than 50 Kmph)	1660 nos. per km. (minimum)

3.4 Types of Sleepers

- Wooden Sleeper
- Cast Iron Sleeper
- Steel trough Sleeper
- Concrete Sleeper

3.4.1.1 Description of Wooden Sleepers

B.G: For ordinary track 2750x250x130 (9'x10'x5")
Durable and non durable types of sleepers.
Life of sleeper: Durable-19 years (B.G)/31years (M.G)
Non-Durable- 12 to 16 years.



3.4.1.2 Advantages/Disadvantage of Wooden Sleeper

Advantages

i) Easy to manufacture and handling
ii) Suitable for track circulated area.
iii) Can be used with or without ballast.
iv) Suitable for Bridges, Points/Crossings.
v) Suitable for gauntleted track
vi) Alignment can be easily correct.

CHAPTER 4

BALLAST

Ballast is the select crushed granular material placed as the top layer of the substructure in which the sleepers are embedded.

4.1 Important Functions of Ballast

- Resist vertical, lateral and longitudinal forces
- Provide resiliency and absorb energy
- Provide large voids
- Facilitate track geometry correction
- Facilitate track drainage
- Reduce formation pressure

4.2 Additional Functions of Ballast

- Inhibit vegetation growth
- Absorb airborne noise
- Provide adequate electrical resistance

4.3 Requirements of Track Ballast

- Tough & wear resistant
- Hard without getting crushed under moving loads
- Generally cubical having sharp edge
- Non-porous & non-absorbent of water
- Resist Attrition
- Durable & should not get pulverised under weather condition
- Good drainage of water
- Cheap & economical in price

Ballast further designated into following zones:

1. Crib Ballast
2. Shoulder Ballast
3. Top Ballast
4. Bottom Ballast

4.4 Flakiness Index

- The flakiness index of an aggregate is the percentage by weight of particles in it whose least dimension (thickness) is less than three-fifths of their mean dimension

4.5 Elongation Index

- The elongation index of an aggregate is the percentage by weight of particles in it whose greatest dimension (length) is greater than one and four-fifths times of their mean dimension

4.6 Ballast Fouling

Potential sources are:

Ballast breakdown because of

- Handling
- Tamping/packing
- Traffic

CHAPTER 5

FASTENINGS

This is a system consists of various components i.e. Base plate, spikes, dowels, rubber pad, clips, insulators etc.

5.1 Type of Fastenings

- Rail free fastenings
- Rigid fastenings
- Elastic fastenings

5.1.2 Different type of fishplates

5.1.2.1 Ordinary fish plate:

610 mm Fishplates are used to join the ends of rails using fish bolts and other fittings such as washers, etc. These are manufactured to comply with RDSO specification, IRS-T-1.

Fig 5.1.2.1(a) Ordinary fishplate

5.1.2.2 One meter Long Fish plates

Where SWR/LWR track is to be laid on concrete sleepers in unavoidable circumstances, the sleeper spacing including at fish plated joint, shall be kept uniform. In addition, 1 m long fishplates, be Used at fishplates joints and repairs to rail fracture.

Fig. 5.1.2.2(a) One meter Long Fish plates

5.1.2.3 Joggled fish Plates:

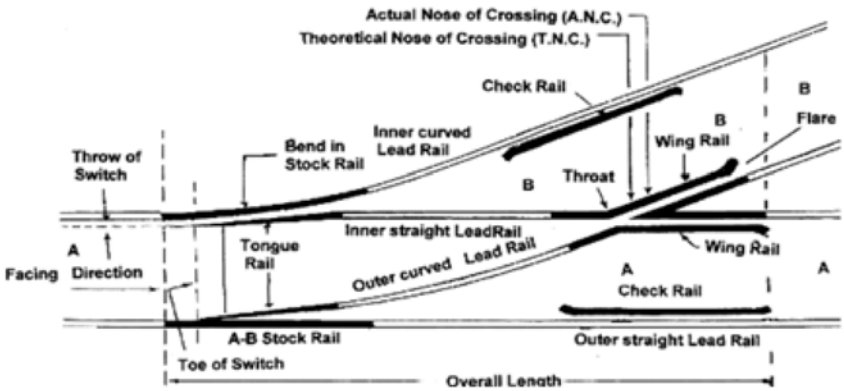
Joggled fish plates with clamps or with far end bolts are used at welded joints or at rail fracture locations. Joggled fishplates shall comply with RDSO specification IRS-T-1.

Fig. 5.1.2.3(a) Joggled fish Plates:

CHAPTER 6

POINTS AND CROSSINGS

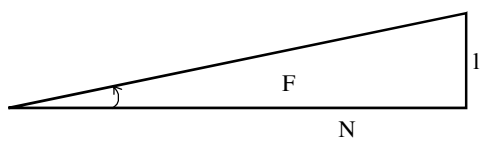
6.1 Basics about Point & Crossings



- Points and crossings are track components which facilitate diversion of vehicles
- **Point** is a pair of tongue rail and stock rail along with necessary fittings .
- **Crossing** is a device introduced in the track to permit movement of wheel flange at the intersection of two running lines.
- The arrangement of Points & Crossings for diversion of traffic from one route to another is called a **Turnout**.

6.1.1 Presentation of Point & Crossing

Points and Crossing are designated as 1 in N where N is the number of crossings defined as N = cot F Values of N adopted on IR are 8.5, 12, 16 & 20



6.1.2 Parts of Turnout :

A) Switch portion B) Lead portion C) Crossing portion

- Turnouts are called left Hand or Right Hand depending on the side on which the rolling stock gets diverted.
- The tip of tongue rail is called Actual Toe of Switch. (ATS)
- The joint between Stock Rail and approach rail is called Stock Rail Joint. (SRJ)

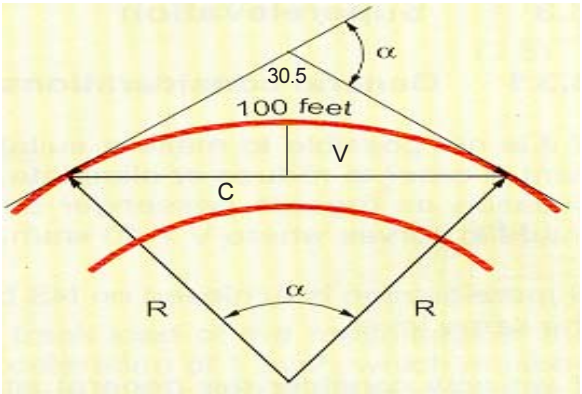
CHAPTER 7

CURVES

7.1 Curve designation

- Curves are designated by their radii except on IR
- On IR degree of curve for designation
- Radii for calculation

7.1.1 Degree of curve is the angle subtended by 30.5m chord at the centre



D = 1750/R

On the IR curves are measured by versine which is mid chord offset on 20m chord.

$V = C^2 / 8R$

7.1.2 Relationship between radius & versine

General Equation can be used to find out the versine, once the chord & radius of a curve are known
V= versine in mm, C= chord in mtr, R= radius in mtr.
$V = 125\ C^2 / R$ mm

The versine is obtained by stretching a fishing/ nylon cord or wire stretched between the end of chord length decided upon, and the measuring distance between the cord/wire and gauge face of the rail at the middle point of the chord.

For measuring versines of a curve,

20 metres overlapping chords should normally beused with stations at 10 metres intervals.

For checking the radii of turnout and turn-in

curves overlapping chord of 6 metres should be used and the versine measuring stations should be located at every 3 metres.

(The turnout curve can also be checked by offsets from the straight)

CHAPTER 8

LEVEL CROSSINGS

8.1 Classification of roads

- Class 1---National high ways, state high ways, important roads within municipal towns, roads in around towns where road & rail traffic is heavy.
- Class 2---Major & other district roads, unimportant roads within municipal towns, roads within non-municipal towns including those within shunting limits, other surfaced roads.
- Class 3 ---Earth roads & cart tracks.
- Class 4----cattle crossings & footpaths.

8.1.1 Criteria of classification of level crossings

Criteria of classification of level crossings with consultation of road authorities are as below;

- Class of road
- Visibility conditions
- Volume of road traffic
- Volume of rail traffic

8.1.2 Classification of LC's

All type of Level Crossing shall be classified as under;

- **Spl. Class-** TVU's > 50,000
- **A class -** TVU's from 50000 and upto 30,000, or line capacity utilization 80% (on single line) and road vehicles > 1000
- **B class -** TVU's upto 10,000 and less than 30000 & number of road vehicles > 750

'B' Class is further sub divided as following-

B1 class - TVUs upto 25,000 and less than 30,000

CHAPTER 9

SHORT WELDED RAIL (S.W.R.) / SHORT WELDED PANEL (SWP)

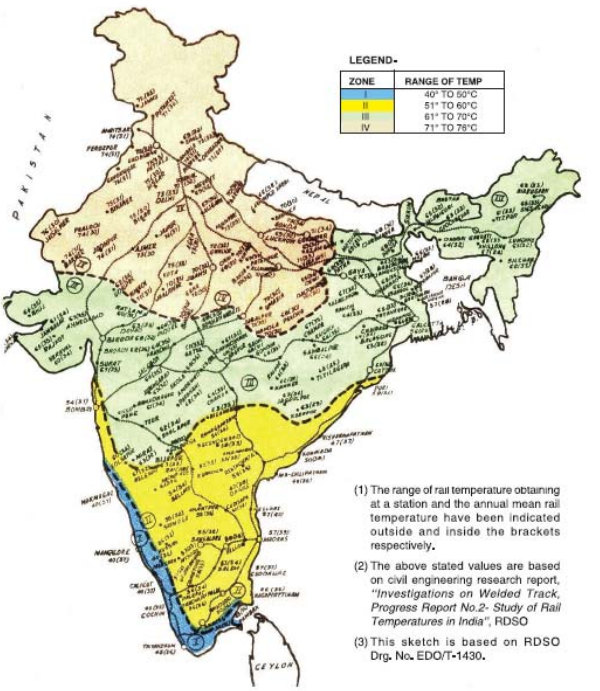
9.1 SWR/SWP:

It is a welded / a piece of panel (39 m) which expands, contracts throughout length. Panel means 39 meter long or a Normal length welded or fish plated having length 3 x 13m BG, and 3 x 12m MG

9.1.1 Rail Temperature:

- Temperature of the rail as recorded by an approved type of rail thermometer at site.
- It differs from the ambient temperature, which is the temperature of air in shade at that place, as reported by the Meteorological Department.
- Indian Railways have been divided into four rail temperature zones. Shown in a Map 9.1.1(a) the four temperature zones and the annual mean rail temperatures at all important places are shown in the map

Map of India showing rail temperayure. 9.1.1(a)



The Rail temperature Range = Max Rail temperature – Min Rail Temperature

Mean Rail Temperature = (Max Rail temperature + Min Rail Temperature) / 2

CHAPTER 10

LONG WELDED RAIL (LWR)

10.1 Basic Principles

A metal rod supported on frictionless rollers can theoretically expand and contract freely with variations in temperature = Lα t

where, L = length of the metal rod

α = coefficient . of linear expansion ($1.152 \times 10^{-5}/^{O}C$)

t = change in temperature

e.g. if L = 13m, t = $20^{O}C$; Change in length = 3mm

Rail is restrained due to

i) Creep resistance on account of friction between the rail and the sleeper at the rail seat.

ii) Creep resistance further offered by the rail-sleeper fastening

This results into development of **'Thermal Forces'**.

10.1.1 Thermal Forces

Thermal forces in the central portion, The thermal force (P) calculated by:

$P = EA \alpha t$

Where P = Thermal force in the rail (kg)

E = Modulus of elasticity of rail steel (2.11×10^{6} kg/sq.cm)

α = Co-efficient of linear expansion of steel ($1.152 \times 10^{-5}/^{o}C$)

A = Area of x-section of the rail (sq.cm)

t = Variation of rail temp. from td / to (^{o}C)

CHAPTER 11

MANUAL MAINTENANCE

11.1 Gang Strength as per MCNTM formulae

The gang strength on Indian Railways is normally now calculated as per **Manpower Norms (Part-1) and Cost Norms (Part-2) for Track Maintenance (MCNTM)** formula in order to cover certain gang activities left out which affect track maintenance effort and to take into account the effect of machine packing and track modernization,

11.2 PART 1 Manpower Norms

(i) PRIMARY MAINTENANCE ACTIVITIES

These are directly related to P.Way maintenance, needing manpower based on continuous length of track, further classified as follows:

(a) Activities T (Affected by Traffic density):

These are aimed at achieving safety and acceptable running quality, commensurate with the loads and speeds carried.

(b) Activities R (Routine: Unaffected by traffic density):

These are for maintaining track, formation and other integrated assets, which are of routine nature, but quite important for train operation and for achieving reliability and long life of assets.

(ii) AUXILIARY MAINTENANCE ACTIVITIES:

These are related to upkeep of P.Way section as a whole, needing manpower based on localized problems, special features and geographical nature of P.Way section, further classified as follows:

(a) Activities M (Miscellaneous):

For these activities, the quantum of work arising in the P.Way section can be assessed on a universally adoptable basis and the yardstick relating man-days requirement to output is rationally stipulated for each sub activity.

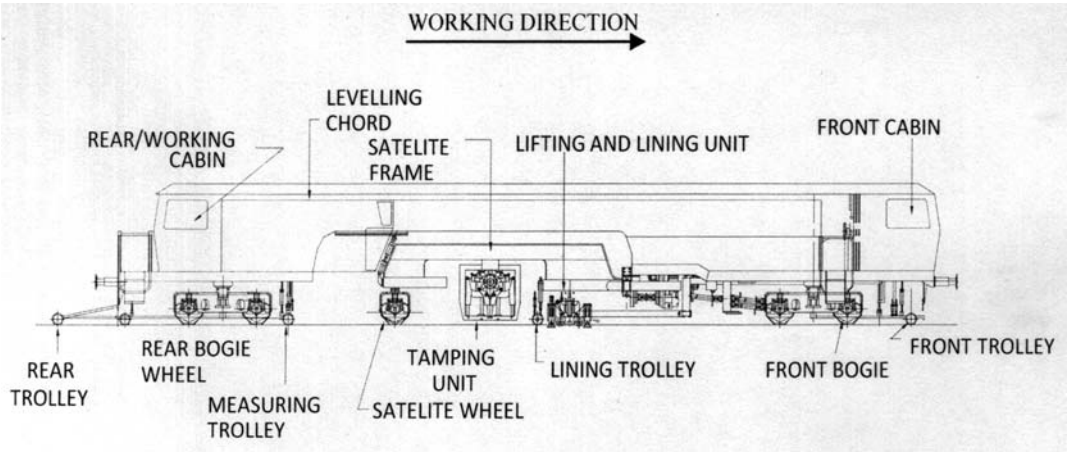
(b) Activities S (Site-specific):

For these activities the quantum of work arising varies from location to location depending on site-specific features of the P.Way section and the yardstick is stipulated generally based on past experience.

The methods of track maintenance and the manpower requirement thereof are entirely different between non-suburban line and very busy suburban line. The Committee defines a suburban line as 'High Density SuburbanLine', if both the following criteria are fulfilled:

CHAPTER 12

MECHANIZE MAINTENANCE



12.1 Necessity

- Modern and heavy track structure
- Less track possession time
- Superior quality
- Increased out put
- Economical

12.1.1 Limitations in manual maintenance

- At no time, more than 30 sleeper spaces in a continuous stretch
- Rail temp. shall be within td+10 to td-30 'C

12.2 Types of Machines-

12.2.1 Tamping Machines

a) **Tampers without Satellite Unit**

i. 08-16 Unomatic

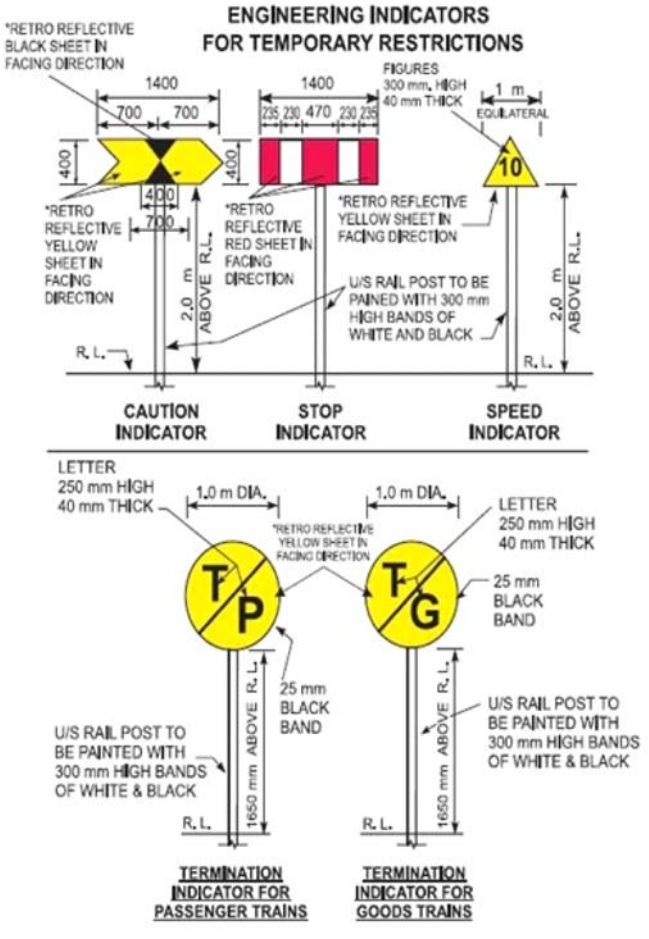
ii. 08-32 Duomatic

- 08-32 Duomatic (Plasser India)
- 08-32C Duomatic (Plasser & Theurer)
- 08-32 WST with flat car (Metex-JSC Moscow, Russia)

CHAPTER 13

PROTECTION OF TRACK AND INDICATORS

13.1 Type of Engineering Indicators



* *Note:* All engineering indicators should be of retro reflective type as per RDSO provisional specification for Retro reflective Indicators, May 2011

Fig.13.1(a) Engineering Indicators

CHAPTER 14

TRACK MONITORING

14.1 Methodology for assessment of track qualities Subjective assessment

- Manual assessment without any measurement or factual correlation
- Track geometry assessed during visual inspection by foot or trolley
- Track-vehicle response is assessed during foot- plate, B/V or last vehicle inspection

14.1.1 Objective assessment

- By actual measuring parameters and its analysis
- Track parameters measured at some interval on a predetermined base
- Track vehicle response is measured in terms of accelerations

14.1.2 Purpose of manual inspection

- Inspection of track structure
- Inspection of Gang working
- Field verification of track defects
- Inspection of other track related items
- Condition of rail, Sleepers & Fittings
- Condition of others i.e formation, Ballast etc.
- Track feature of Level Crossing
- Track feature of Points & Crossing
- Track feature of Curve
- Related signalling equipment
- Related structures i.e FOB, ROB & Platform etc

14.1.3 Track related work:

- Machine Packing/Through Packing overhauling
- Deep screening
- Distressing of LWR
- Rail renewal
- Sleeper renewal

14.1.4 Limitations of Manual Inspection

- Subjective
- In floating condition
- Slow progress
- Analysis of inspection data takes time
- Some of the parameters cannot be measured manually.

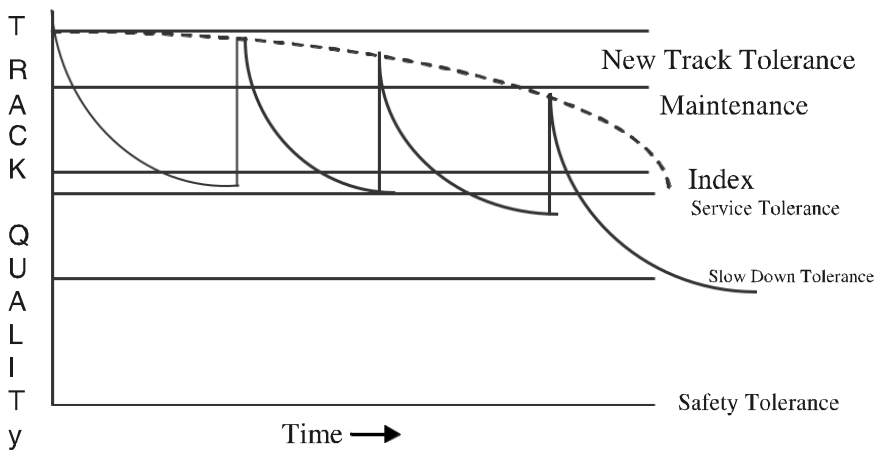
CHAPTER 15

TRACK TOLERANCES

15.1 Why Track Tolerances?

- Monitoring of Track Quality and Performance
- Optimal Use of Maintenance Inputs to Track
- To know where maintenance inputs are required
- To identify the deviations or the defects
- To compare the existing track parameters with the standard/desired track parameters.
- To monitor the rate of deterioration for special attention
- To give timely input and prolong the life of the asset
- To assess the quality of track maintenance inputs Safe, Comfortable and Economical Transportation

15.2 Track tolerances at a Glance



Track Tolerances

15.3 Track Quality

Track Performance is judged by Riding comfort, which depends on -

- Track Geometry parameters

CHAPTER 16

TRACK RENEWAL

16.1 Classification of track renewal works

i) Complete track renewal (CTR)

ii) Through rail renewal (TRR)

iii) Through sleeper renewal (TSR)

iv) Through fitting renewal (TFR)

v) Through ballast renewal (TBR)

vi) Through weld renewal (TWR)

vii) Through bridge sleeper renewal (TBSR)

viii) Through Turnout Renewal TTR

Primary renewals (P) are those where only new materials are used and secondary renewals(S) are those where released serviceable materials are used. Whereas in Casual renewal (CR), unserviceable rails, sleepers and fastenings are replaced by identical sections of serviceable and nearly the same vintage or new trackcomponents.

16.2 Criteria for primary rail renewal

i. Incidenceofrailfractures/failures.

ii. Wearonrails.

iii. Maintainabilityoftracktoprescribedstandards.

iv. Expectedservicelifein termsofGrossMillionTonnesoftrafficcarried.

v. Plan basedrenewals.

vi. Renewal of special track components like SEJ, Glued joints etc.

16.2.1 Incidence of rail fractures/failures.

A spate of rail fractures on a particular section having 5 withdrawals of rails per 10 km in a year due to fracture and/ or rail flaws detected ultrasonically falling in the category of IMR will have priority while deciding rail renewals. Through Rail Renewal is also allowed in locations of track where more than 30 defective welds per track km are existing.

16.2.2 Wear on Rails

Rail renewals may become necessary, because of excessive wear. The following different criteria has been laid down for the same.

CHAPTER 17

PATROLLING OF RAILWAY TRACK

The following types of patrolling are in vogue on Indian Railways to ensure the safety of the track and traffic moving over it.

1. Keyman's daily patrol
2. Gang patrolling during abnormal rainfall or storm.
3. Hot weather patrollingfor LWR/CWR
4. Cold weather patrollingfor LWR/CWR
5. Monsoon patrolling
   - i) Mobile patrolling
   - ii) Stationary patrolling
6. Security patrolling.
   - i) During Civil disturbance
   - ii) During VIP movement

17.1 Keyman's daily patrol

The keyman inspect the track daily on foot the entire beat under his control .The Keyman shall preferably be provided with a GPS tracking device, to monitor his movements so as to ensure effective patrolling.

17.2 Gang patrolling during abnormal rainfall or storm.

The Mate either at his own initiative or under instruction from JE/SSE/P.Way organizes patrolling over the length of track affected by rains or storm.On receipt of weather warning ,Gang Mates to be extra vigilant and be prepared to introduce patrolling, as necessary .The beat length of Gang Patrolling shall be similar to the monsoon patrolling.

17.3 Hot weather patrolling in LWR/CWR

Hot weather patrolling as decided by the Sr.DEN/DEN of the section shall be introduced in LWR/ CWR track when the rail temperature exceeds.

i) **td +20^{O}C** on PSC sleeper track with sleeper density less than 1540 nos per km

ii) **td+ 25^{O}C** on PSC sleeper track with sleeper density 1540 nos per km and above.

iii) **td + 30^{O}C** on Wider base PSC sleeper track with sleeper density 1660 nos. per km.

17.3.1 Beat:

The beat of the patrolman shall be as follows.

CHAPTER 18

ULTRASONIC FLAW DETECTION (USFD)

18.1 Basic principles

Introduction

- ❒ Non-destructive material testing first introduced in to the rail steel .
- ❒ The future belongs to the qualified operator who carried out his task responsibly and who continuously endeavours to keep his knowledge at the latest state of the art.

18.1.1 Type of rail tester:

Flaw detection by ultrasonics is carried out with the help of two different types of equipment viz. Single rail tester and double rail tester.

(a) Single rail tester: Single rail tester is capable of testing only one of the rails at a time and is provided with nine probes.

(b) Double Rail testerThe double rail tester is capable of testing both the rails at a time. For each rail, nine probes have been provided

18.2 Sonic & Sound

- ❒ Sound is vibrations in an elastic medium.
- ❒ Sonic is synonym of sound.
- ❒ Acoustics is the science of production, transmission & effects of sound.
- ❒ Sound waves (Mechanical Waves) are categorized by their frequencies as.....
  - Subsonic (less than 20 hz)
  - Sonic (between 20 & 20,000 hz)
  - Ultrasonic (> 20,000 hz)
- ❒ Other Waves are Electro Magnetic Waves

18.3 Types of sound waves

- ❒ Longitudinal or compression
- ❒ transverse or shear
- ❒ Surface

18..3.1 Longitudinal waves

- ❒ Vibration of the particles of the material are in the same direction as that of propagation of the wave

CHAPTER 19

RAIL WELD FAILURES

19.1 Introduction

- ❒ Common types of defects
- ❒ Nature of Defects
- ❒ Action to be taken on occurrence of Rail Failure & Weld Failure
- ❒ Codification of Rail and Weld Defects
- ❒ Various ways of analysing Rail Weld Failures
- ❒ Annual statistics and analysis of Rail Weld Failure
- ❒ Factor leading to R/W Failure
- ❒ Measures to prevent
- ❒ Fatigue Failures, Kidney and Gauge Corner defects
- ❒ Handling of 90 UTS rails
- ❒ Photographs of RF/WF involved in accidents

19.2 Common type of defects in Rails / welds

19.2.1 At manufacturing stage

Material defects originating during the manufacturing process such as clusters of non-metallic inclusions, hydrogen flakes, rolling marks, guide marks etc. which may be present in spite of successful non-destructive tests carried out on the rails during quality assurance examination.

i) **Pipes:** These are shrinkage cavities, which occur whenmolten steel solidifies in the mould.

They are also associated with harmful contaminants such as segregated phosphorous, non-metallic oxides, silicates etc.

Pipes should be discarded at the ingot or bloom stage.

Such defects lead to vertical splits, horizontal splits etc.

ii) **Heavy segregation:** Segregation of elements such ascarbon, silicon, manganese etc. occurs when molten steel solidifies. This leads to non-uniformity of property of steel. These defects also lead to vertical splits, horizontal splits etc.

iii) **Inclusions:** There is certain non-metallic material suchas sulphides, silicates etc. present in steel which are weak and brittle and hence form weak spot in steel. Inclusions in head give rise to failure due to transverse fissure, compound fissure, shelling etc.

iv) **Seams:** It is a longitudinal discontinuity of materialoccurring in the rolling process. This defect is

CHAPTER 20

WELDING

20.0 Purpose of welding:

The purpose of welding is to join railends together by application of heat, with or without the use of the filler material, with or without the external pressure application, thus eliminate the rail effects of rail joints such as

- To increase the life of track assets as well as rolling stock.
- To decrease the maintenance cost.
- Formation of LWR / CWR from fish-plated track.
- To introduce modern method of maintenance.
- To decrease the noise level hence improving riding comfort to passengers.
- To make anti-sabotage track.

20.1 Methods of Weldings

Normally Welding is to be done by following methods :

1 Flash Butt welding

2. Alumino thermic welding.

3. Gas pressure welding

4. Electric arc welding

CHAPTER 21

Small Track Machines

Due to the growing traffic and introduction of heavy traffic structure, faster and efficient methods of maintenance are needed. This has increased the role of Small track Machines.Different types of small machines have been developed for various activities on track. These small track machines are to be used for day-to-day maintenance, laying and construction of track. Based on field experience, recommendations of small track machine committee and manufacturer's instructions, this manual has been documented.

21.1 Need for Small track machines

- Modern track cannot be laid and maintained manually.
- Mechanized maintenance of track introduced in early sixties.
- Track machines are of two categories
- Large track machines andSmall track machines
- The Small Track Machines shall be charged to proper sanctioned estimates under Demand No. 16 or revenue budget (Demand No.4 -P. Way Works):

21.2 Description of Small track machine

- Machines for operations on rail
- Machines for operations on sleeper
- Machines for welding operations
- Machines for operation on fittings
- Machines for lifting and slewing
- Machines for transportation/handling of men/material
- Machines for track & ballast.

21.3 Machines for operations on rail

- Abrasive rail cutter
- Rail cutting machine (saw type)
- Rail drilling machine
- Chamfering kit
- Hydraulic rail tensor (non-infringing type) 70t capacity
- Hydraulic rail bender (Jim crow) heavy duty
- Hydraulic rail joint straightner
- Rail creep adjuster

21.4 Machines for operations on sleeper

- Hydraulic sleeper spacer

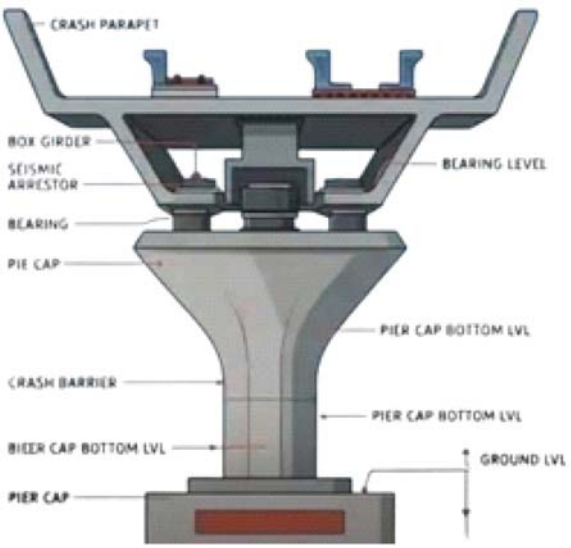
CHAPTER 22

METRO TRACK

22.1 General specifications

The design of the metro track work is based on the following principles:

- Passenger safety and comfort,
- Noise and vibration control,
- Maximum speed through the alignment, as per requirements of railway system,
- Constructability,
- Reliability, Availability, Maintainability,
- Cost



22.1.1 Abbreviations used

A.C. Alternative Current ASTM American Society for Testing and Materials

BC Beginning of Curve BS British Standards

BTC Beginning of Transition Curve CA Contractor's assumption

CHAPTER 23

BRIDGES

23.1 Classification of Bridges

23.1.1 According to Function

1) Track Bridge (for rail vehicle)

i) Over water bodies i.e River/ Nallah /Canal (water bodies)

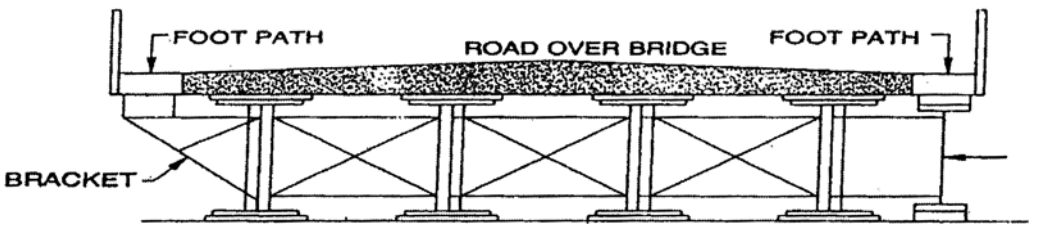
ii) Over Valley (viaduct)

iii) Over Railway (Fly-over)

iv) Over Road (RUB)

2) Road Bridge (For Road Vehicle)

a) Over Railway (ROB)



ROB OECK TYPE

CHAPTER 24

ESTABLISHMENT

PASS RULES

24.0 General pass rules

Railway servants (pass) rules, 1986 (2ND1993 edition)&(RBE 120/2019 dated 26/07/2019)

24.1 Important definitions

(i) 'Attendant' means a person exclusively employed on salary in the personal service of a railway servant.

(ii) 'Adopted child' means a child for whom there is satisfactory proof of adoption irrespective of the fact whether such adoption is permissible or not under the personal law governing the railway servant concerned.

(iii) 'Dependent relative'-

- Mother including a divorced mother
- Unmarried or widowed sister
- Brother/step-brother under twenty-one years of age
- Invalid brother of any age
- Brother who has attained the age of twenty-one years and is a Bonafide student
- Legally divorced sister
- Widow mother-in-law in case of widows appointed on compassionate grounds, whether her father is alive or not.

Provided that:

A person shall not be considered to be a dependent relative if his/her income from all sources including pension, dearness relief, etc. **exceeds 15% of pay per month of the Railway servant or the amount arrived at by adding minimum Pension/Family Pension of Rs 9000/- (excluding the element of additional pension to old pensioners) and the dearness relief** admissible to the pensioners/family pensioners on pension rounded off to the nearest ten rupee figure, whichever is more. (Revised limit for dependency w.e.f 01.01.2016 RBE 132/2016 Dated 24/11/2016)

Provided further that dependent relatives may be included in the Privilege Passes/PTOs given to the railway servants in cases where **father is missing for a period of at least 7 years** Passes/PTOs can also be given to the sisters in similar circumstances. However, an affidavit as to the period since when the person is missing, duly attested by a Magistrate is necessary.

iv) 'Family' includes

- Spouse of a railway servant whether earning or not;

CHAPTER 25

FINANCE, TENDER AND CONTRACT

25.1 Railway Budget

The estimated receipts and expenditure of the Government of India for that year' referred to as the "Annual Financial Statement" and popularly called the "Annual Budget". Every budget contains three elements-

a) a review of the preceding year, including the actual receipts and expenditure in that year;

b) an estimate of the receipts and expenditure of the coming year; and

c) proposals, if any, for meeting the requirements of the coming year

Railway budget merged with Annual budget W.E.F. 21.09.2016

25.1.1 Annual Budget estimates are prepared for:

i) Earnings Estimates&

ii) Expenditure Estimates

1. Revenue Budget (Demand 1 to 15)
2. Capital Budget (Demand 16) includes, Works Programme, Rolling Stock Programme&Stores Budget

25.1.2 Demands for Grants

The proposal of Govt. in respect of sums required to meet the expenditure from the Consolidated Fund of India submitted to the Parliament. The Demands shall be for gross expenditure; the credits or recoveries being shown in the form of footnotes to Demands.

S.N.	Groups	Demand No	Name of Demand	Classification
I	Policy formation andservice common to all Railways	1	Rly Board	
	-do-	2	Research, Audit,Establishmentand Misc	
II	General Superintendence and services on Railways	3	General Superintendence and service on Railways	
III	Repairs and Maintenance	4	Repairs and Maintenance of Way & Works	
		5	Repairs and Maintenance of Motive Power	
		6	Repairs and Maintenance of Motive Power	
		7	Repairs and Maintenance Plant and equipment	

CHAPTER 26

STORES

26.1 Ordinary Stores

Generally, such items of stores for which there is a regular turnover caused by a constant demand.

- New,
- Second hand / Serviceable and
- Scrap

26.2 Emergency Stores

certain items of stores even though they do not have a regular turnover, but may be required to be kept in stock to meet emergency due to breakage or unanticipated deterioration.

These items are not readily available in the market and as such would require a long time for procurement in case they are not stocked. These are generally components of P&C, SEJ, etc.

26.3 Surplus Stores:

If any item is not issued for past 24 months or more, it is declared as surplus. Surplus stores are further classified as dead surplus and movable surplus.

a. Dead Surplus Stores :

These are the items which have not been issued to any indenter during past 24 months or more and are not likely to be utilized on any Railway within next 2 years

b. Movable Surplus Stores:

These are the items which have not been issued to any indentor during past 24 months but their use in near future (within 24 months) is anticipated.

26.4 General Classification Of Stores :

26.4.1 Stock items - items which are frequently required and thus stocked in adequate quantities. (PL code)

26.4.2 Non-stock items - other items which are not frequently required or are of one-time requirement, and thus no stocks are maintained. These items are purchased as and when required to meet specific demands (NS item)

26.5 Stock item - PL code

All the Railway materials have been classified in 76 `Major Groups' or 'Main Groups' or groups, each further classified into several sub-groups.

Each PL No. (say 90 35 058 3) is sub-divided into 4 parts as under;

CHAPTER 27

GENERAL & SUBSIDIARY RULE

27.1 Short title and commencement -

(1) These rules may be called the Indian Railways (Open Lines) General Amendment Rules, 2020.

(2) They shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint.

27.2 Definitions- In these rules, unless the context otherwise requires

27.2.1 Act" means The Railways Act, 1989 (24 of 1989);

27.2.2 Adequate distance" means the distance sufficient to ensure safety;

27.2.3 "Approach lighting" means an arrangement in which the lighting of signals iscontrolled automatically by the approach of a train;

S.R. 1.02(3)-1. No approach lighted signals are provided on the Central Railway.

27.2.4 Approved special instructions" means special instructions approved of or prescribed by the Commissioner of Railway Safety;

27.2.5 Authorized officer" means the person who is duly empowered by general or special order of the Railway Administration, either by name or by virtue of his office, toissue instructions or to do any other thing;

27.2.6 Block section" means that portion of the running line between two block stations on to which no running train may enter until Line Clear has been received fromthe block station at the other end of the block section;

27.2.7 Controller" means a railway servant on duty who may for the time being beresponsible for regulating the working of traffic on a section of a railway providedwith the system of speech communication;

27.2.8 Facing and trailing points" points are facing or trailing in accordance with the direction a train or vehicle moves over them. Points are said to be facing pointswhen by their operation a train approaching them can be directly diverted fromthe line upon which it is running;

27.2.9 "Fixed signal" means a signal of fixed location indicating a condition affecting themovement of a train and includes a semaphore arm or disc or fixed light for use byday and fixed light for use by night;

27.2.10 Fouling mark" means the mark at which the infringement of fixed StandardDimensions occurs, wHere two lines cross or join one another;

27.2.11 Interlocking" means an arrangement of signals, points and other appliances, operated from a panel or lever frame, so interconnected by mechanical locking orelectrical locking or both that their operation must take place in proper sequence to ensure safety;

CHAPTER 28

PIPELINE TRACK CROSSING

28.1 General:

1. Pipeline track crossing means carrying cables, water, sewage, petroleum product under the Railway Track . (RDSO/ Railway Board up to September-97) ,
2. Typical drawings to aid the preparation of the drawings and execution of work for different types of Pipe line track crossing plan are given below:
3. Pipes for track crossings have been broadly divided into following categories -
   a) **A.1 :-** Carrying non electrical cable such as Telephone Wires/TV cables / Optical Fibers cable etc.
   b) **A.2:-** Conveyingwater, Sewage or other Non-inflammable Effluents without pressure.
   c) **A.3.1 :-** Conveying Water, Sewage or other Non- inflammable Effluents under pressure through carrier pipe of dia up to 600mm.
   d) **A.3.2 :-** Conveying Water, Sewage or other Non- inflammable Effluents under pressure through carrier pipe of dia. More than 600mm and up to 1200mm.
   e) **A.4:-** Conveying Inflammable Effluent like petroleum, oil or gas etc. Pipelines included under this category are those installed to carry oil, gas or other inflammable or highly volatile substance under pressure might cause damage if escaping on, in the vicinity of the Railway property.

28.2 Standard Plan :

The type plans showing the standard arrangement with measurements and specifications for track crossing of above pipes are annexed which are as under:

1. **Type plan No. 1:** Pipeline crossing of category A.1 & A.2 upto 300mm dia carrying telephone wires. TV cables/ Optical Fiber cable etc. (Appendix - 'A' - Sheet 1)
2. **Type plan No.2:** Pipe crossing of category A.2 Conveying water, Sewage or other Non-inflammable Effluents without pressure. (Appendix - 'A' - Sheet 2)
3. **Type plan No.3:** Pipe crossing of category A.3.1 where end of casing pipe is a tor above ground level the crossing shall be provided. (Appendix - 'A' - Sheet 3)
4. **Type plan No.4:** In case the pipe line crossing of category A.3.1 & A.3.2 are below ground level.(Appendix - 'A' - Sheet 4)
5. **Type plan No.5:** Pipeline crossing of category A.4 conveying inflammable substance like petroleum, oil and gas etc. (Appendix - 'A' - Sheet 5)

CHAPTER 29

IMPORTANT TABLES, SOD & SIGNALING DATAS

29.1 WEIGHT OF TRACK MATERIAL ALONGWITH DRAWINGS (For P & C Refer Table 6.66)

SN	Description	Drg.No.	Approx.weight	Remarks
		MAIN LINE RELATED		
i	**Rails**			
1	60 R	T-630/2	29.76 Kg /m	
2	75 R	T-630/3	37.13 Kg /m	
3	90 R	T-630/4	44.61 Kg /m	
4	82 BH		40.75 Kg /m	
5	100 DB	T-630/S	49.70 Kg /m	
6	52Kg	T-630/2	51.89 Kg /m	
7	52 kg/m (IU)	T-630/2	51.89 Kg /m	
8	60 Kg (UIC 60)	RS-T-12	60.34 Kg /m	
9	60 E1	RS-T-12	60.21 Kg /m	
10	136 RE 14		68.00 Kg /m	
11	ZU 1-60		73.00 Kg /m	
12	R 260	EN 13674		
13	R 260 NC	EN 13674		
14	R 350 HT	EN 13674		
ii	**Sleepers (steel ML)**			
1	For 52kg/90R rails BG	T-460(M)	78.69kg each	
2	For 75 R Rails BG	T-0273	71.80 kg/each	Used in BG
3	For 75 R Rails MG	T-0271	33.01kg/ each	
4	For 60 R Rails MG	T-0272	33.01 kg/ each	
iii	**Cast Iron Sleepers**			
1	For 52kg /90R Rails BG	T-476(M)	43.55 kg/pot	
2	For 75 R Rails MG	T-498(M)/T-439	24.50 kg/pot	
3	For 60 Rails MG	T-10257	25.07 kg/pot	
4	For 60 Rails MG	T-10232	25.00 kg/pot	
5	CST-9 Pair	T-478	99.92 kg/pair	
6	CST-9 Pair	T-443	101.2 Kg/pair	
7	CI - Pot Pair 100 lb		118.46 kg/pair	
8	CI - Pot Pair 82 lb		100.60 kg/pair	
9	CI - Linked pot 90 BH		120 Kg /each	
10	CI - Linked pot 50 BH		44 Kg /each	