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Study material for Indian construction & railway engineering

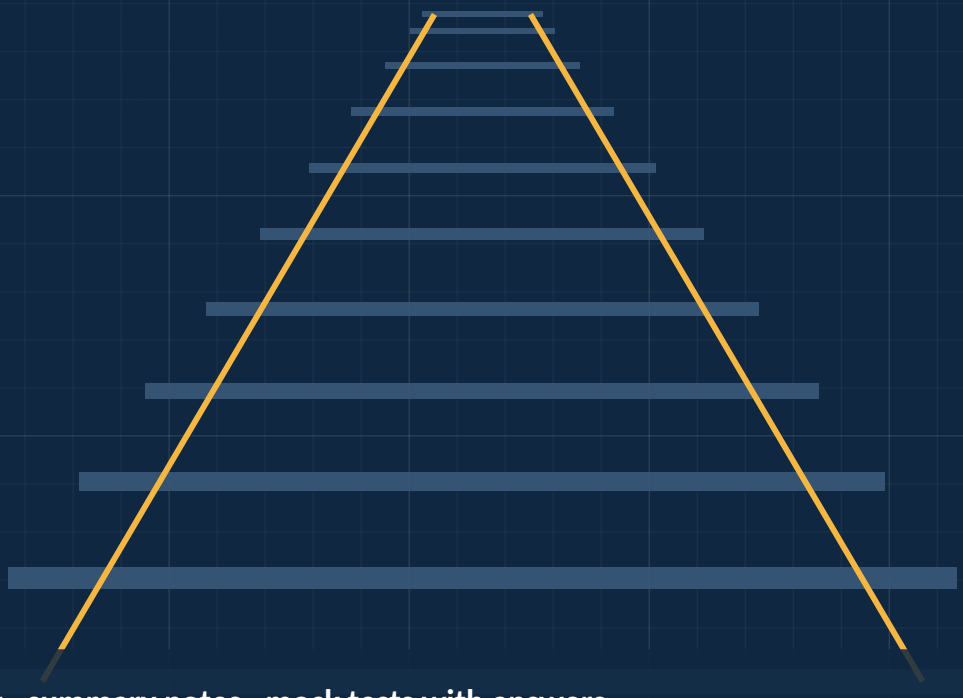
RAILPRO · VOLUME 2 OF 4

Railway Engineering

Study Notes

IRSOD, turnouts, renewal, track machines & level crossings

Chapter-wise compilation of Indian Railways training notes and circulars for engineering-department departmental & promotional exams.



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In this volume

IRSOD, turnouts, renewal, track machines & level crossings

PART II — PERMANENT WAY & TRACK ENGINEERING (CONTINUED)

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The complete set (free)

Vol 1 — Railway fundamentals, track structure & curves
Vol 2 — IRSOD, turnouts, renewal, track machines & level crossings (this file)
Vol 3 — Works, drawings, tenders, land, finance & stores
Vol 4 — Establishment, rules, safety & reference circulars

About this compilation: the chapters reproduce Indian Railways training material — course notes of the railway training institutes for JE/SSE (P.Way, Works, Bridge and Drawing) induction programmes — and Railway Board circulars, arranged chapter-wise for revision. The original pages are kept unchanged; Nirmaanpro only adds this navigation, bookmarks and branding and does not claim authorship of the source material.

Before you rely on any value

The source documents span many years; limits, rates and rules may have been revised since. For exam answers and field work, confirm against the latest IRPWM, IRSOD, IRWM, G&SR, codes, Railway Board/RDSO letters and zonal instructions.

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PART II (continued)

Permanent Way & Track Engineering

JE Bridge Induction Phase I

2.10

Standard Dimensions (SOD)..

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SCHEDULE OF DIMENSIONS
Schedule 1
Chapter 1 General

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What is SOD ?

- Schedule of dimension is nothing but a schedule, which lays down :-
- Limiting values, recommended values, and infringement to limiting values, which can be continued over entire Indian railways system for various track parameters unless prior sanction has been obtained from the railway board through the CRS to execute works which infringe SOD.
- Goods wagon and coaching stock parameters.
- Horizontal and vertical clearances to be followed on Indian railways.

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Necessity of S O D

- It is absolutely essential to ensure safety of traveling public as well as goods over entire Indian railways system.
- To adopt uniform system of track tolerances, location of structures and construction standard all over the Indian railways.
- To permit different types of coaching and goods stock owned by different railways to ply on entire railway system with same level of degree of safety.

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MAIN FEATURES OF SOD-2004

- Dimensions are given only for 1676 mm gauge.
- Consists of only metric units.
- Only two schedules – schedule I & schedule II
- Extra clearances required for curves are modified to suit speed of 160 kmph and SE of 165 mm
- Additional appendix for extra clearances required for 200 kmph is also given with 185 mm SE

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SCHEDULE - I

- Schedule I of SOD-2004 consists of those items which are mandatory and have to be observed on all 1676 mm gauge Railways in India.
- Contains the items of Schedule- I and certain selected items of Schedule- II of 1973 Version

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Contd. …

- DIMENSIONS given in Schedule-I are classified under two heads :-
- Existing works – The works which were existing before issue of SOD (2004) and shall be allowed to continue.
- New works – Include new constructions, additions of new lines/structure, gauge conversion and doubling and electrification works

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Contd. ...

However following works will not be included in New works-

- Works of addition/alteration of small works.
- Shifting of Points & Crossings.
- Extension of loop line
- Extension of siding.
- Alteration in building.

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SCHEDULE - II

- Schedule – II contains the existing infringements of Schedule – I which may be permitted to continue on existing railways subjected to such restrictions of speed as considered necessary.

- These are items, which were included in Schedule – III of 1973 version.

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Contd. ...

- DIMENSIONS given in Schedule-I are classified under two heads :-
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Contd. …

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- New works – Include new constructions, additions of new lines/structure, gauge conversion and doubling

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Chapter no	Topic
1	General
2	Station Yards
3	Workshops and Station machinery
4A	Rolling stock carriage and wagon
4B	Rolling stock 3660 MM Wide stock
4C	Rolling stock Locomotive
5	Electric current Direct current
5A	Electric current 25 KV AC current
5B	25 KV AC with high rise OHE
	Schedule 2

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ACS	Topic	Chapter/Para
16	Maximum steepest gradient 12.05.15 Max horizontal distance to any structure	2 / Para 2 2 / Para 11
17	Amendment to ACS 16 Note e(3) 03.08.15	2 / Para 2
18	Min distance Centre to Centre track 16.11.16	1 / Para 1
19	Min distance Centre to Centre track Note 16.11.16	2 / Para 1
20	Clearance power line crossings and horizontal distance of structure 17.07.17	1 / Para 11(i) (iv)
21	Chapter VB 25KV double stack container 27.09.17	New
22	Height of ROB and FOB Height over head structures Height of platforms 08.12.17	1 / Item 10 2 / Item10 2 / Item 4,5,6
23	Buildings and structures on platform 08.12.17	2 / Item 7(a)
24	Horizontal distance of any building or longitudinal boundary fence from the centre line of track of passenger platform 02.08.18	2/Item 7 (b)

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ACS	Topic	Chapter/Para
25	Amendment To Opening Paragraphs of Chapter-I: General 06.11.18	1/ Opening paragraph
26	Spacing of track 10.01.19	1/ Para 1
	Horizontal distance from centre of track Below RL	1/ Para 8 (iii)
	Formation width	1/ Par 16
	Formation width	1/ Par 17
	Spacing of track	2/ Para 1
	Min horizontal distance from centre of track to any structure	2/ Par 11 (a&b)
	Max length over centre buffer couplers or side buffers	4(A)/Para 20
	Max width overall projections	4(A)/Para 24,25
	Min height above RL fully loaded vehicle	4(A)/Para 31
	Max width of body and overall projections	4(C)/Para 11

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ACS	Topic	Chapter/Para
26	Min height above RL fully loaded locomotive	4(C)/Para 17
27	Opening paragraph 17.07.2019	1 / Opening para
	Min distance Centre to Centre track	2 / Para 1
	Maximum steepest gradient	2 / Para 2
	Platforms	2 / 4,5,6
	Maximum height above rail level	4A / Para 29
	Maximum height above rail level	4C / Para 12
	Maximum height of pantograph collector	5A / Para 4
	Drawings modified	
28	Corrigendum slip for ACS 28 23.07,2019	2 / Para 2
29	Maximum steepest gradient in yards 13.05.2020	2 / Para 2

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Chapter 1
General

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ACS 27 dated 17.07.2019 Amendment to opening paragraph of chapter 1 general

- New works – Include altogether new constructions, additions of new lines/structure, gauge conversion and doubling
- However it does not include
- Works of alteration such as shifting of Points & Crossings.
- Extension of siding.
- Extension of loop line
- Alteration in building.

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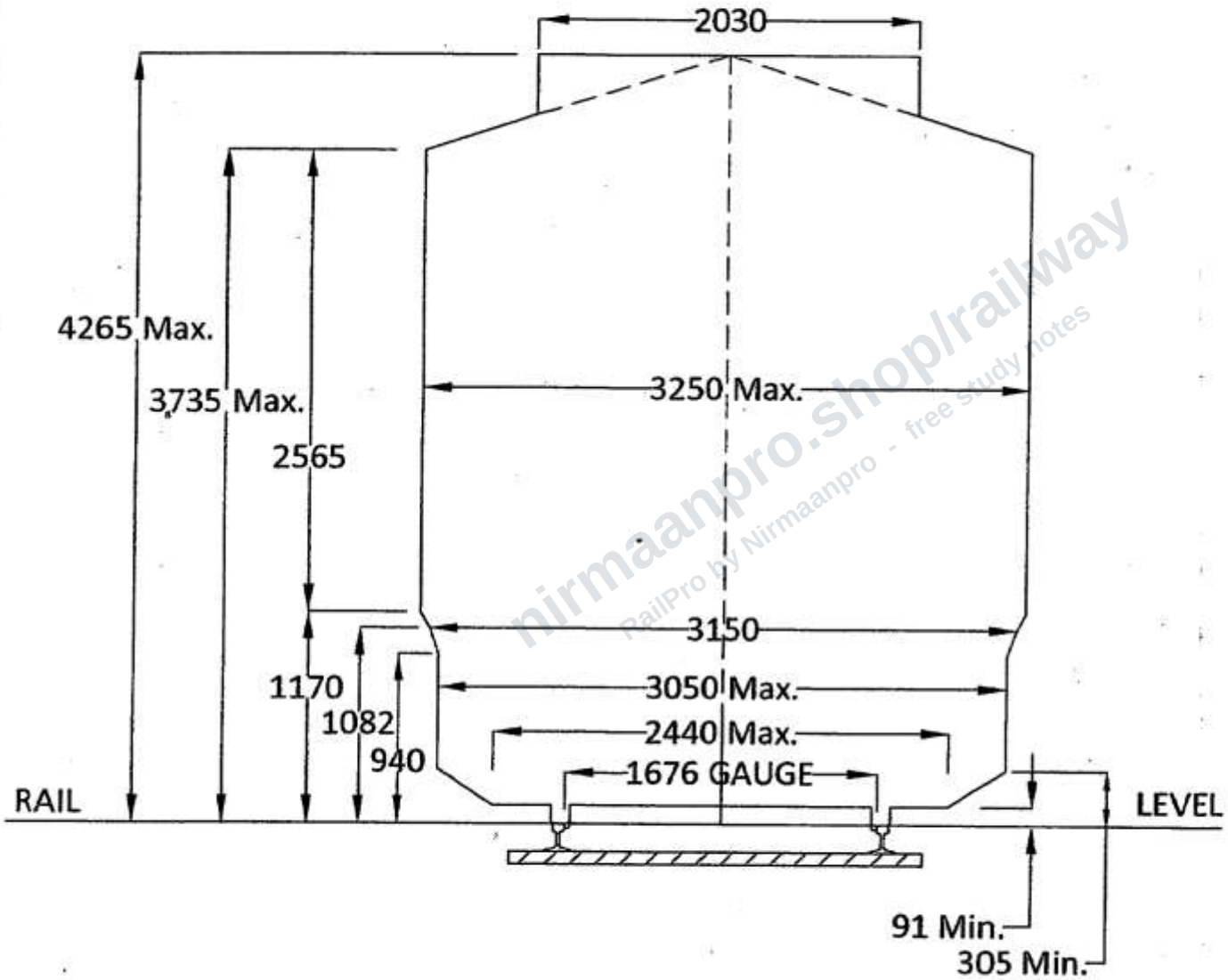
ACS 27 dated 17.07.2019 Amendment to opening paragraph of chapter 1 general

- The dimensions, except for existing works, are to be observed on all 1676 mm gauge on Indian Railways for execution of new works.
- Provided further that infringement to provision of IRSOD Chapter I, 11, III, V, VA & VB of Schedule I can be condoned by Commissioner , provided further that infringements beyond the limits prescribed , in Schedule 2 if any or wherever specific mentions appear in schedule 1 sanction of condonation shall be obtained from RB through Commissioner / CCRS

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MAXIMUM MOVING DIMENSIONS

DIAGRAM No. 1D
(EDO/T-2202)
1676mm GAUGE



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NOTE:- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

Prem Sag
17.07.19

Item 1 Minimum Horizontal distance centre to centre of track between straight tracks – Spacing between tracks

For Works	Horizontal distance from centre to centre of track
For existing works	4265 mm
For new works/additions to existing works	5300 mm

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- Extra clearances required on curves to be added.
- For spacing up to 5300mm extra clearances up to 5° has been accounted and for more than 5°are to be calculated and accounted.

Minimum Horizontal distance centre to centre of track in tunnels, Road Over Bridges / Flyovers, through and semi through girder bridges clearances prescribed

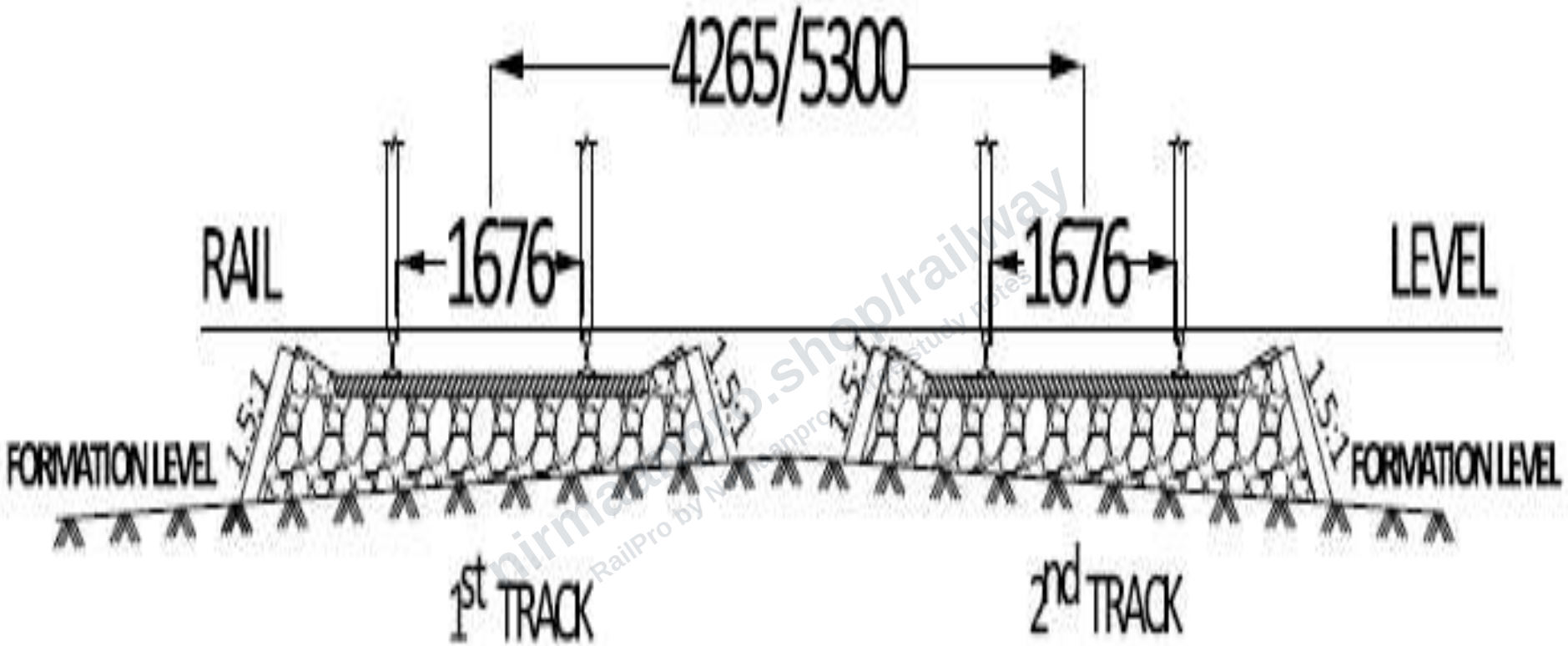
For Works	Horizontal distance from centre to centre of track
For existing works	4495 mm
For new works/additions to existing works	4725 mm

- Extra clearances required on curves to be added.

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- New/Additional works cover laying of new line and new running loops. Extension of existing line or replacement of points & crossings will not be treated as new work.
- OHE mast and Signal post shall not preferably be provided in between tracks. However, under unavoidable circumstances, the clearance 5300 mm above shall be increased by equal to the width of such provisions/structures/foundation, as the case may be.
- In case of tunnels, ROB, flyovers, through and semi through girder bridges where centre to centre distance between tracks is lesser than 5300 mm has been provided, lesser centre to centre distance can be provided on approaches also up to adequate distance to facilitate gradual increase in centre to centre distance up to 5300 mm (ACS 26)

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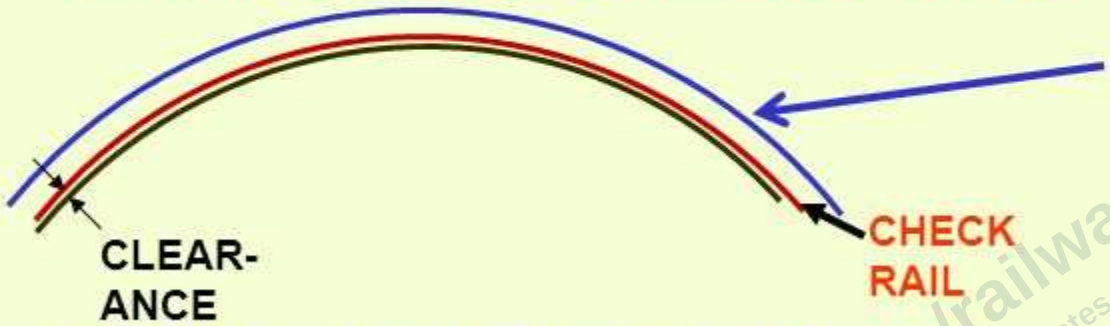
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- **Item no 2 : Minimum Radius of curves -**

  175 m (10 degree)
- **Check rails to be provided in curves having radius 218 meters(8 degree) and sharper.**
- **Check rails may also be provided in flatter curves, if high speed is contemplated.**
- **Minimum clearance of check rail on curve - 44 mm**
- **This clearance must be increased by not less than half the amount of any difference between 1676mm and the gauge to which the curve is actually laid.**

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CHECK RAILS ON CURVES



TOO MUCH WEAR ON OUTER RAIL IN SHARP CURVES

- PARA 426 IRPWM
- CL. 4, CHAPTER 1, BG SOD

- ON CURVES OF 8 DEGREES & ABOVE
- MIN. CLEARANCE = 44 mm
- CLEARANCE = 44 + (G-1676)/2

53

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Item no 3: Bridges must confirm to the requirements of railways opening for the public carriage of passengers rule 2000

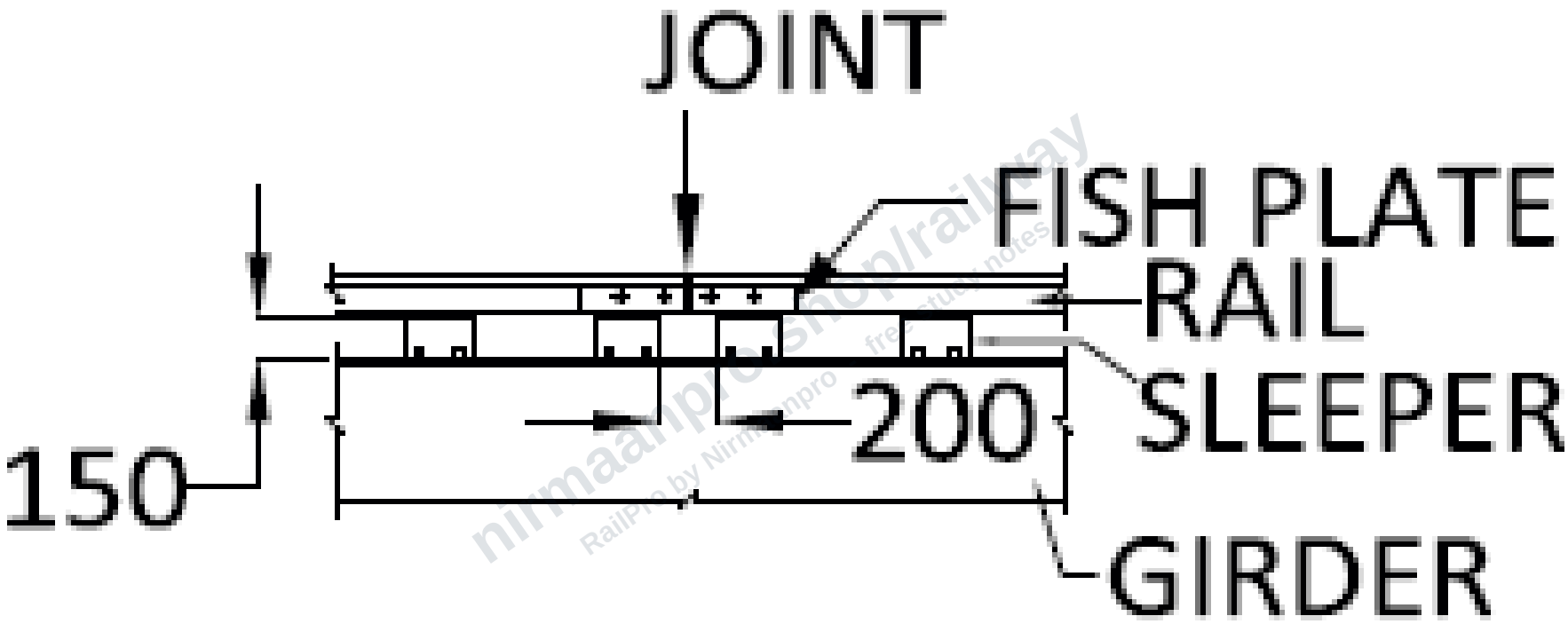
Maximum clear distance between two consecutive sleepers on bridge	
i) on existing Bridges where nothing solid is there between sleepers to prevent a derailed vehicle dropping	510 mm
ii) New construction & on existing bridges during regirdering /TSR	450 mm
Maximum distance between Joint	200 mm

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Dimensions of bridge sleepers resting directly on longitudinal girders

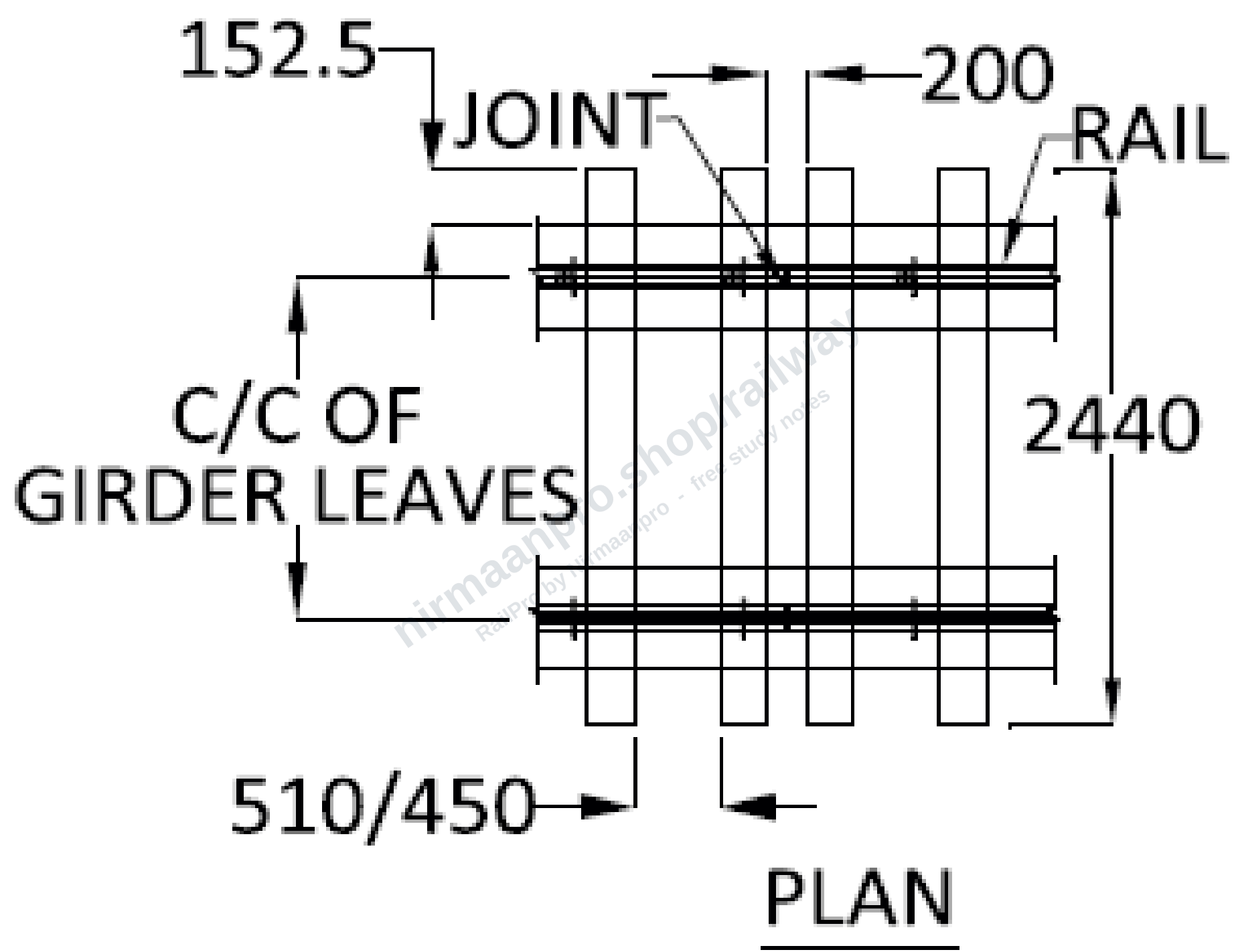
Depth exclusively of any notching which may be required to for cover plates and camber	150 mm
Length outside of girder flanges subject to a minimum total length of sleeper as 2440mm	152.50 mm
Length of steel trough sleeper subject to a minimum length of outside to outside of girder flanges	2440 mm

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ELEVATION

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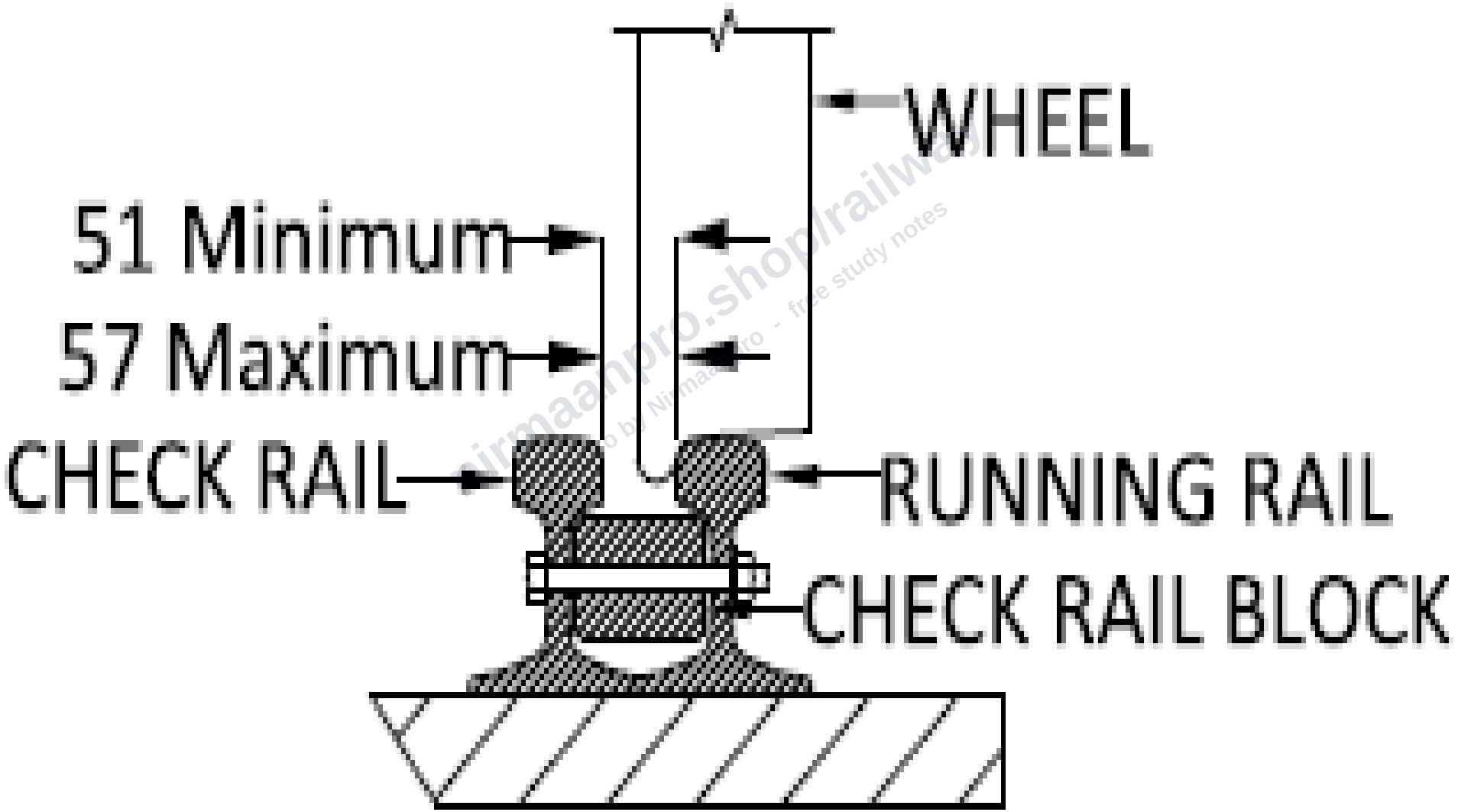
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Item no 4 , 5 & 6

Description of structure	Clearance
Minimum clearance of check rail at Level crossing	51 mm
Maximum clearance of check rail at Level crossing	57 mm
Minimum depth of wheel flange from rail level at Level crossing	38 mm

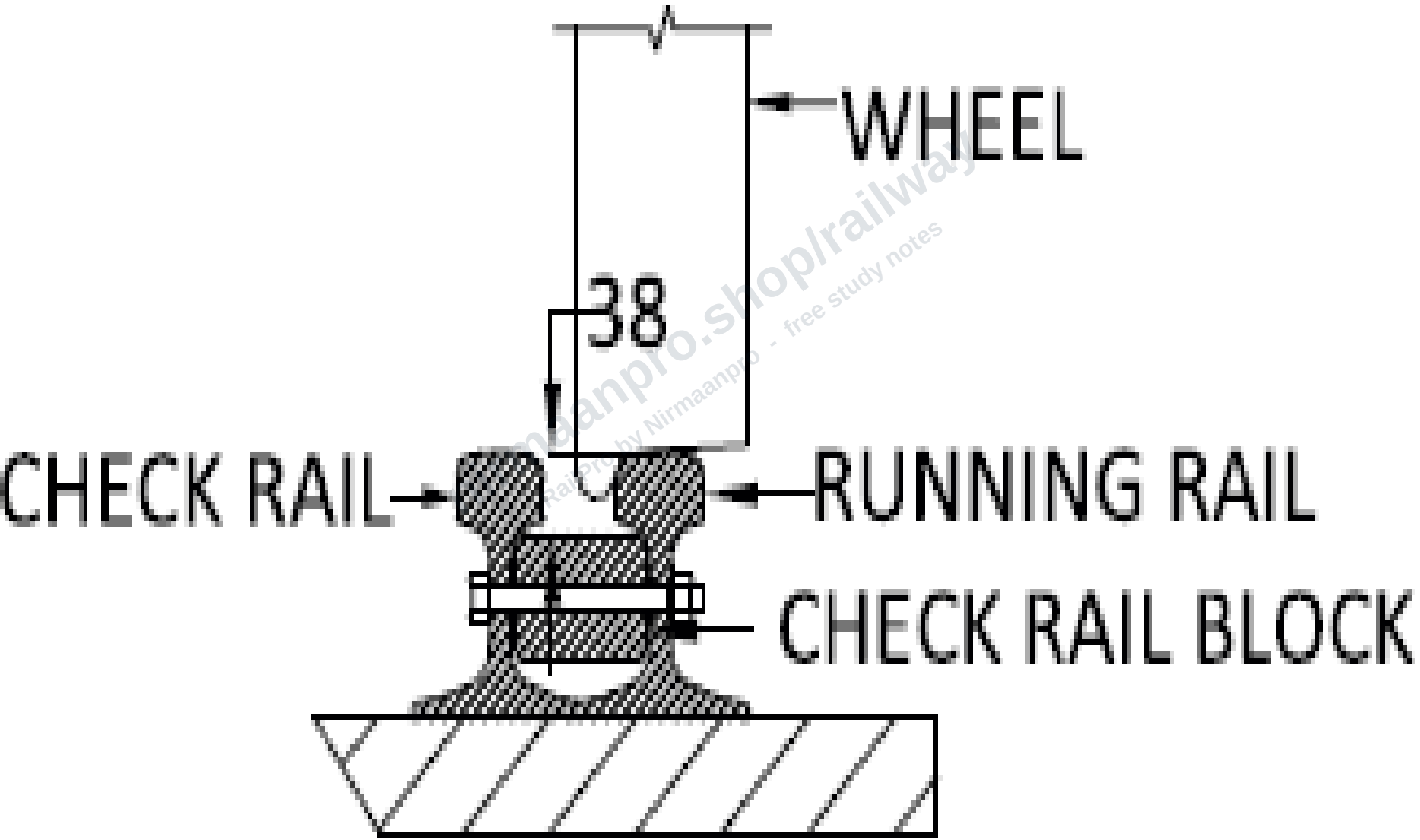
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Clearance of check rail at Level crossing



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Minimum depth of wheel flange from rail level at Level crossing



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- **Item 7 & 8: Minimum horizontal distance from centre of track to any structure for existing works except a platform**

Height above RL	Max horizontal distance from track
From RL to 305mm above RL	1673 mm
From 305 mm to 4420 mm above RL	2135 mm

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- **Minimum horizontal distance from centre of track to any structure for new works/alterations to existing works**

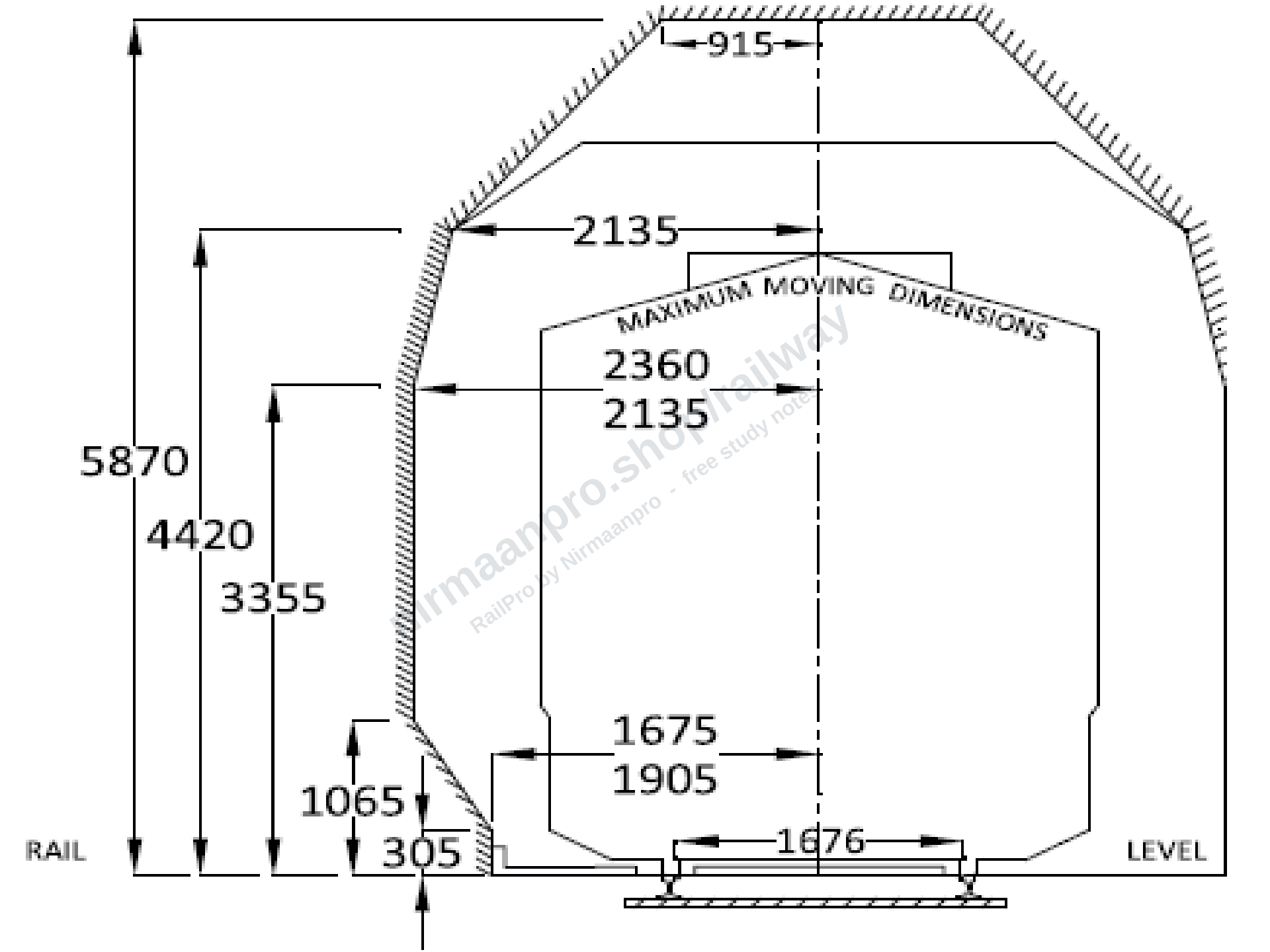
Height above RL	Horizontal distance from centre of track
From RL to 305mm above RL	1905 mm
From 305 mm to 1065 mm above RL	1905 increasing to 2360 mm
From 1065 mm to 3355mm above RL	2360 mm
From 3355 mm to 4420 mm above RL	2360 decreasing to 2135 mm
From 4420mm to 5870mm above RL	2135 decreasing to 915 mm

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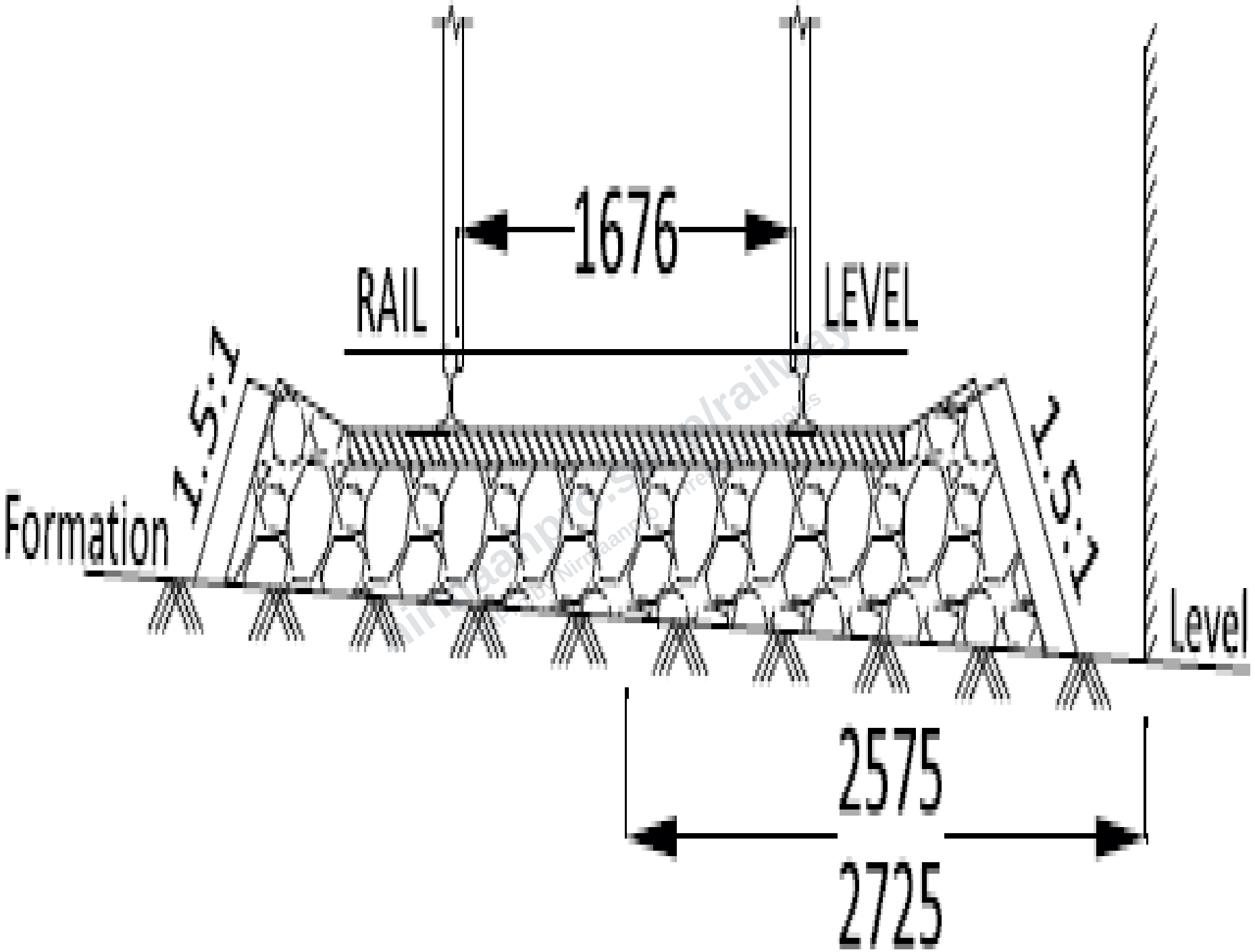
- **Minimum horizontal distance from centre of track to any structure**

Description	New works / Alterations to existing works
Below RL and upto Formation level of the track on straight and curves upto radius of 875 M	2575 mm
Below RL and upto Formation level of the track on curves upto radius less than 875 M	2725 mm

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1676
RAIL
LEVEL
1 in 4
1 in 4
Formation
Level
2575
2725

- **Note**
- Any material stacked by the side of line is to be considered a structure, These items also apply to projections of rock etc., from the side of cutting.
- Extra clearances required on curves to be ensured.
- Light structures such as ladders, thin posts etc. erected along side the track at a distance of less than 2360mm from centre of adjacent track should be obstructed off to a height of 300mm between 2060mm and 2360mm above rail level.

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- **Minimum horizontal distance from centre of track to any structure**

Description	New works / Alterations to existing works
Below RL and upto Formation level of the track on straight and curves upto radius of 875 M	2575 mm
Below RL and upto Formation level of the track on curves upto radius less than 875 M	2725 mm

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- The required clearances as mentioned below RL to FL will be applicable in case of new lines / doubling / electrification.
- The various fixture which are attached to the track like traction bonds etc. and are required to be fitted with the rail can be provided and the clearance as mentioned below RL to FL will not be applicable to these fixtures.
- The clearances mentioned below RL are not applicable for ballast less track including washable apron.(ACS 26)

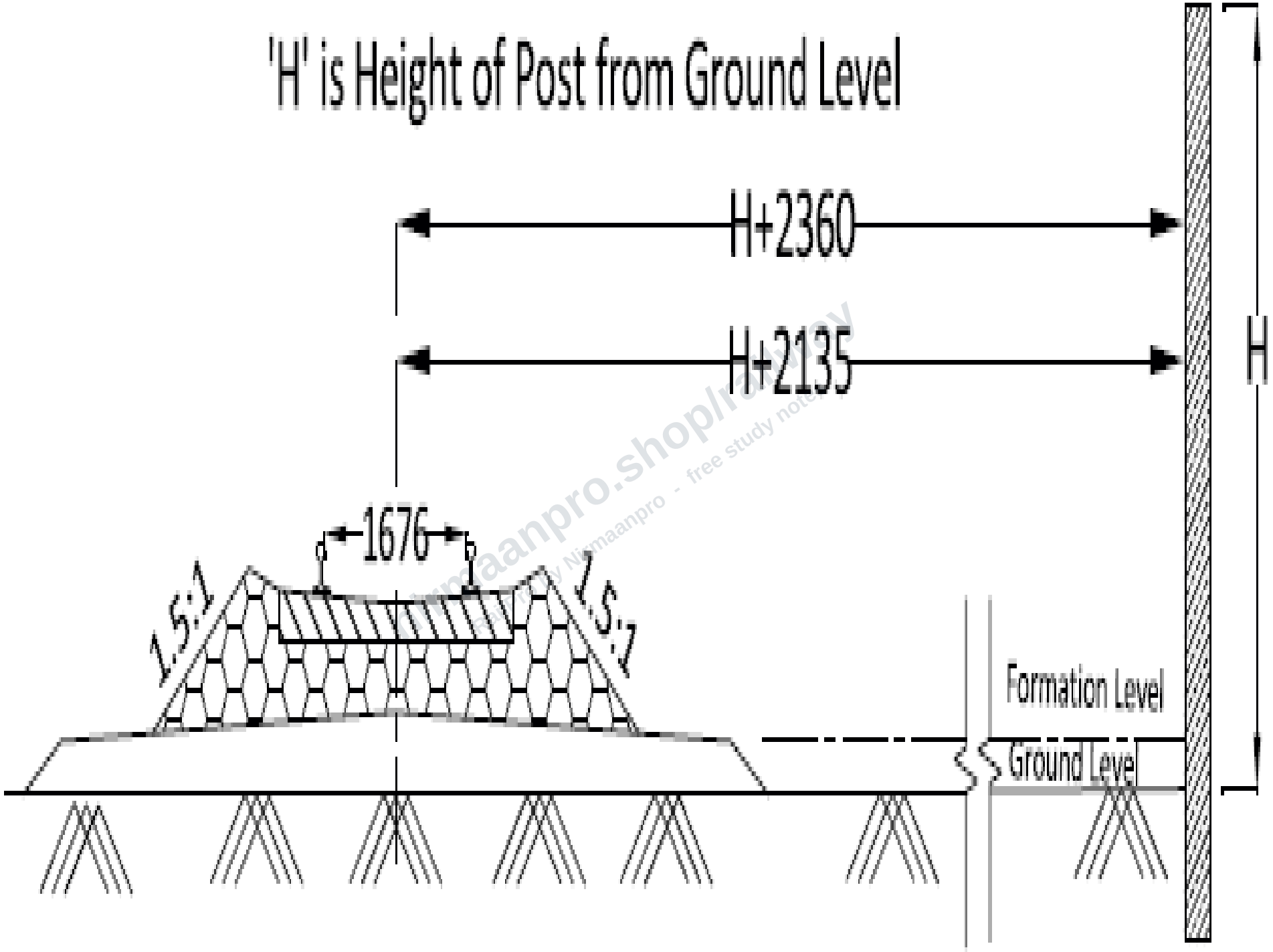
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- **Item no 9: Minimum horizontal distance measured from any telegraph post and at right angle to any nearest centre of track.**

Type of work	Clearance
For existing works	Height of post plus 2135 mm
For new works / Alterations to existing works	Height of post plus 2360 mm

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- **When the line is in cutting, telegraph post erected outside the cutting, must be at a distance from the edge of the cutting not less than the total height of the post.**

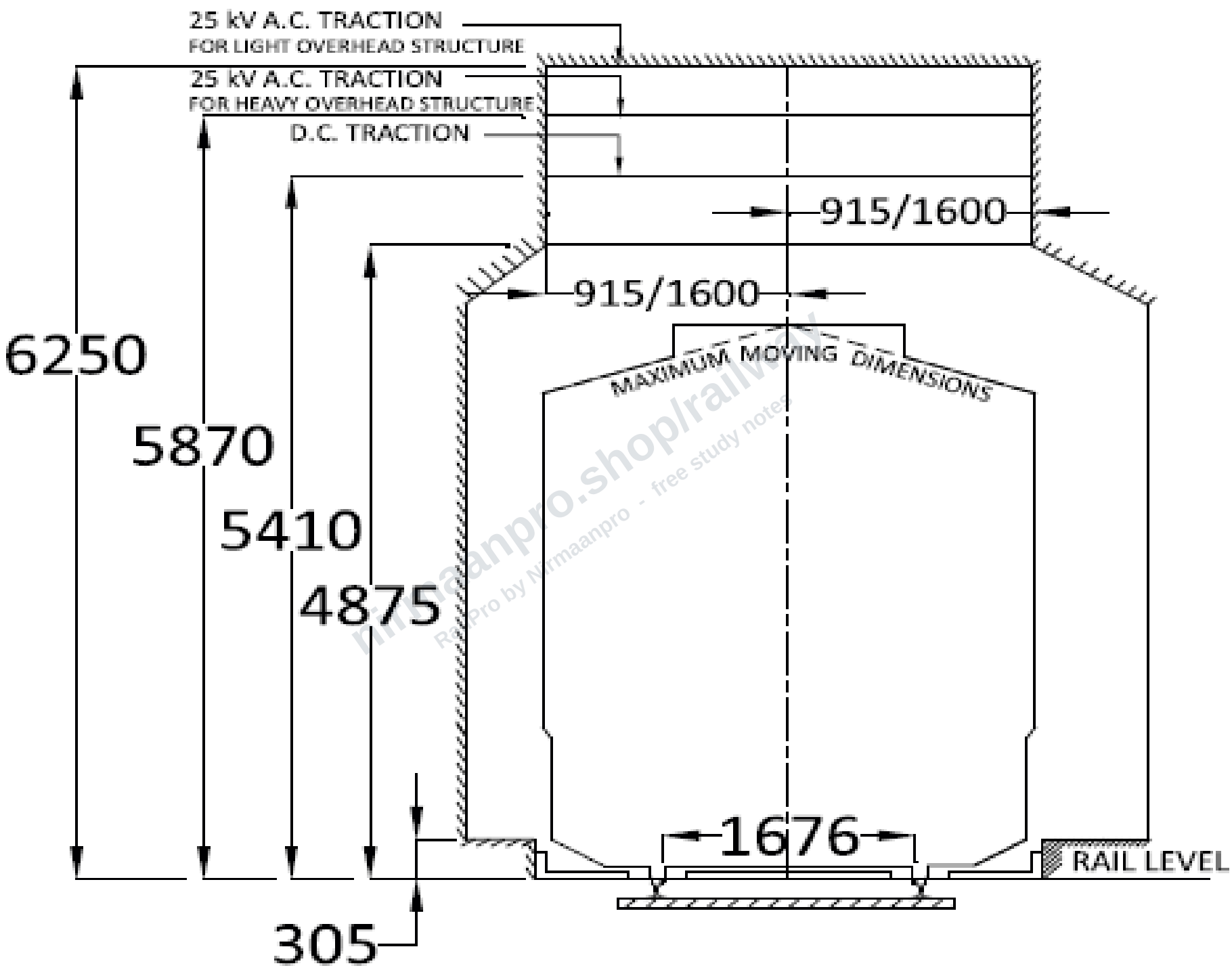


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- **Item 10 (ACS 21) Height of road over bridges and foot over bridges**

Description	Height in mm
Min. height above RL for a distance of 915mm on either side of the Centre of track for overhead structures	4875 mm
When D.C electric current is in use or likely to be used	5410 mm
When 25 KV A.C Min. height above RL for a distance of 1600 mm on either side of the Centre of track for 1) Light overhead structures such as foot over bridges.	6250 mm
2) Heavy overhead structures such as road over bridges	5870 mm

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- Extra clearances required on curves to be ensured.
- In case of restricted height of existing structures a special case study shall be done before introduction of 25 KV A.C. Accordingly the minimum height above rail level shall not be lower than

1. For Heavy overhead structures such as ROB and flyovers 5070 mm.

2. For Light over head structures such as FOB – 5270mm.

- In above two cases the minimum height of contact wire shall be 4800 mm above RL.

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- **Where 25 KV A.C. traction is used or likely to be used**

1. **If any turnout or crossover is located under a heavy over head structure or within 40 mts from face, irrespective of position of LC the minimum height to be maintained is 6250mm.**
2. **In case if turnout or crossover is beyond 40 mts away, but LC is within 520 mts from heavy over head structures the minimum height to be maintained is 6250mm.**

- **In case of restricted height as against the height of 6250mm of existing heavy overhead structure, can be reduced but minimum height above rail level shall not be lower than 5270mm, the minimum height of contact wire shall be 4800 mm above RL subject to condition that minimum height of contact wire shall be 5500mm ensured at level crossing.**

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- In curves Height should be measured from higher rail.
- On lines existing or proposed to be electrified provision shall be made in over head structure and equipment, if necessary using longer masts and equipment to permit extra allowance of 275mm for raising of track in future to cater for modern track structure in form larger ballast cushion or larger sleeper thickness or deeper rail sections.

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- On secondary lines where traction is not likely to be introduced Minimum height above rail level – 4875mm.
- This also applies to overhead piping arrangement parallel to track wherever provided which shall be changed over to ground hydrants when section is electrified.
- Tunnel, through girder bridge and semi through bridge in station yards shall be treated as heavy over head structure.

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For Mumbai suburban the height of FOB can be reduced from 6250 mm to 5750mm subject to

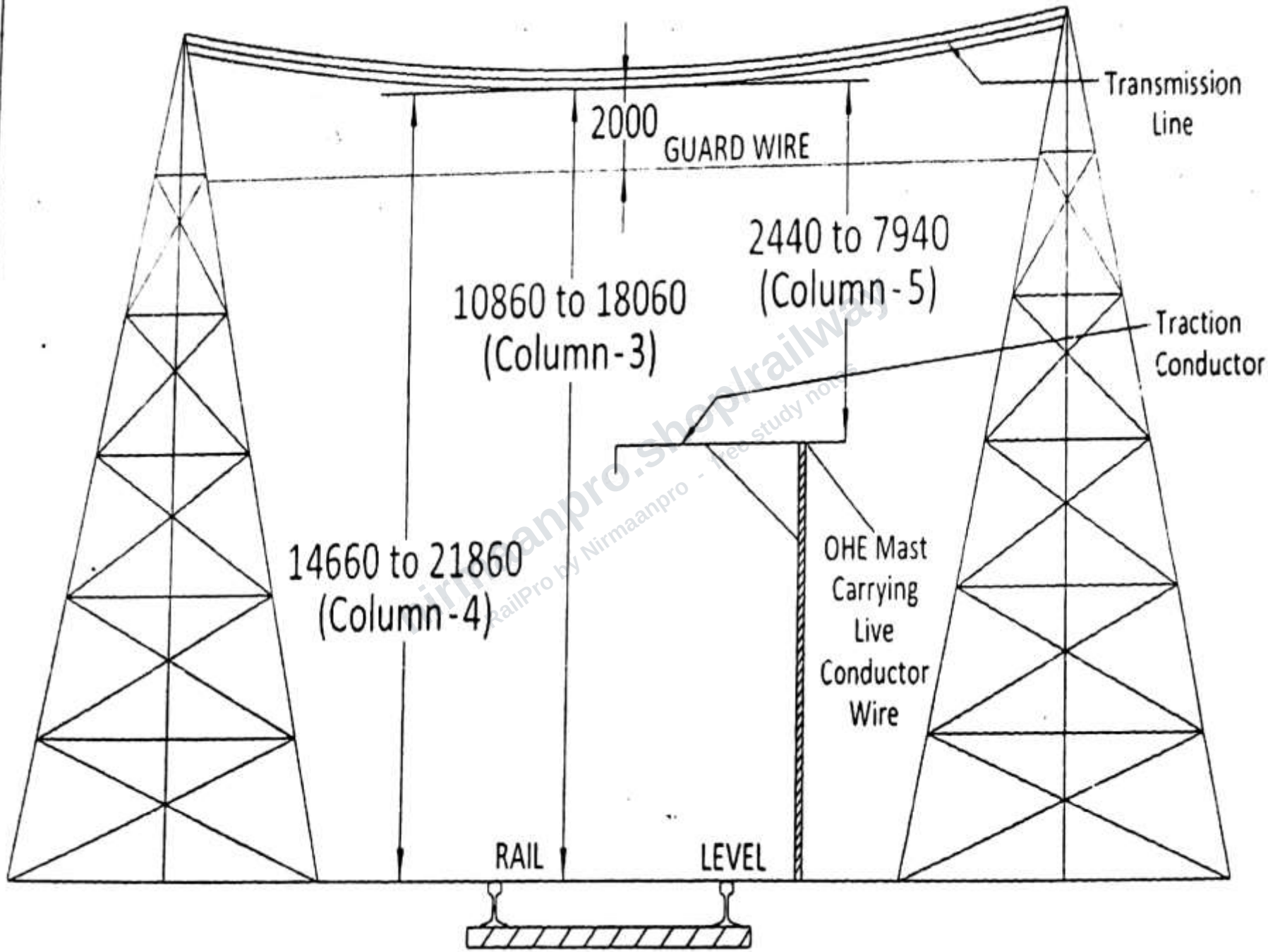
- Minimum of contact wire is 4800mm above RL.
- Special case study shall be done to cater contact wire height as 4800mm.
- No crossover or turnout within below FOB or 40 mts from face of the FOB.
- No LC within 520 mts from FOB.
- Max height of rolling stock restricted to 4420mm.
- In curves Height should be measured from higher rail.

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Item no 11 (i) : Clearances for power line crossings in non electrified and electrified territory. (ACS No 20 Para no 11(i)

SL	Over head crossing voltage	Minimum clearances from rail level.		Minimum clearance between highest traction conductor and lowest transmission line crossing conductor
		Existing power line crossing for non electrified territory	New power line or crossing planned for alteration	
1	Up to and including 11KV	•Normally by under ground		
2	Above 11KV & up to 33KV	10860mm	14660mm	2440mm
3	Above 33KV & up to 66KV	11160mm	14960mm	2440mm
4	Above 66KV & up to 132KV	11760mm	15560mm	3050mm
5	Above 132KV & up to 220KV	12660mm	16460mm	4580mm
6	Above 220KV & up to 400KV	14460mm	18260mm	5490mm
7	Above 400KV & up to 500KV	15360mm	19160mm	7940mm
8	Above 500KV & up to 800KV	18060mm	21860mm	7940mm

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- All heights are under max sag conditions.
- If crossing is provided with guarding a minimum clearance of 2000mm shall be maintained between bottom of guard and highest traction conductor.
- Power line crossing shall be avoided in yards and station areas.
- For any electrification work of existing line, doubling/gauge conversion along with electrification existing crossing can continue if dimensions are as per col 5 even if dimensions col 3 are not satisfied for electrical works, col 3 is not applicable.

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Item 11 (ii) Minimum Clearance between any conductor not adequately insulated and any railway structure under most adverse condition.

Voltage	Clearance
Up to and including 650 volts	2500 mm
Above 650 up to and including 33KV	3700 mm
Above 33 KV up to and including 66KV	4000 mm
Above 66 KV up to and including 132 KV	4600 mm
Above 132 KV up to and including 165 KV	4900 mm
Above 165 KV up to and including 220 KV	5500 mm
Above 220 KV up to and including 400 KV	7300 mm
Above 400 KV up to and including 500 KV	8200 mm
Above 500 KV up to and including 800KV	10900 mm

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- **Item 11 (iii) Minimum height above rail level for telegraph, telephone and any other such low tension wires crossing a railway ---- 6100 mm.**

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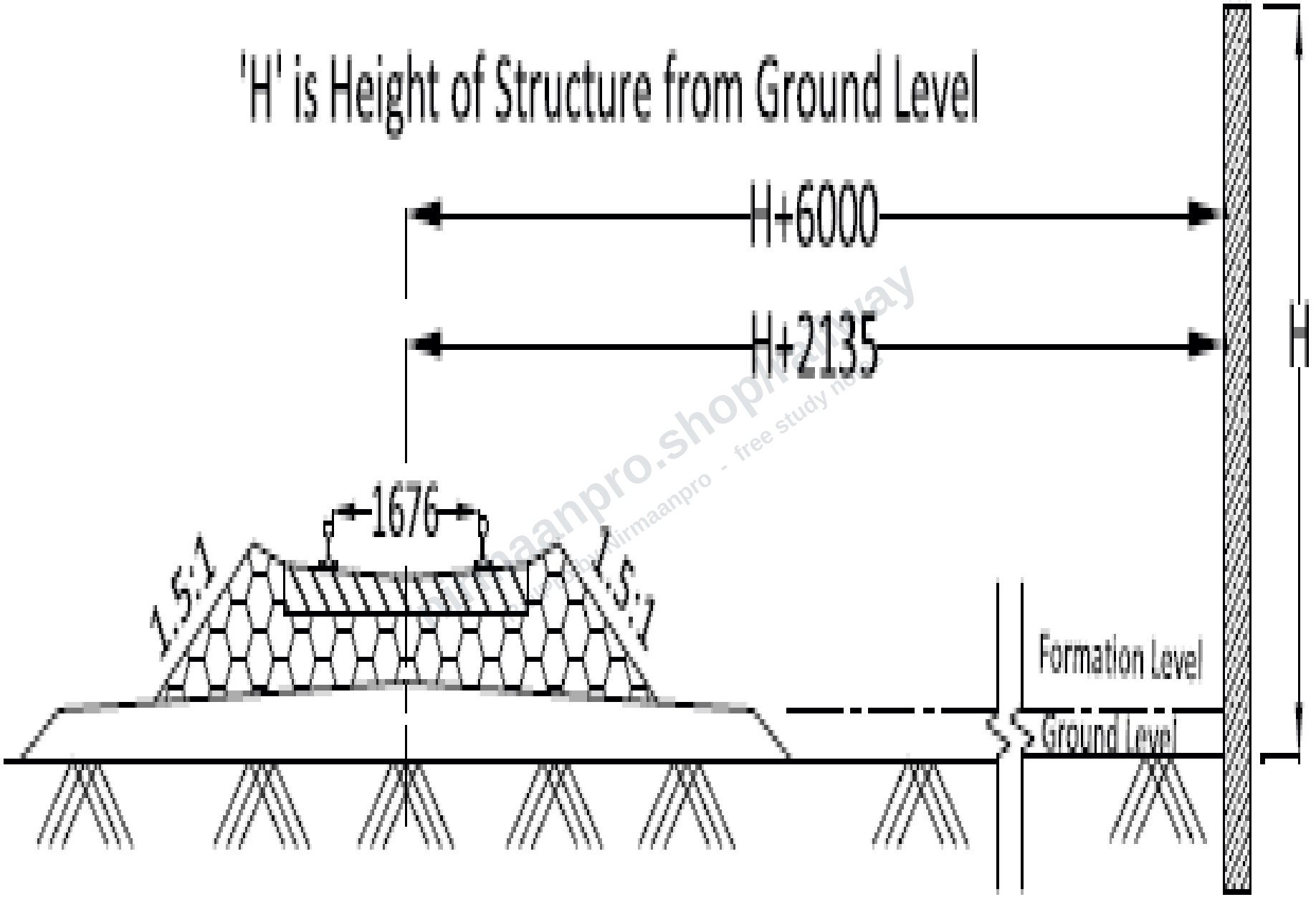
- **Item 11 (iv) Minimum horizontal distance measured at right angle to and from center of nearest track to any part of structure measured above ground level carrying a electrical conductor crossing a railway line shall be**
- **For New structures H+6 M**
- **For existing rigid well founded structure**

  3 M or 1.5 M from toe of embankment or top of cutting which ever is more.

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- Any post or structure which is so constructed or guyed as to remain in vertical position or failing this to continue to provide the minimum horizontal clearance of 2.135 M from the center of nearest track with one or all the conductors broken or with its conductors attached when subjected to maximum wind pressure shall be considered to be a rigid well founded structure.

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- The existing rigid well founded post presently at a distance equal to or more than above but less than H+2.135 M shall be inspected by a railway's nominated electrical official jointly with the owner of the post once in a year and certify the safety of structure keeping appropriate record of inspections.
- If the structure carrying electrical conductors crossing railway line is not a rigid well founded post then the minimum horizontal distance measured at right angles to center line of nearest track shall be equal to height of structure above ground level plus 2.135 M.

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- **Item no 12: Interlocking and signal gears**
- **Maximum height above rail level of any part of Interlocking or signal gear for a width of 1600 mm or 1830mm in the case of tunnels, through and semi-through girder bridges on either side of centre of track --- 64 mm.**

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Item no 13 (i): Minimum Horizontal distance centre to centre of track in tunnels, through and semi through girder bridges clearances prescribed

For Works	Horizontal distance from centre to centre of track
For existing works	4495 mm
For new works/additions to existing works	4725 mm

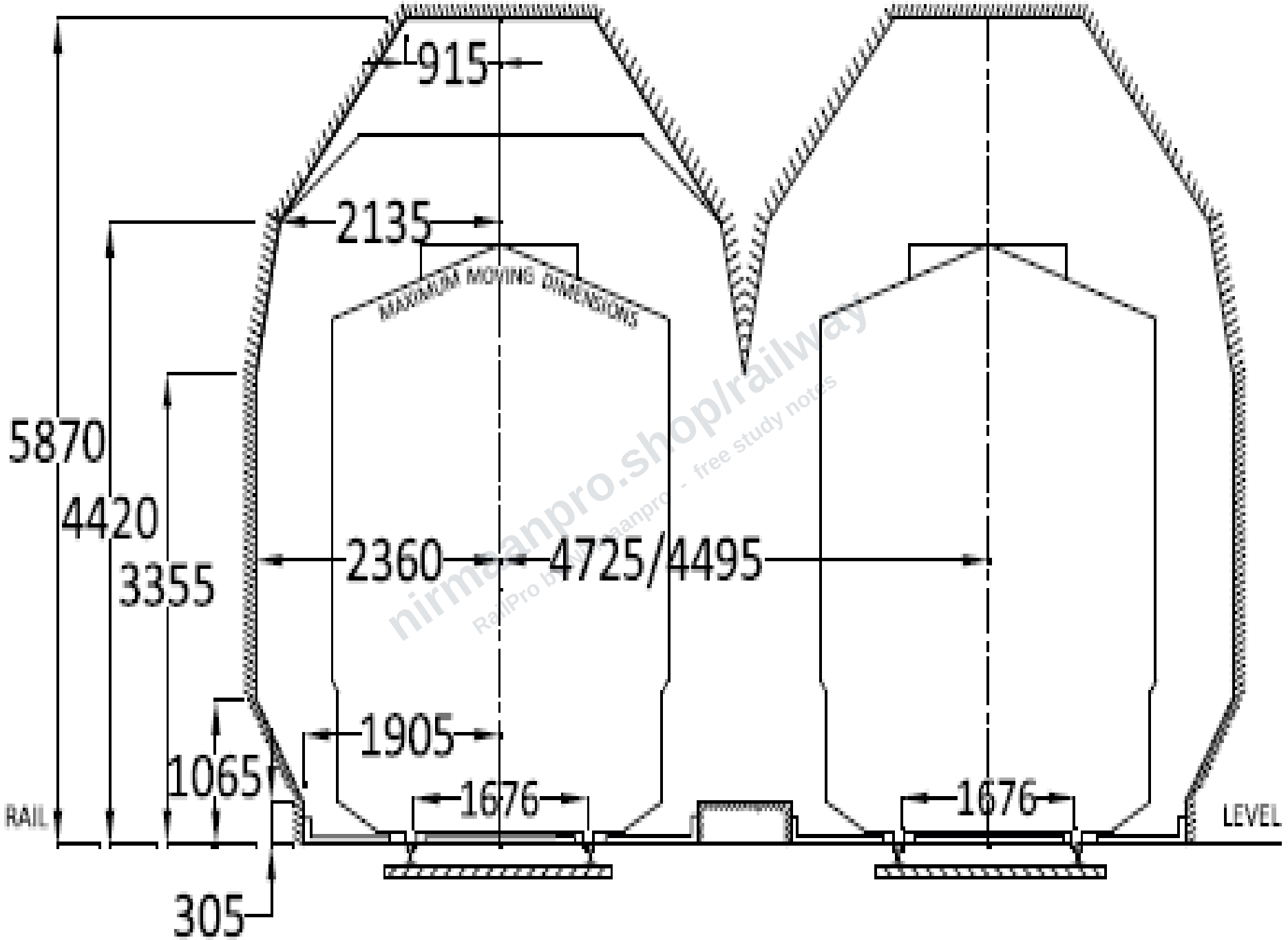
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- Extra clearances required on curves to be added.

- **Item no 13 (ii) Minimum horizontal distance from centre of track to any structure n tunnels, through and semi through girder bridges**

Height above RL	Max horizontal distance from track
From RL to 305mm above RL	1905 mm
From 305 mm to 1065 mm above RL	1905 mm increasing to 2360 mm
From 1065 mm to 3355 mm above RL	2360 mm
From 3355 mm to 4420 mm above RL	2360 mm decreasing to 2135 mm
From 4420 mm to 5870 mm above RL	2135 mm decreasing to 915 mm

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- **Where electric traction is not likely to be used, over head bracing of bridges may be 5030mm above rail level for a distance of 1370mm on either side of the centre of track.**
- **Extra clearances required on curves shall be ensured.**
- **Where D.C. traction is in use item above may be as under:**

  From 4420mm to 5410 mm
  2135 mm decreasing to 915 mm

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- Tunnels , through girder and semi through girder bridges outside station yards should be treated as heavy over head structures such as ROB for electrification works
- if any turnout or crossover is located under a heavy overhead structure or within 40m from its nearest face irrespective of the position of level crossing gate, the minimum height of such overhead structure shall be 6250mm*.Also, in case the turnout is beyond 40m but the level crossing gate is within 520m from the nearestface of the bridge, the height of such overhead structure shall be 6250mm and OHE arrangement shall be as per RDSO drawing.

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STANDARD DIMENSIONS OUT OF STATIONS

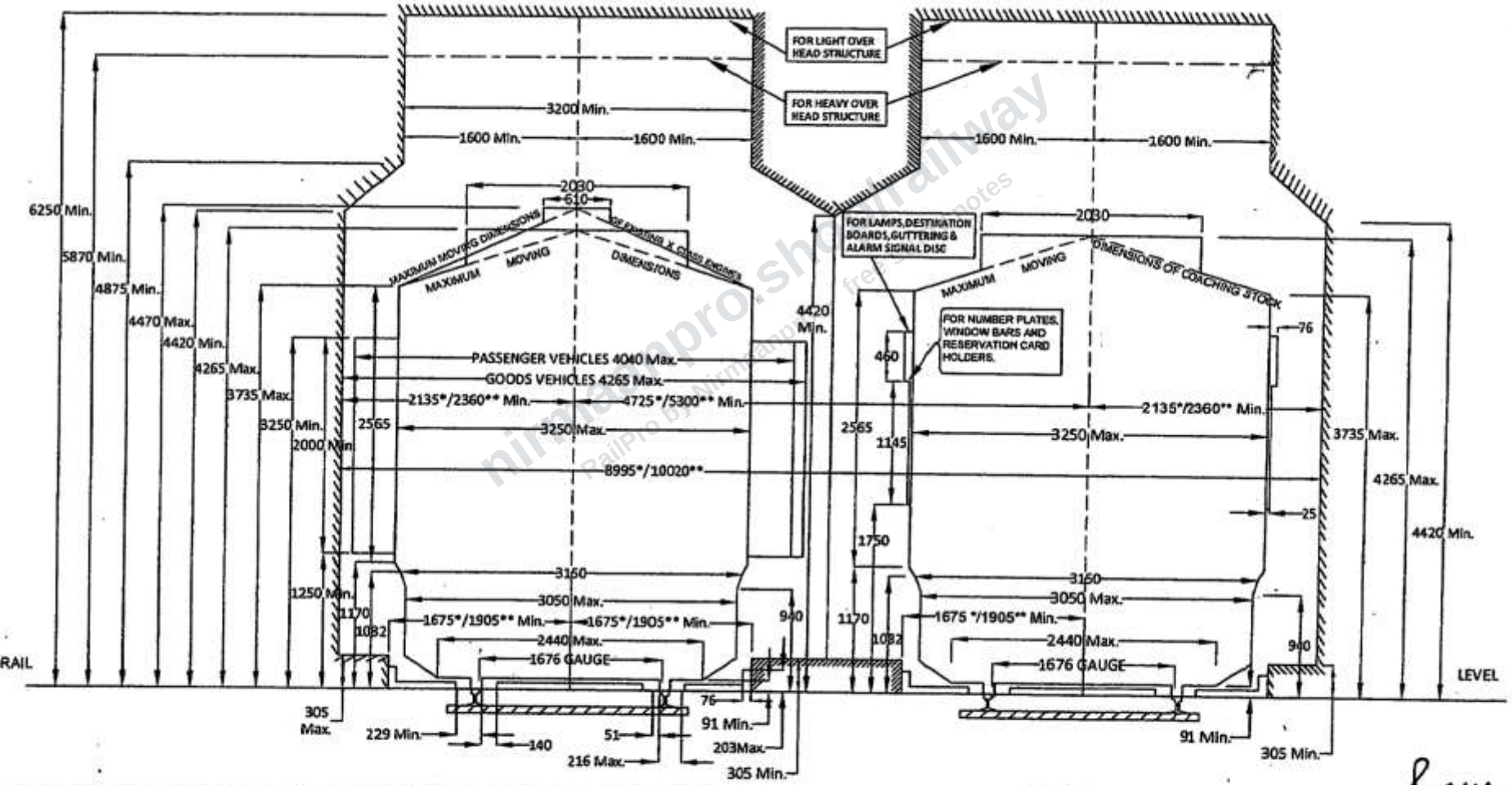
TO SUIT 25 kV. A.C. TRACTION

SCHEDULE I - CHAPTER I

DIAGRAM No. 1C

1676 mm GAUGE

NOTE:- *THE DISTANCES SPECIFIED, APPLY ONLY IN CASE OF STRAIGHT TRACK. ON CURVES, THE HORIZONTAL DISTANCE SHOULD BE INCREASED BY AN AMOUNT 'D' TO ALLOW FOR THE LEAN DUE TO SUPER-ELEVATION CALCULATED BY THE FOLLOWING FORMULA, WHERE 'H' IS THE HEIGHT OF THE CONTACT WIRE, 'S' THE SUPERELEVATION AND 'G' THE GAUGE OF THE TRACK, ALL DIMENSIONS BEING IN METRES* $D = \frac{H \times S}{G}$



NOTE:- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

NOTE:-

* - *For existing works*

** - *For new works or alteration to existing works*

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Item no 14 & 15: Safety Refuges

Max. distance in tunnels 100 m

On bridges with

a)span less than 100 m 100 m

b)spans of 100 m or more - On each pier

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Provision of Trolley refuse as per CS No 116 of IRPWM

Location	Distance
Maximum distance should not be more than 1Km subject to following	
Cutting in straight	200M
Cutting in curve	100M
High Embankment	200M
Tunnel	100M
Bridges with span less than 100 m	100M
Bridges with spans of 100 m or more	On each pier
On Ballasted deck bridges	50M

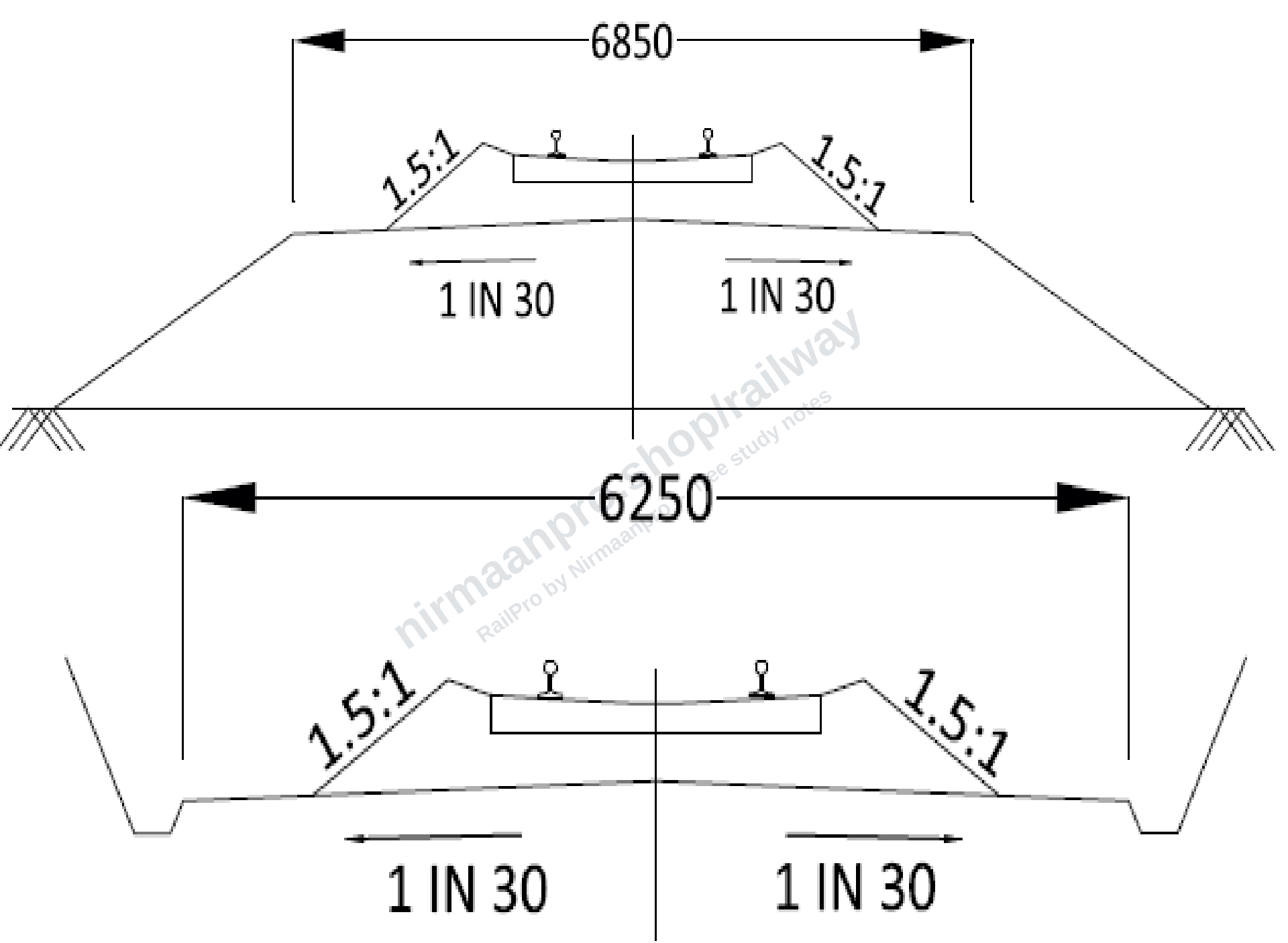
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Item no 16, 17 & 18: As per SOD Formation width for single line straight track for existing works (ACS 26)

Straight Track	Minimum width
In Embankment	6850 mm
In Cutting excluding side drains	6250 mm

On curves, the actual width to be provided should take into account 150mm extra widening of ballast shoulder (500mm in place of 350mm) required on the outer side of curves. Thus, additions in the width on this account will be 150mm for single line .

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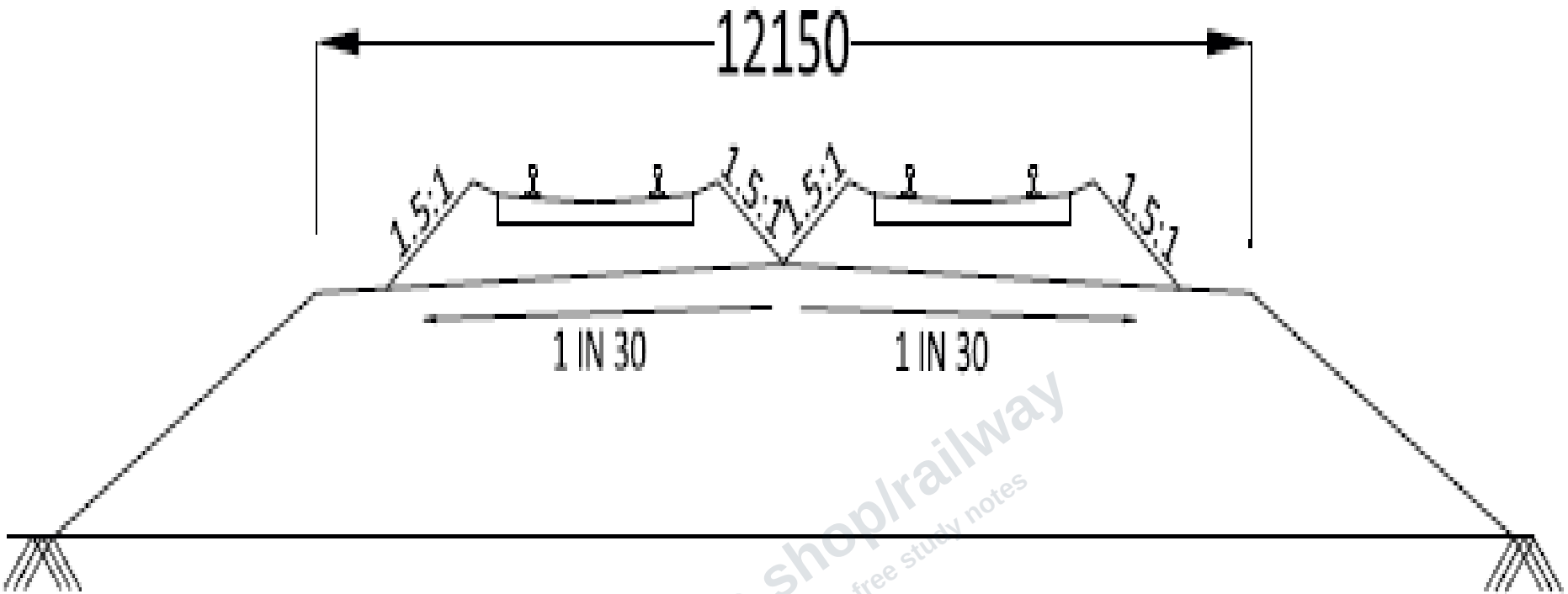
As per SOD Formation width for Double line straight track (ACS 26)

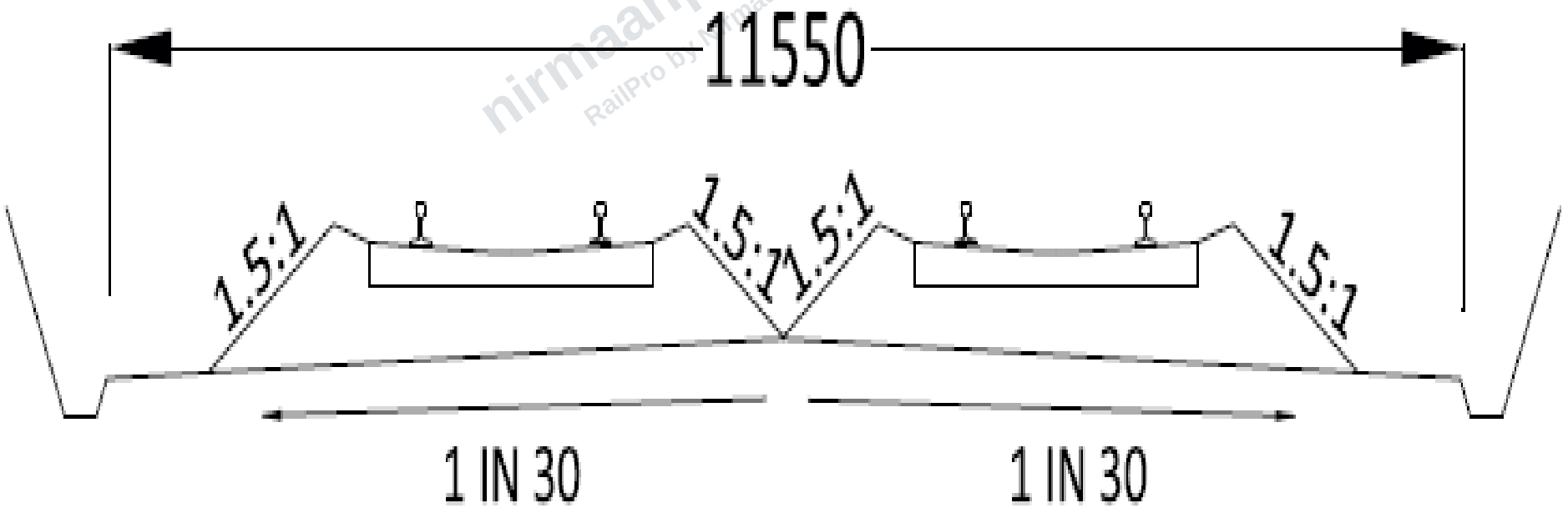
Straight Track	Minimum width
In Embankment	12150 mm
In Cutting excluding side drains	11550 mm

On curves, the actual width to be provided should take into account 150mm extra widening of ballast shoulder (500mm in place of 350mm) required on the outer side of curves. Thus, additions in the width on this account will be 300mm for double line .

Due to requirement of extra clearances on double line on curves, increase in track centres with corresponding increase in formation width would be necessary to take into account the effect of super elevation.

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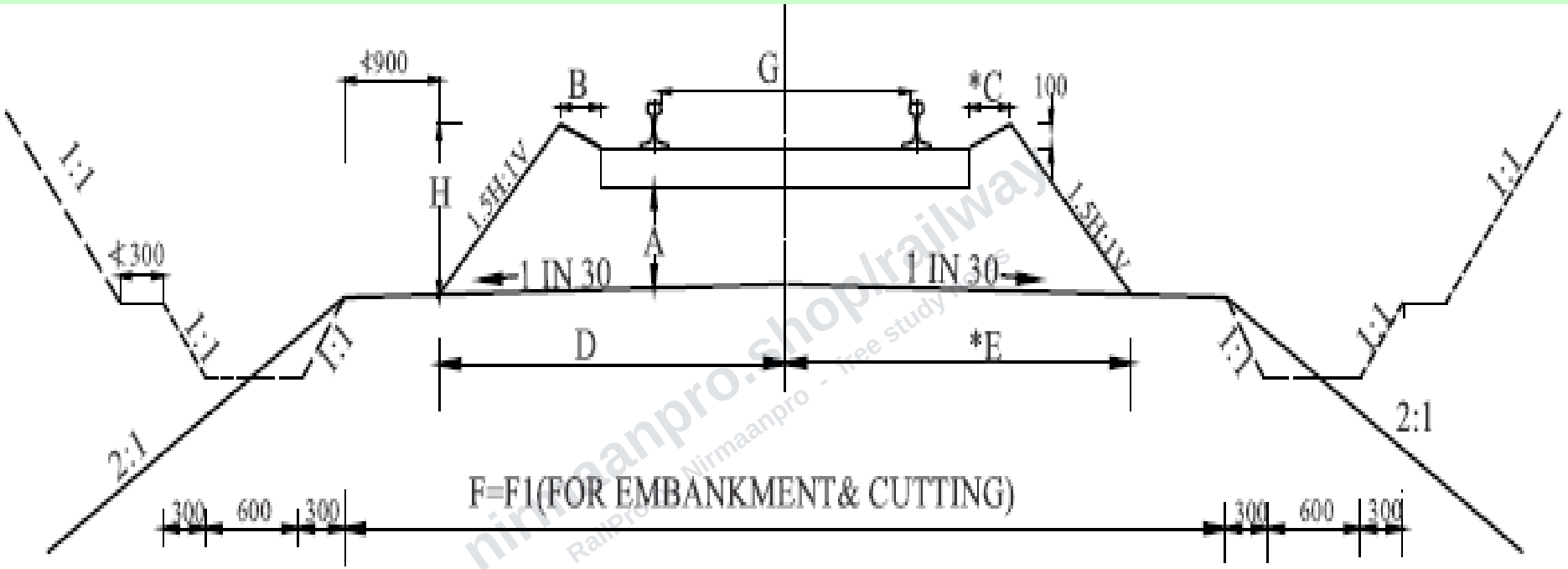
As per SOD Formation width for single line straight track for new works / alterations to existing works (ACS 26)

Straight Track	Minimum width
In Embankment	7850 mm
In Cutting excluding side drains	7850 mm

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Formation width in embankment and cutting for straight and curved track as per LWR manual is 7.85 Mts for single line



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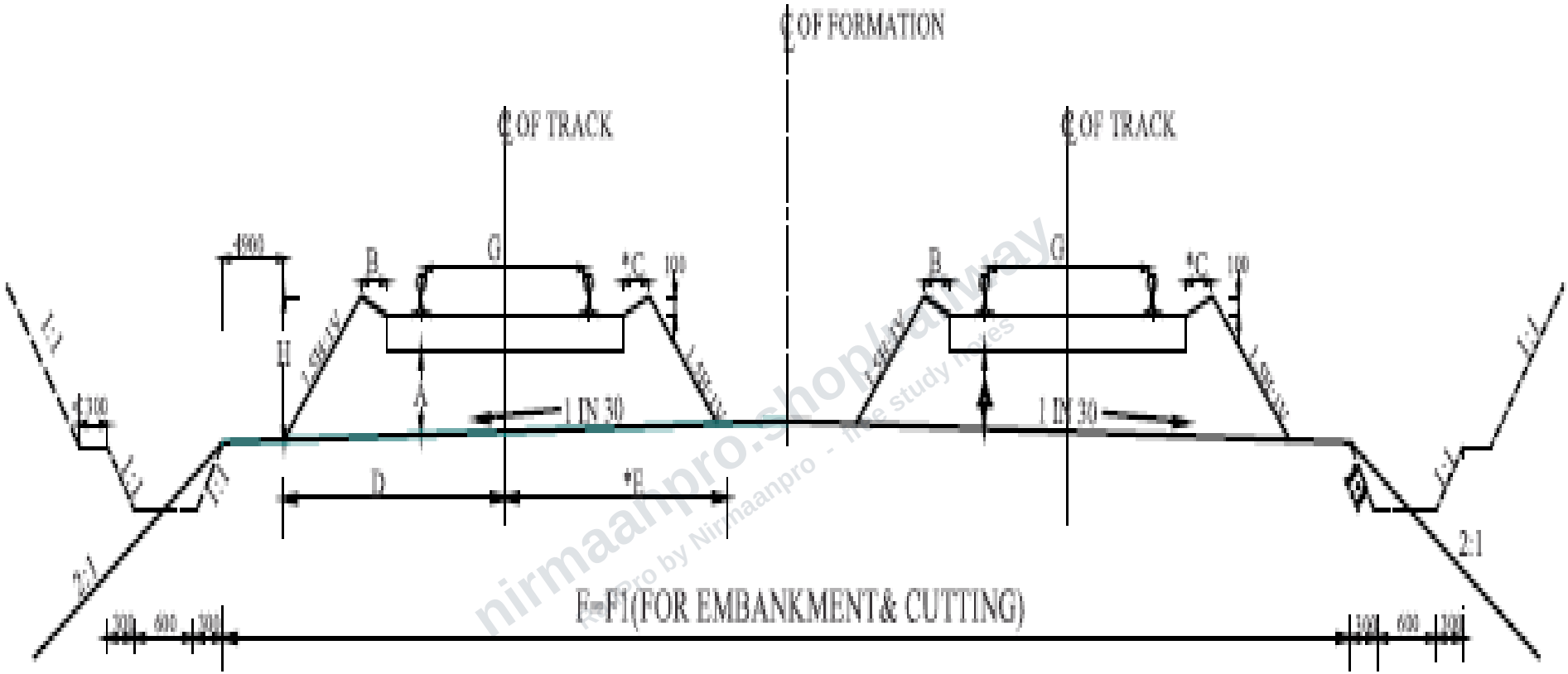
As per SOD Formation width for double line straight track for new works / alterations to existing works (ACS 26)

Straight Track	Minimum width
In Embankment	13160 mm
In Cutting excluding side drains	13160 mm

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Formation width in embankment and cutting for straight and curved track as per LWR manual is 13.16 Mts for double line



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Item no 19: As per SOD Gauge on straight and curves and IRPWM para no 520(3) for On new lines and on lines where complete renewal or through sleeper renewal is carried

Location	Permitted gauge
Straight including on curves up to 350 mts radius	-5mm to +3mm i.e 1671mm to 1679mm
On Curves of radius less than 350 m	Upto +10mm i.e. 1686mm

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As per Para 525(1) IRPWM Gauge on straight and curves in floating condition

Location	Maintenance tolerances of gauge
On Straight	-6mm to +6mm i.e 1670mm to 1682mm
On Curves of radius 440 mts or more	-6mm to +15mm i.e. 1670mm to 1691mm
On Curves of radius less than 440 mts	+20mm i.e. 1696mm

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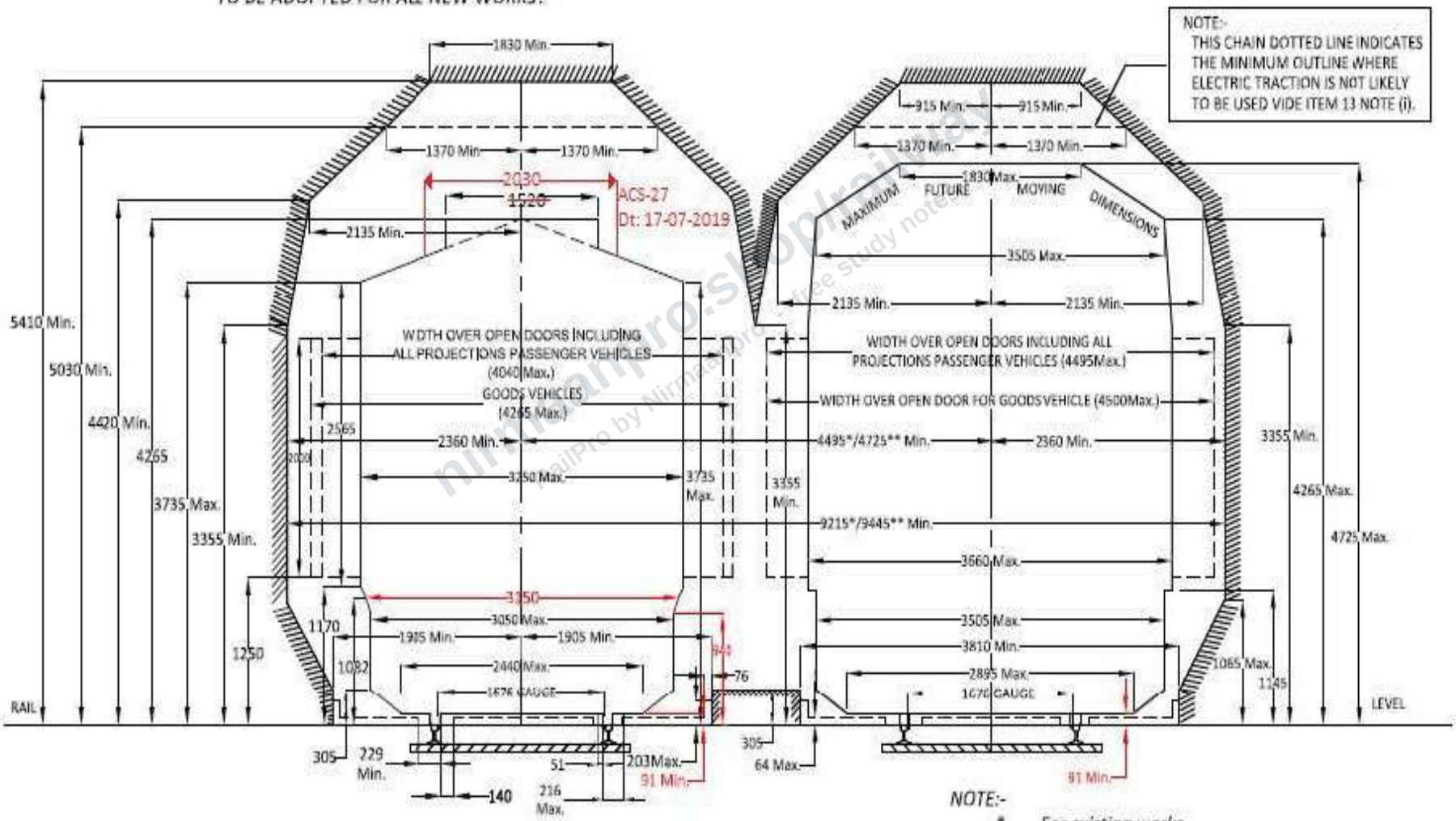
STANDARD DIMENSIONS FOR TUNNELS & THROUGH GIRDER BRIDGES
SCHEDULE I - CHAPTER I

DIAGRAM No. 1A
1676mm GAUGE

NOTE:-

1. *WHERE THE LINE IS ON A CURVE ,THE HORIZONTAL DISTANCE OF ANY STRUCTURE FROM THE CENTRE OF ADJACENT TRACK AND THE DISTANCE BETWEEN CENTRES OF TRACKS ARE TO BE INCREASED ACCORDING TO THE APPENDIX.*

2. *WHEN RE-SPACING EXISTING LINES,THE MINIMUM DISTANCE CENTRE TO CENTRE OF TRACKS MAY BE REDUCED FROM 4725 TO NOT LESS THAN 4495 FOR THE PURPOSE OF AVOIDING HEAVY ALTERATIONS TO TUNNELS OR THROUGH GIRDER BRIDGES. THE 4725 DIMENSION IS TO BE ADOPTED FOR ALL NEW WORKS.*



NOTE:- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

NOTE:-

* - *For existing works*

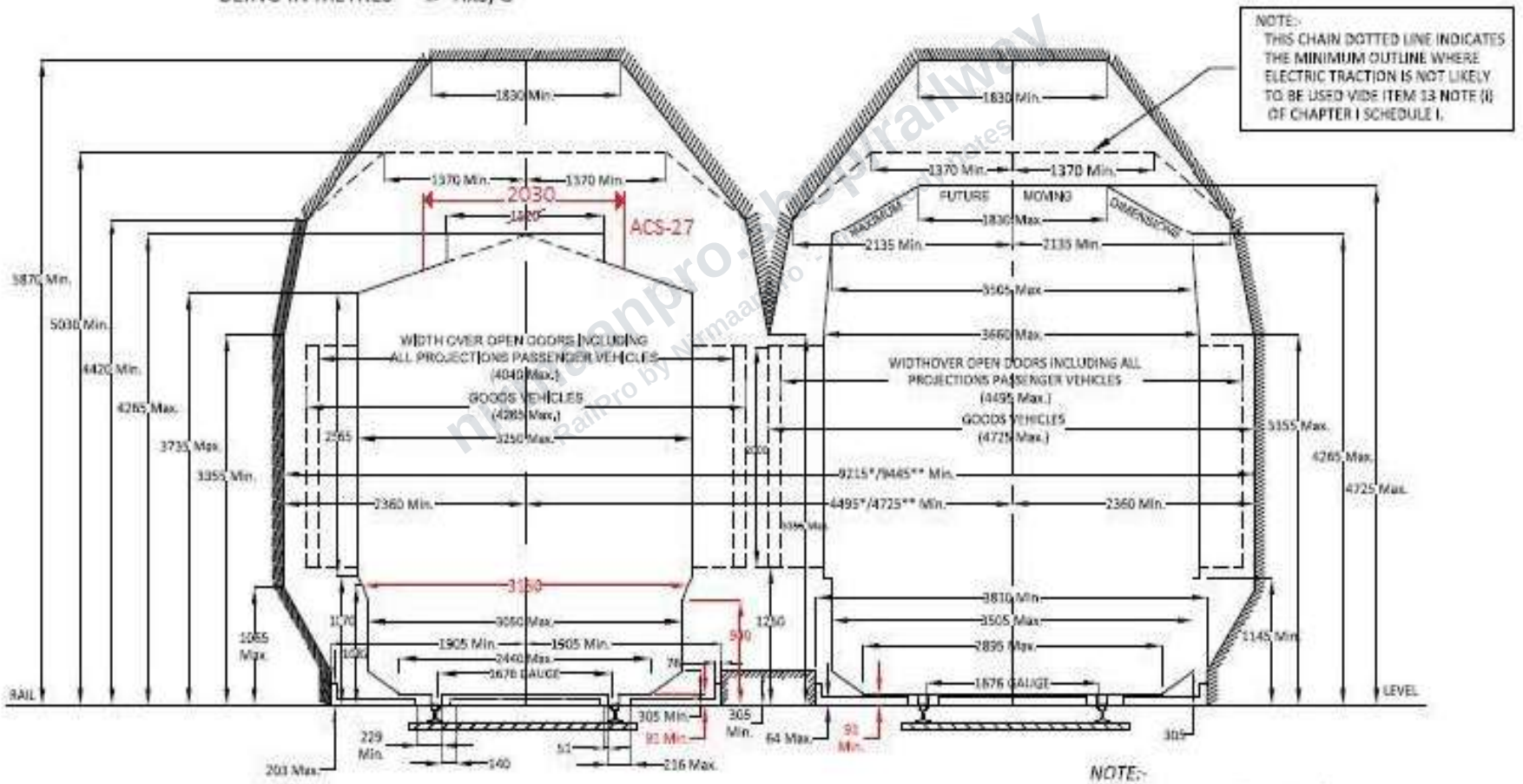
** - *For new works or alteration to existing works*

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DIAGRAM No. 1A (MODIFIED)
1676 mm GAUGE

STANDARD DIMENSIONS FOR TUNNELS & THROUGH GIRDER BRIDGES
TO SUIT 25 k.V. A.C. TRACTION SCHEDULE I CHAPTER I

NOTE:- THE DISTANCES SPECIFIED APPLY ONLY IN CASE OF STRAIGHT TRACKS.ON CURVES, THE HORIZONTAL DISTANCE SHOULD BE INCREASED BY AN AMOUNT 'D' TO ALLOW FOR THE LEAN DUE TO SUPER-ELEVATION CALCULATED BY THE FOLLOWING FORMULA, WHERE 'H' IS THE HEIGHT OF THE CONTACT WIRE, 'S' THE SUPER- ELEVATION AND 'G' THE GAUGE OF THE TRACK, ALL DIMENSIONS BEING IN METRES D=HxS/G



NOTE:-
* - For existing works
** - For new works or alteration to existing works

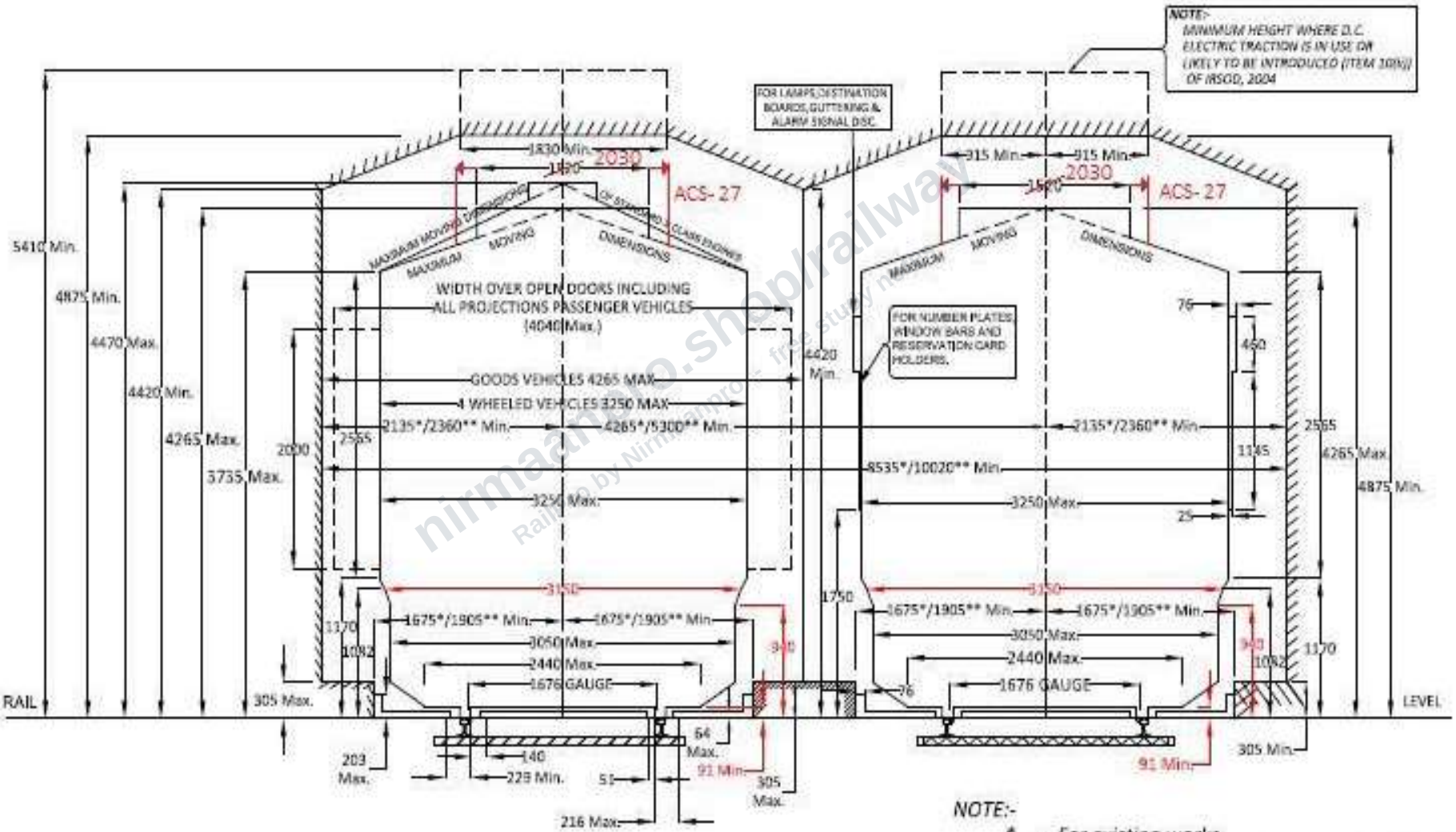
NOTE:- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

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STANDARD DIMENSIONS OUT OF STATIONS
SCHEDULE I - CHAPTER I

DIAGRAM No. 1B
1676 mm GAUGE

NOTE:- *WHERE THE LINE IS ON A CURVE, THE HORIZONTAL DISTANCE OF ANY STRUCTURE FROM THE CENTRE OF ADJACENT TRACK AND THE DISTANCE BETWEEN CENTRES OF TRACKS ARE TO BE INCREASED ACCORDING TO THE APPENDIX.*



NOTE:- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

NOTE:-
* - *For existing works*
** - *For new works or alteration to existing works*

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SCHEDULE OF DIMENSIONS

Schedule 1

Chapter 3

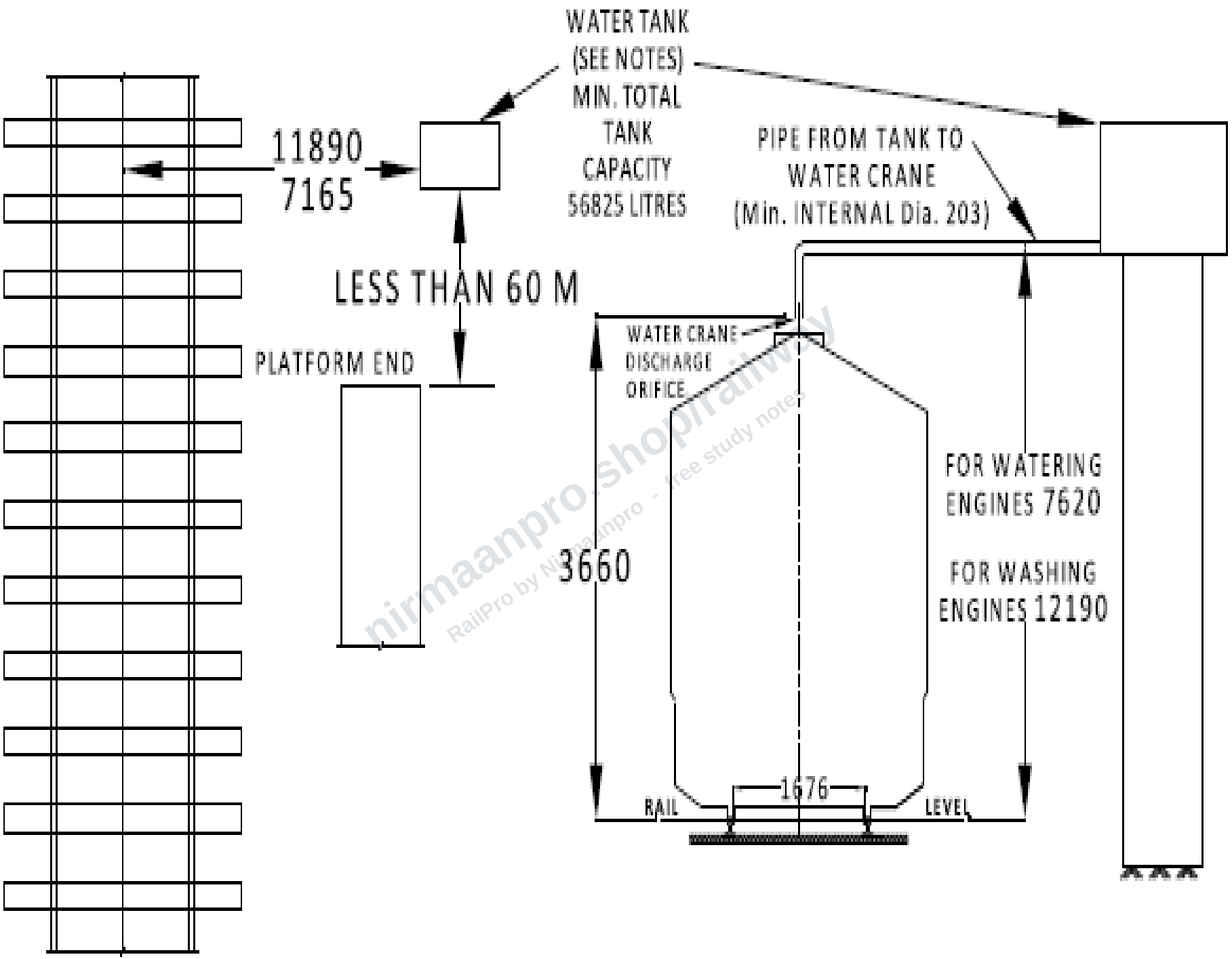
Workshops and Station Machinery

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- **Water tanks and water cranes**

Item description	Minimum
Minimum height for bottom of tank above rail level at water column FOR WATERING ENGINES	7620 mm
Minimum height for bottom of tank above rail level at water column FOR WASHING ENGINES	12190 mm
Minimum total tank capacity at any station	56.5 cu metres or 56825 liters
Minimum internal diameter for piping from tank to water crane	203 mm

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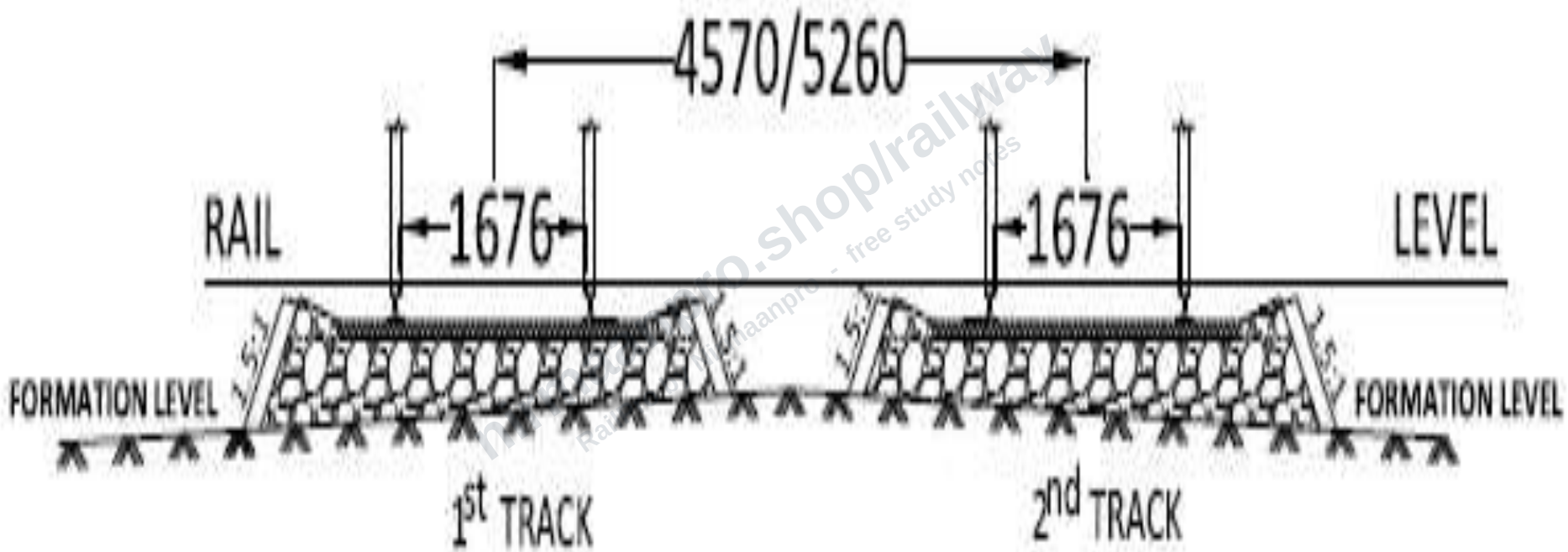
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- Item no 2: Workshops and running sheds
- Minimum distance from centre to centre of tracks

For Works	Horizontal distance from centre to centre of track
For existing works	4570 mm
For new works/additions to existing works In workshops	4570 mm
For new works/additions to existing works In running sheds	5620 mm

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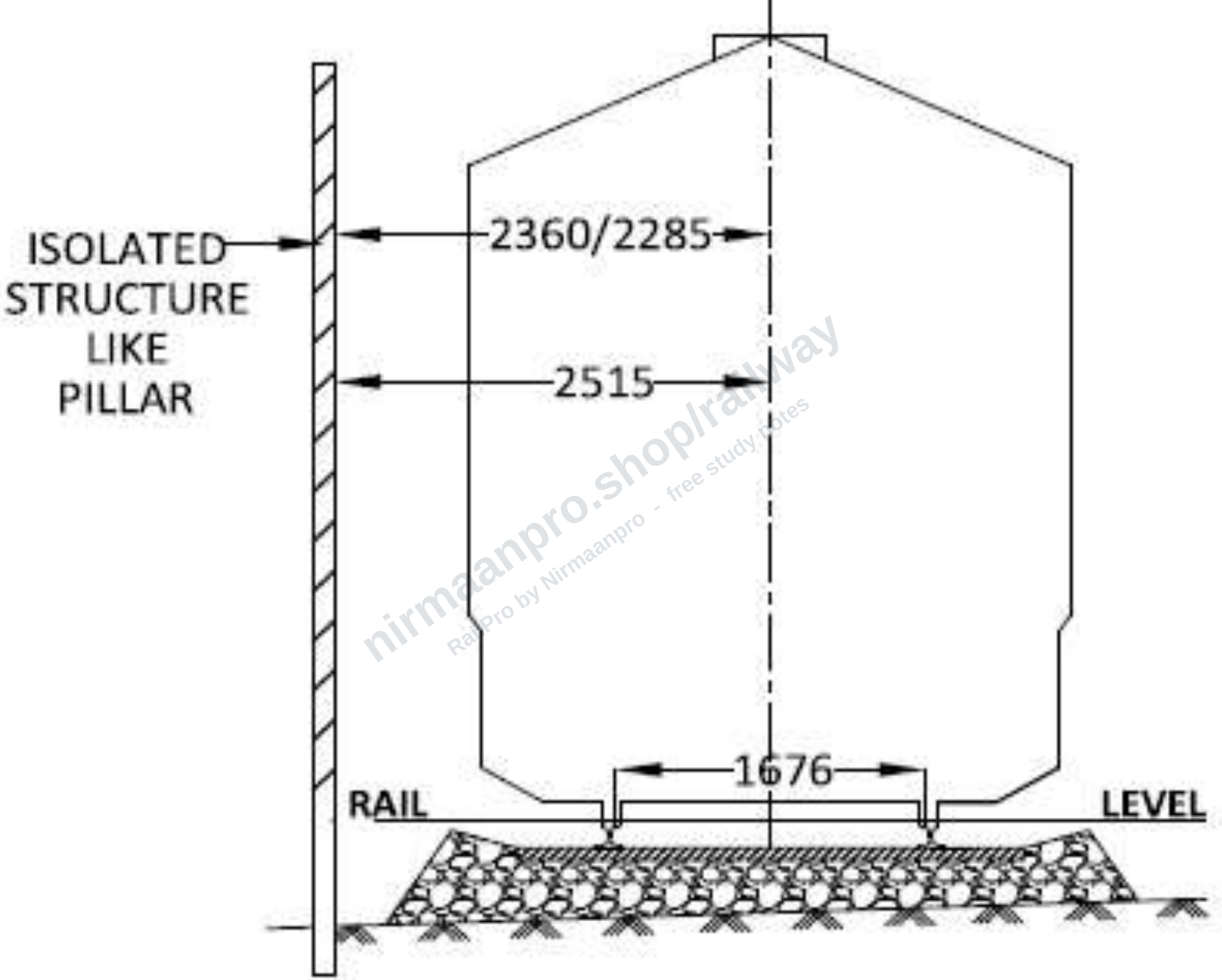
Note :
Where there is a structure between tracks, the distance of centre to centre of tracks is to be increased by the amount of the width of the structure like O.H.E. post *etc.*


4570/5260
RAIL
1676
1676
LEVEL
FORMATION LEVEL
FORMATION LEVEL
1st TRACK
2nd TRACK

- Item no 3: Workshops and running sheds
- Minimum clear distance from centre of track to any isolated structure such as a pillar in :

Item description	Horizontal distance from centre of track
In workshops existing works	2285 mm
In workshops new works/additions to existing works	2360 mm
In running sheds	2515 mm

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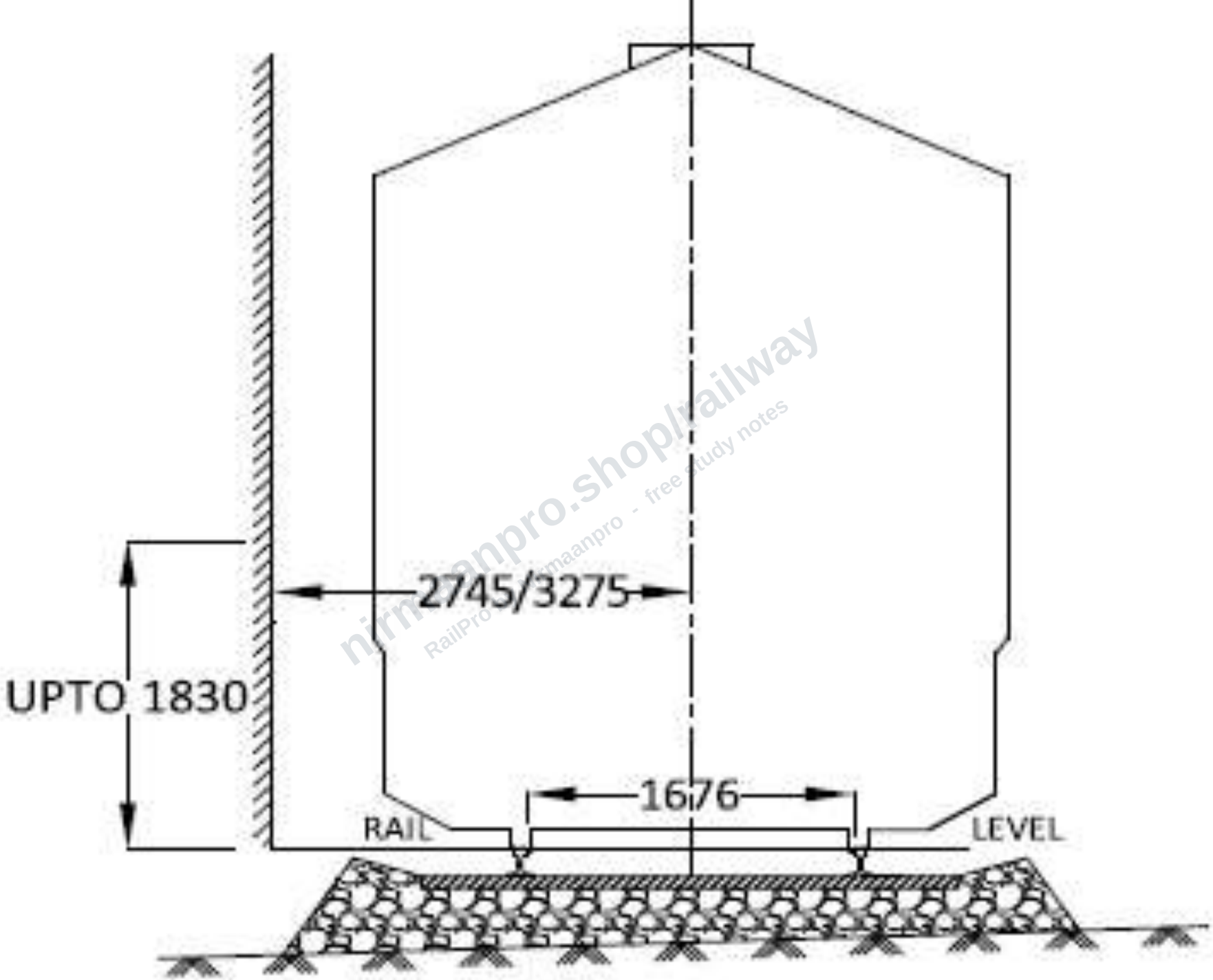


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- Item no 4: Workshops and running sheds
- Minimum clear distance, for a height of 1830mm above rail level, from centre of track to any continuous structure in

Item description	Horizontal distance from centre of track
In workshops	2745 mm
In running sheds	3275 mm
In running sheds for standard 'C' Railways	2745 mm

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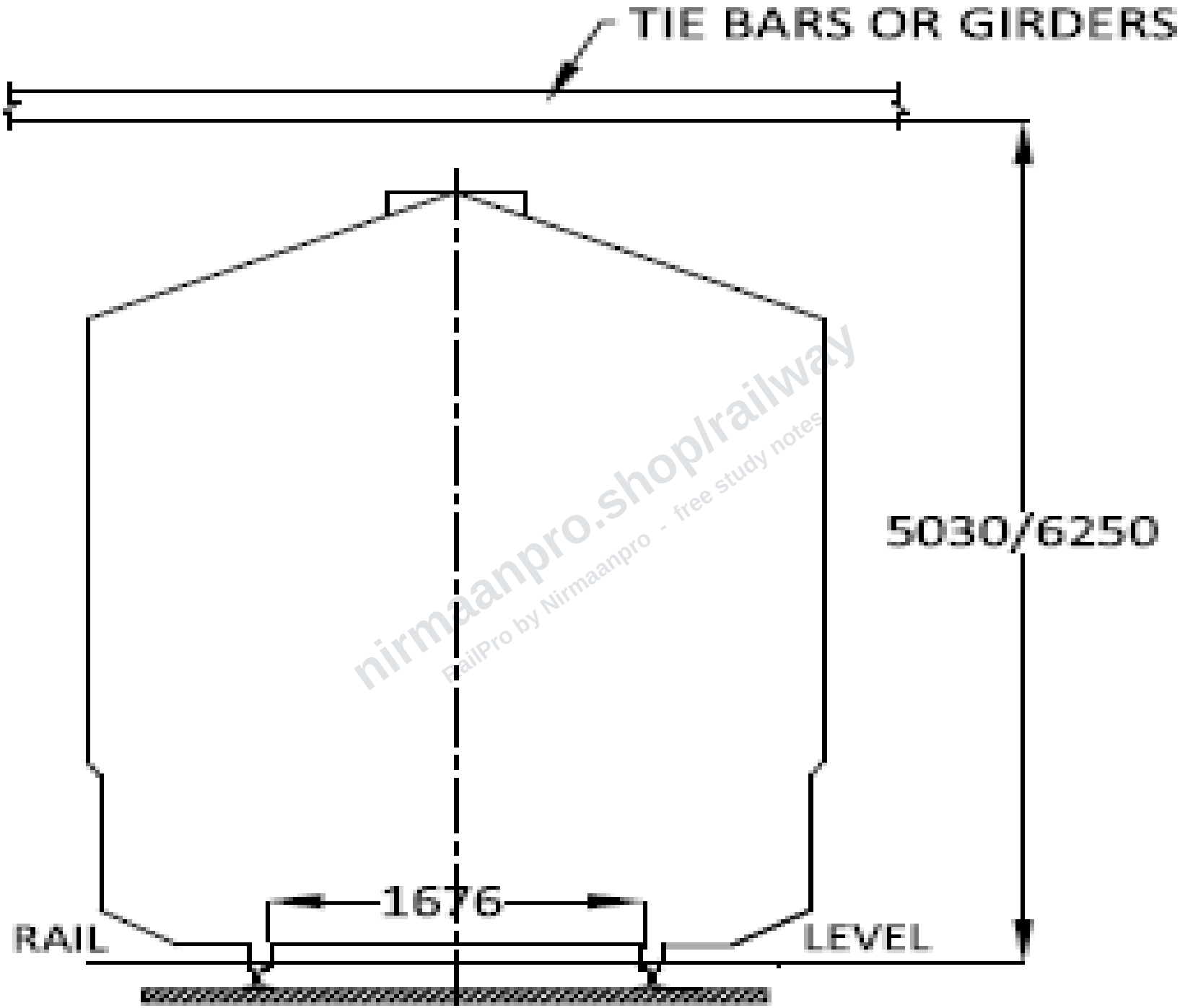


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- Item no 5: Workshops and running sheds
- Minimum height above rail level to overhead tie bars, girders etc. in workshops and running sheds

Item description	Vertical height above rail level
Where electric traction is not likely to be used	5030 mm
Where electric traction is likely to be used	6250 mm

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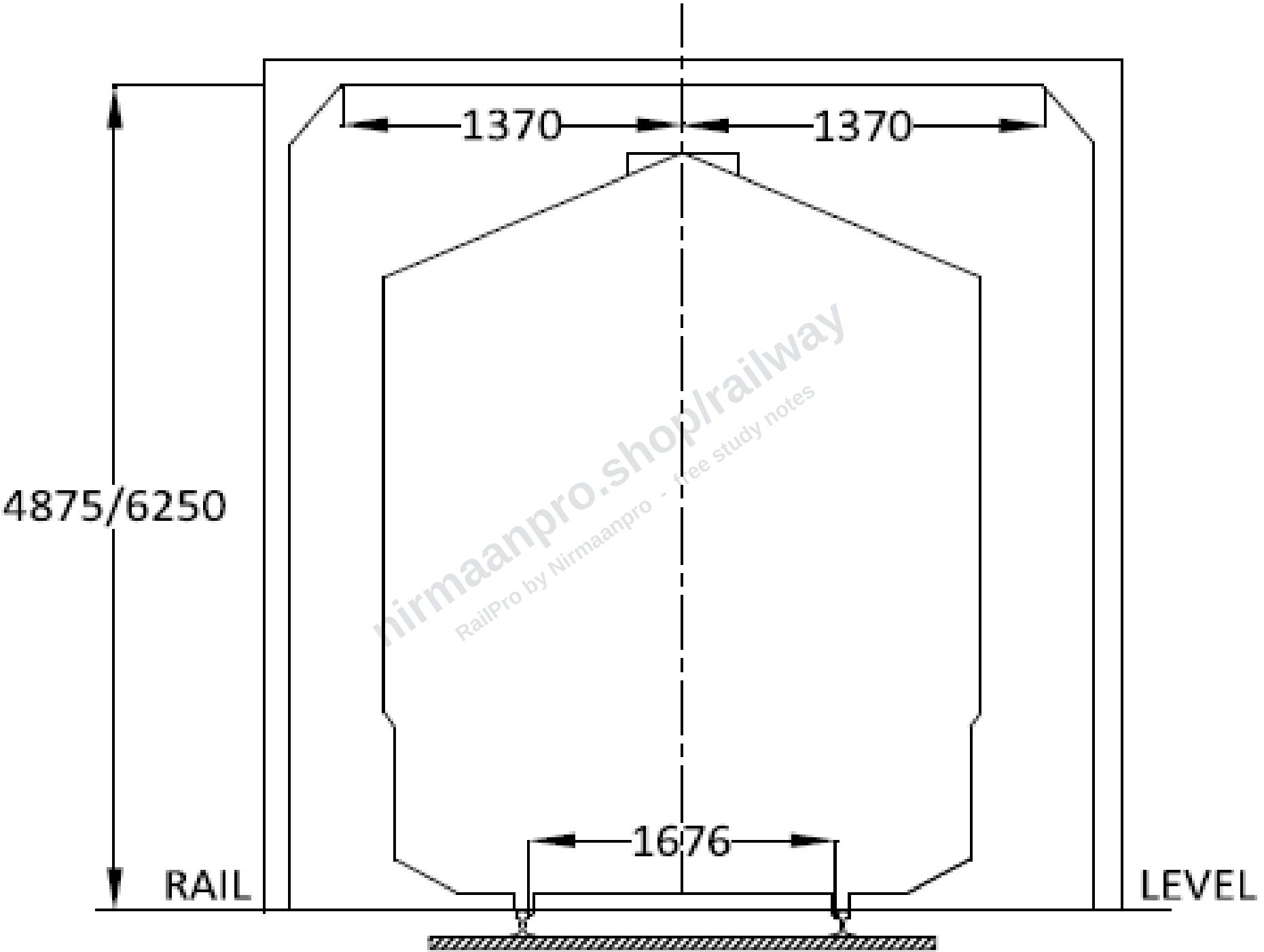


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- Item no 6: Workshops and running sheds
- Minimum height above rail level of doorways for a width of 1370mm on either side of centre of track in both workshops and running sheds :

Item description	Vertical height above rail level
Where electric traction is not likely to be used	4875 mm
Where electric traction is likely to be used	6250 mm

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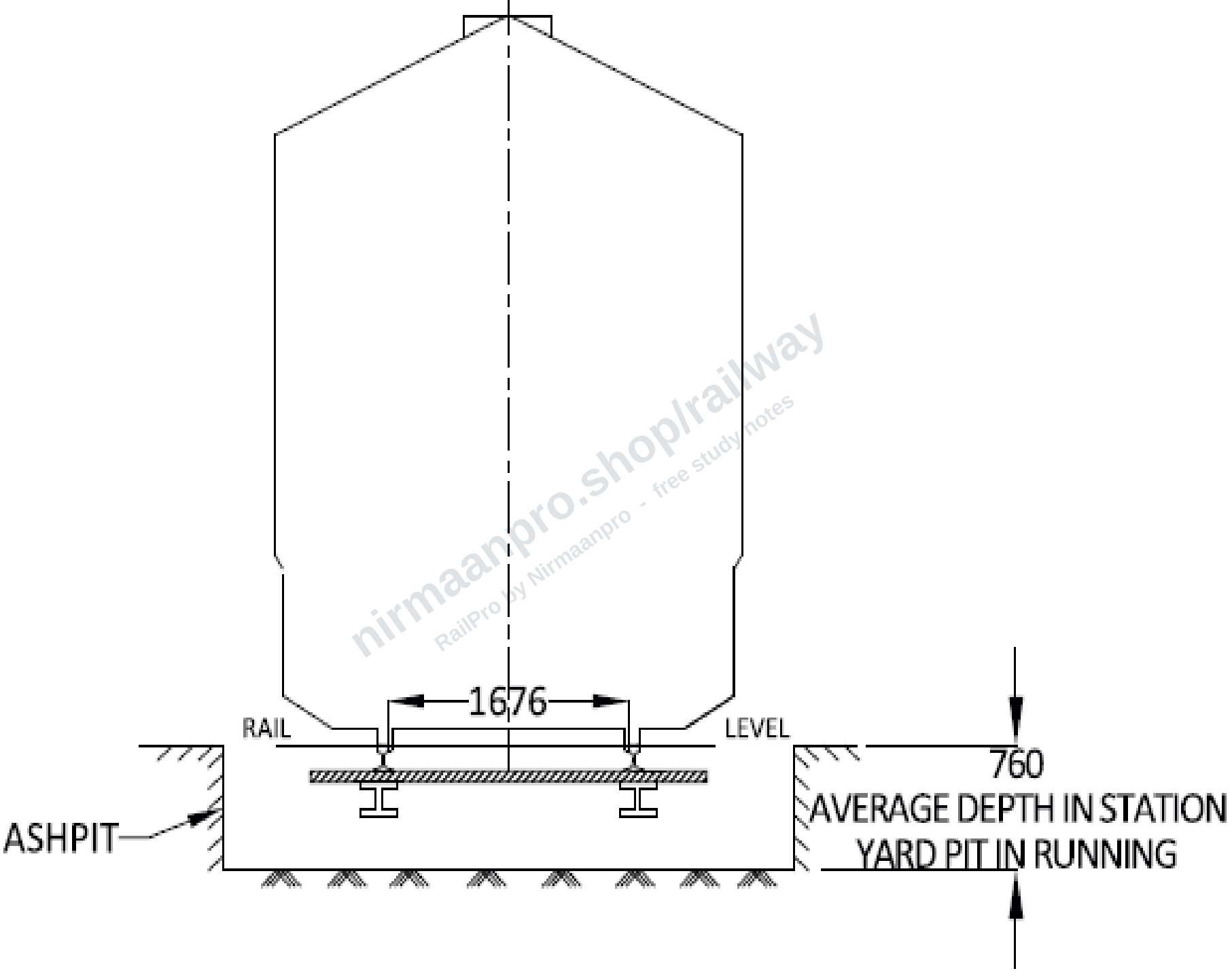


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- **Item no 7: Workshops and running sheds Ash pits etc**

Item description	Vertical height below rail level
Average depth for ash pits in station yards, pits in running sheds and carriage examination pits	760 mm
Provision of Ash pits on run through lines should, if possible, be avoided	

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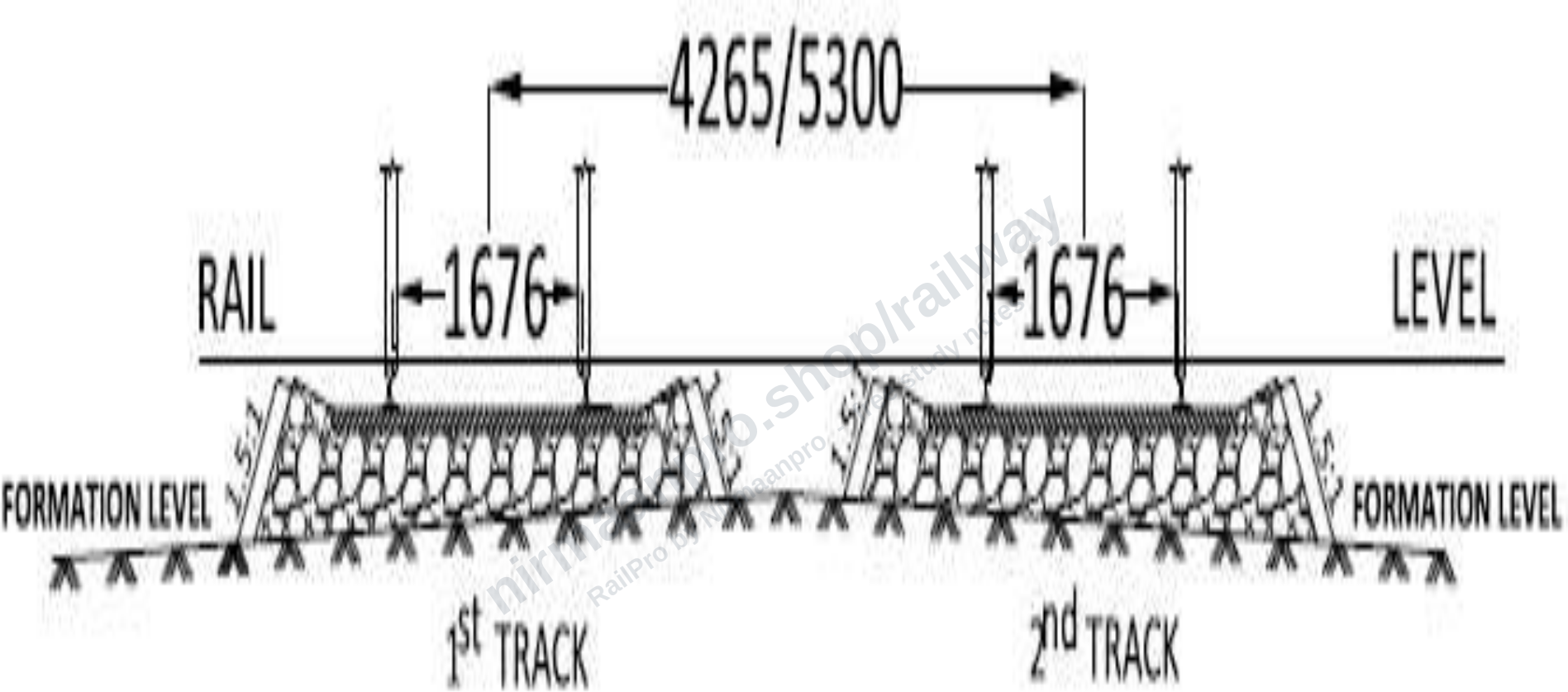
SCHEDULE OF DIMENSIONS
Schedule 1
Chapter 2 Station yard

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Item no 1: Spacing of tracks (ACS 27).

Minimum distance centre to centre of tracks	Distance in mm
For Existing works	4265 mm
For new works or alterations to existing works	5300 mm

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- Extra clearances required on curves to be added.
- For spacing up to 5300mm extra clearances up to 5° has been accounted and for more than 5°are to be calculated and accounted.
- In case of New/signal mast are required to be provided in between tracks under unavoidable circumstances the clearance of 5300 mm shall be increased by equal to the width of such provisions/structures/foundations as the case may be.
- In case of tunnels, ROB, flyovers, through and semi through girder bridges where centre to centre distance between tracks is lesser than 5300 mm has been provided, lesser centre to centre distance can be provided on approaches also up to adequate distance to facilitate gradual increase in centre to centre distance up to 5300 mm.

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- For new works / additions to existing works in existing yard such as conversion of existing loop lines into main lines etc, if the stipulations of 5300 mm are not achieved due to field constraints, then minimum horizontal distances from center of track to any structure shall be ensured i.e; 2360mm on straight and curves up to 875 mts radius and 2510 mm for curves less than 875 mts after making full efforts it is not possible to provide 2575 mm on straight and curves up to 875 mts and 2725 mm for curves less than 875 mts.
- In completely new yard or portion of existing yard where New work is being done independent of existing yard 5300 mm c/c distance to be ensured.

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- **Para 2 of chapter 2 (ACS 16) Maximum steepest gradient in station yard unless special safety devices are adopted and or special rules enforced to prevent accidents in accordance with approved instructions**

For works	Gradient
For new works and alteration to existing works • Recommended • Maximum (steepest)	 1 in 1200 (0.083%) 1 in 400 (0.25%)
For existing works	1 in 400 (0.25%)

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- Recommended dimension are good practice but not to be treated as standards any deviation in above requires sanction.
- In case after making efforts for recommended gradient of 1 in 1200 in yard as flat as possible reasons for deviation from recommended gradient and up to max steepest gradient 1 in 400 shall be recorded on the ESP. For new yards and new projects adoption yard gradient steeper than 1 in 1200 will require approval of GM before finalizing ESP.(ACS29)
- No station yard shall be constructed nor shall any siding shall join a passenger line on a grade steeper than ~~1 in 260~~ 1 in 100 (0.10%) (ACS 27) except it is unavoidable and then also only with providing slip siding or other arrangement is made sufficient to prevent accidents and prior sanction from railway board through CRS is received.
- Wherever 1 in 100 (0.10%) gradient mentioned to be read as 1 in 100 (1.0%) (ACS 28)

The power of condonation for gradient steeper than specified (ACS 27) For existing yards

Gradient	Authority
Steeper than 1 in 400(0.25%) and up to 1 in 100(1.0%)	C.R.S.
Steeper than 1in 100 (1.0%)	Railway Board through C.C.R.S.

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The power of condonation for gradient steeper than specified (ACS 27) FOR New line yard in new line projects

Gradient	Authority
Steeper than 1 in 400(0.25%) and up to 1 in 260(0.38%)	C.R.S.
Steeper than 1in 260 (0.38%)	Railway Board through C.C.R.S.

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Station yard will be taken to extend as (ACS 17)

Line	Extended up-to
On single line	50 Mts beyond stock rail joint of outer most points on either end of station
On double line with 2 aspect	From home signal to a distance of 50 Mts beyond stock rail joint of outer most points at the trailing end or where there are no loops to last stop signal of each line
On double line with multiple aspect signaling	50 Mts beyond stock rail joint of outer most points on either end of station or where there are no loops from block section limit board to last stop signal of each line

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Note :

1. There shall be no change of grades within 30 mts of P&C.
2. ~~Provisions shall also apply to all flag and halt stations in case of new lines projects (ACS No 17).~~
3. In case of new line projects the provisions shall also apply to all flag and halt stations or class “C” stations. This is to keep provision for conversion of flag , halt or class “C” stations into class “A” or “ B” station in future.(ACS 27)
4. For other than New line projects the above provision are not applicable for Flag station, Halt station or class “C” station.

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Item no 3, 4 & 6: Platform

- Horizontal distance from centre of track to face of passenger platform and goods platform coping

  Maximum: 1680 mm

  Maximum: 1670 mm
- Note : The coping of passenger platform must be so constructed that when necessary, to allow for introduction of wider stock, it can be easily and expeditiously set back to 1905mm. from centre of track.
- Extra clearances on curves to be ensured.

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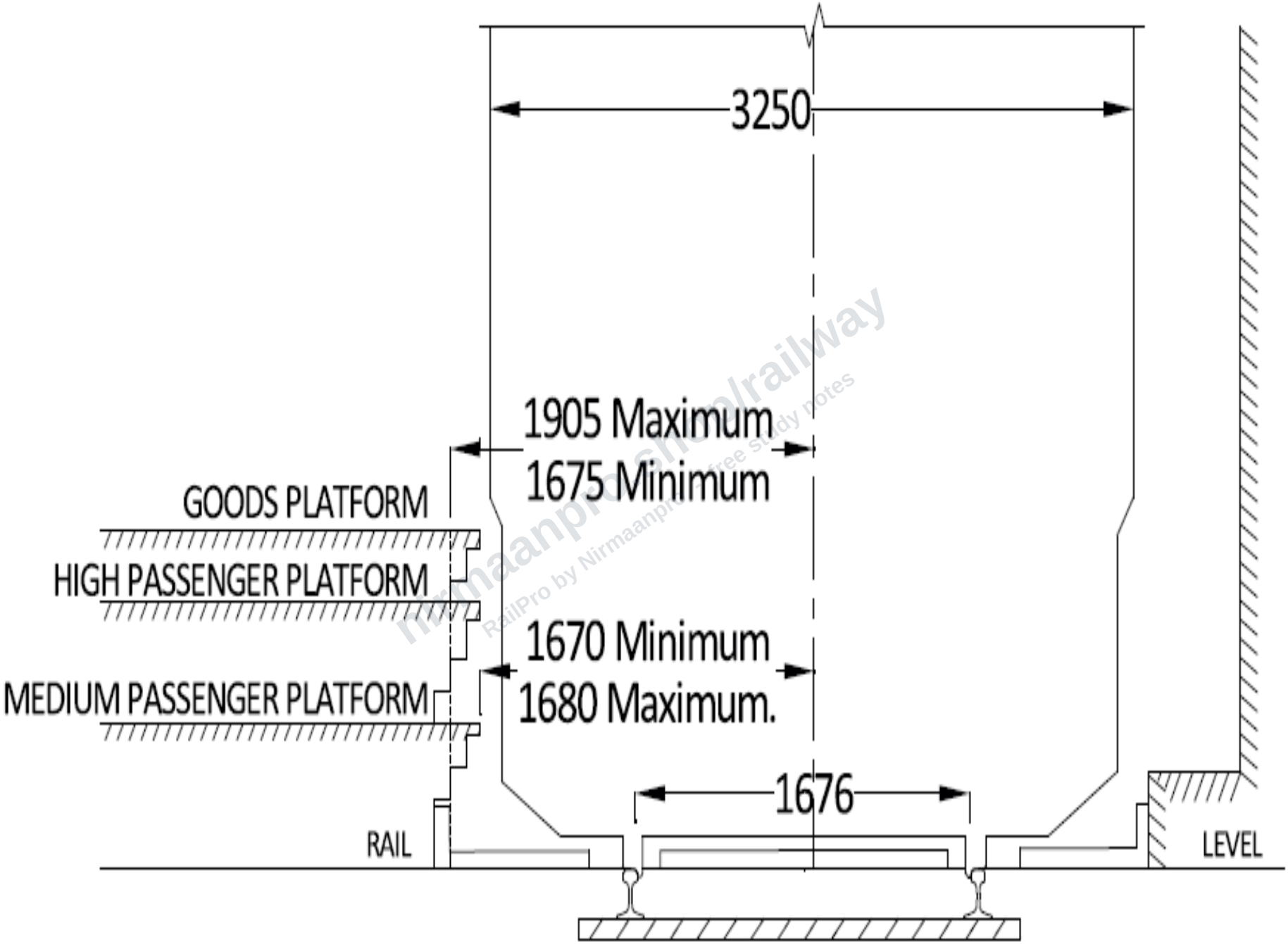
Platform

- Horizontal distance from centre of track to face of any platform wall.

  Maximum 1905mm

  Minimum 1675mm
- <u>Note:</u> New platform walls should be built to maximum dimensions and the coping corbelled out to 1675mm unless provision is made to allow for the introduction of wider rolling stock either by slewing the platform track out by 230mm or by moving the platform wall 230mm further from the track.
- Extra clearances on curves to be ensured.

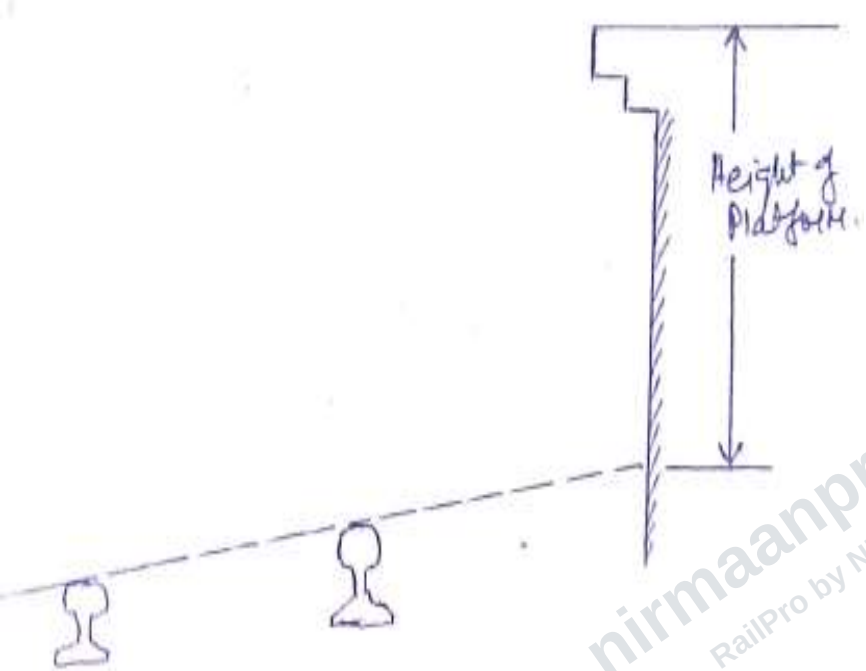
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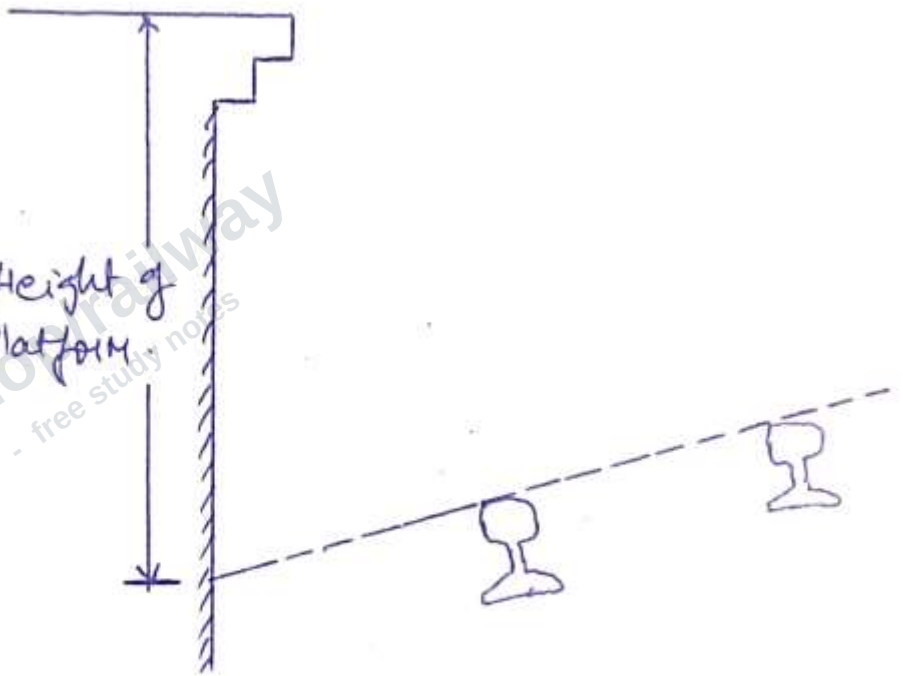
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Platform	Height above RL
High passenger platform	Max 840 mm Min 760 mm
Medium level passenger PF	455 mm
Goods platform (Except end and horse loading)	1065 mm

- End of PF shall be ramped to slope 1 in 6 for a width not less than 1 mts from face of PF wall and rest can be ramped to same slope or fenced.
- Height of PF in canted track should be measured vertically from the face to a plane passing through the top of both the rails.
- End loading platforms and on sidings exclusively for horse loading shall be raised by 1295mm above Rail level.
- Signal wires or supports may be permitted to pass



Platform on outside of Curve.

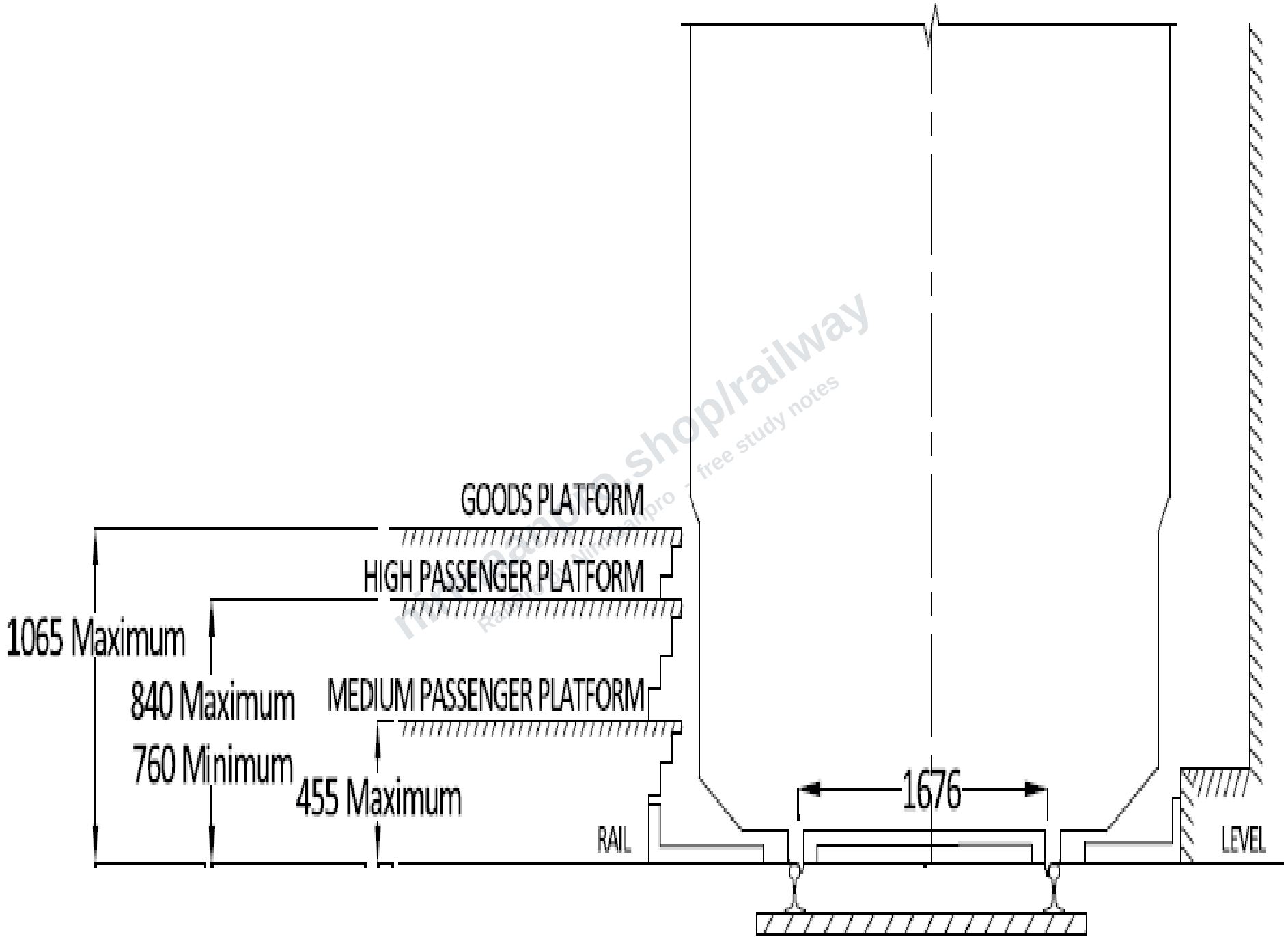


Platform on Inside of Curve.

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Platform	Height above RL
Mumbai sub urban passenger platform	Max 900 mm – Min 840 mm

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Platform in curves	Minimum Radius of curve
Minimum radius of curve in new line having passenger platform	875 Mts (Maximum 2°)

- No passenger platform in case of new line would be constructed on a curve having radius less than 875mts (less than 2◦).
- Construction of new platform on existing line or addition/alteration to existing platform or in gauge conversations/doubling works where new platforms are constructed or old dismantled and reconstructed efforts shall be made out to ease out the curve with radius less than 875mts. However for these works having platforms are located/to be located on curves less than 875mts no condo nation by CRS/Board would be necessary.

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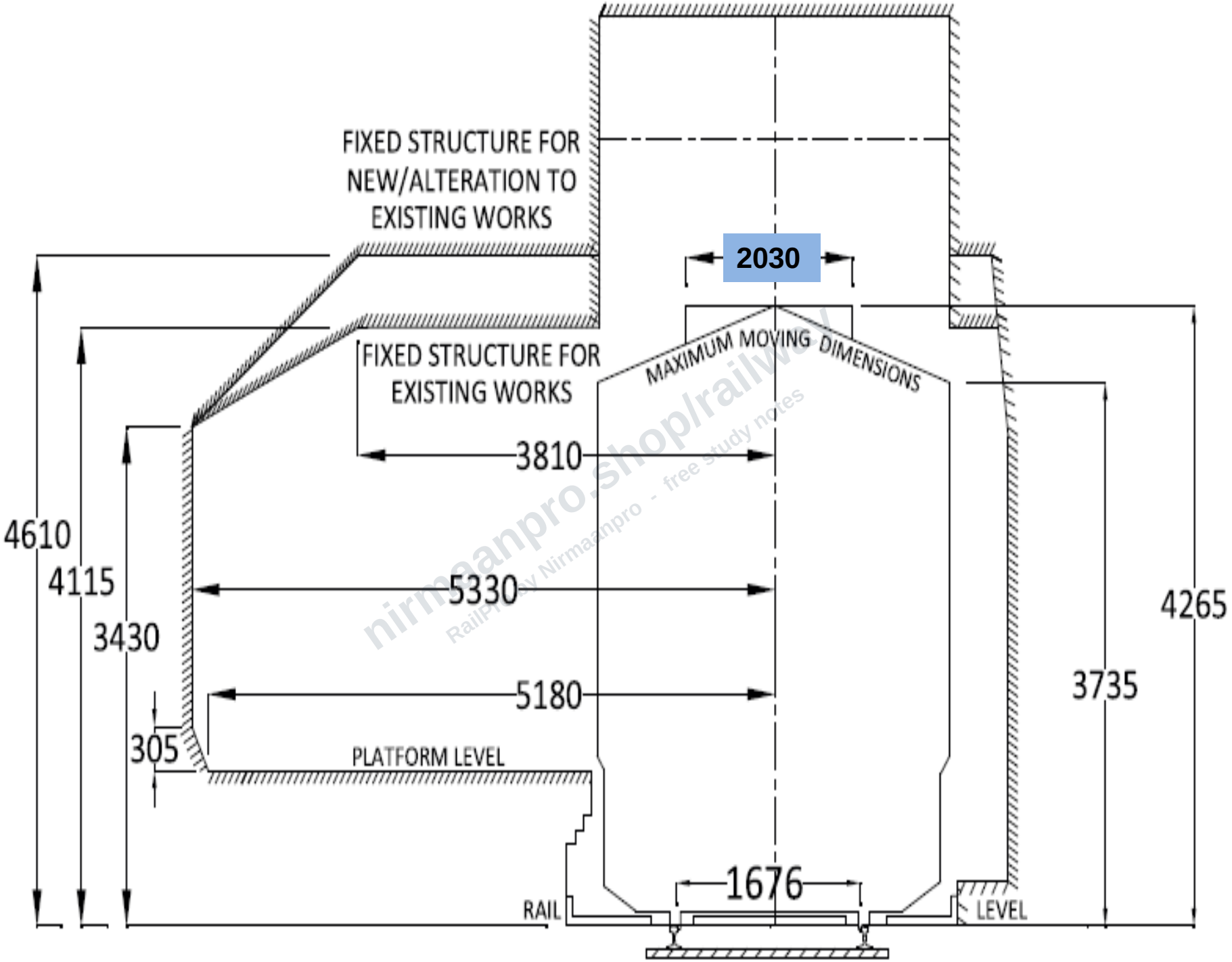
Length of passenger Platform	Minimum Length
Minimum Length of passenger platform	Length of longest passenger train excluding engine booked to stop at the platform

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- **Item No 7(a) Minimum Horizontal distance of any building on a passenger platform from center of track.**

Height of the structure	Horizontal Distance
1. From P/F level to 305 mm above P/F level	5180mm increasing uniform to 5330mm
2. From 305mm above P/F level to 3430mm above RL	5330mm
3. From 3430 to 4115mm above RL for existing work	5330mm decreasing uniformly to 3810mm
4.From 3430 to 4610mm above RL for new work/alterations to existing works	5330mm decreasing uniformly to 3810mm

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- For return end of platform fencing the dimensions may be reduced to 2740mm.
- In Mumbai sub-urban areas when it is not possible to provide as per 1,2,3,4 above the dimensions can be reduced by CRS for construction of new FOB on case to case basis subject to as

Height of the structure	Horizontal Distance
From platform level to 3430mm above rail level	4115 mm
From 3430mm above rail level to 4610mm aboverail level	4115 mm decreasing uniformly to 3810 mm

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1. From 3430mmabove RL to 4610 above RL is 4115mm decreasing uniformly to 3810mm.
2. The supporting column of FOB deck and landing on Platform shall be designed in such a way that there is no lateral bracing between two columns up to a height of 2440mm from PF level to allow free movement of passengers.
3. The FOB and as well as PF surface covering all members of FOB having clearance less than 5330 from center line of track to 2440mm above rail level shall be painted with red and yellow strips to alert the passengers.
5. No temporary or permanent structure, no stabling of hand trolley shall be permitted in this zone.

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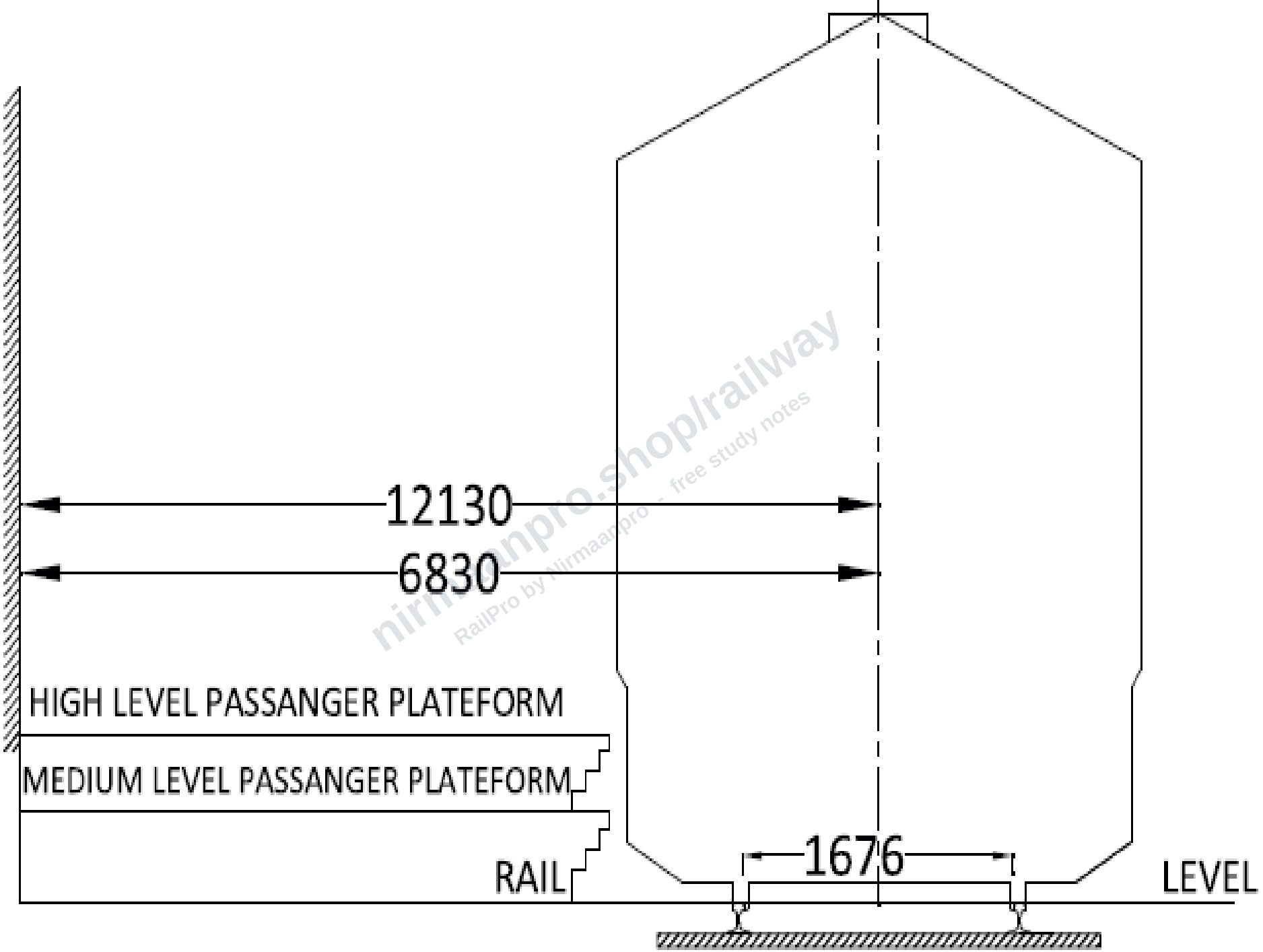
6. This area shall be well illuminated during night.
7. No slewing of track towards PF shall be permitted in the FOB zone.
8. In any case the width of landing shall be not more than 50% of PF width.

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Item No 7(b) Minimum horizontal distance of any building or longitudinal boundary fence from the centre line of track of passenger platform which is not an island platform For new works alterations to existing works (ACS 24)

For new works or alterations to existing works	
Minimum	6830 mm
Recommended	12130 mm

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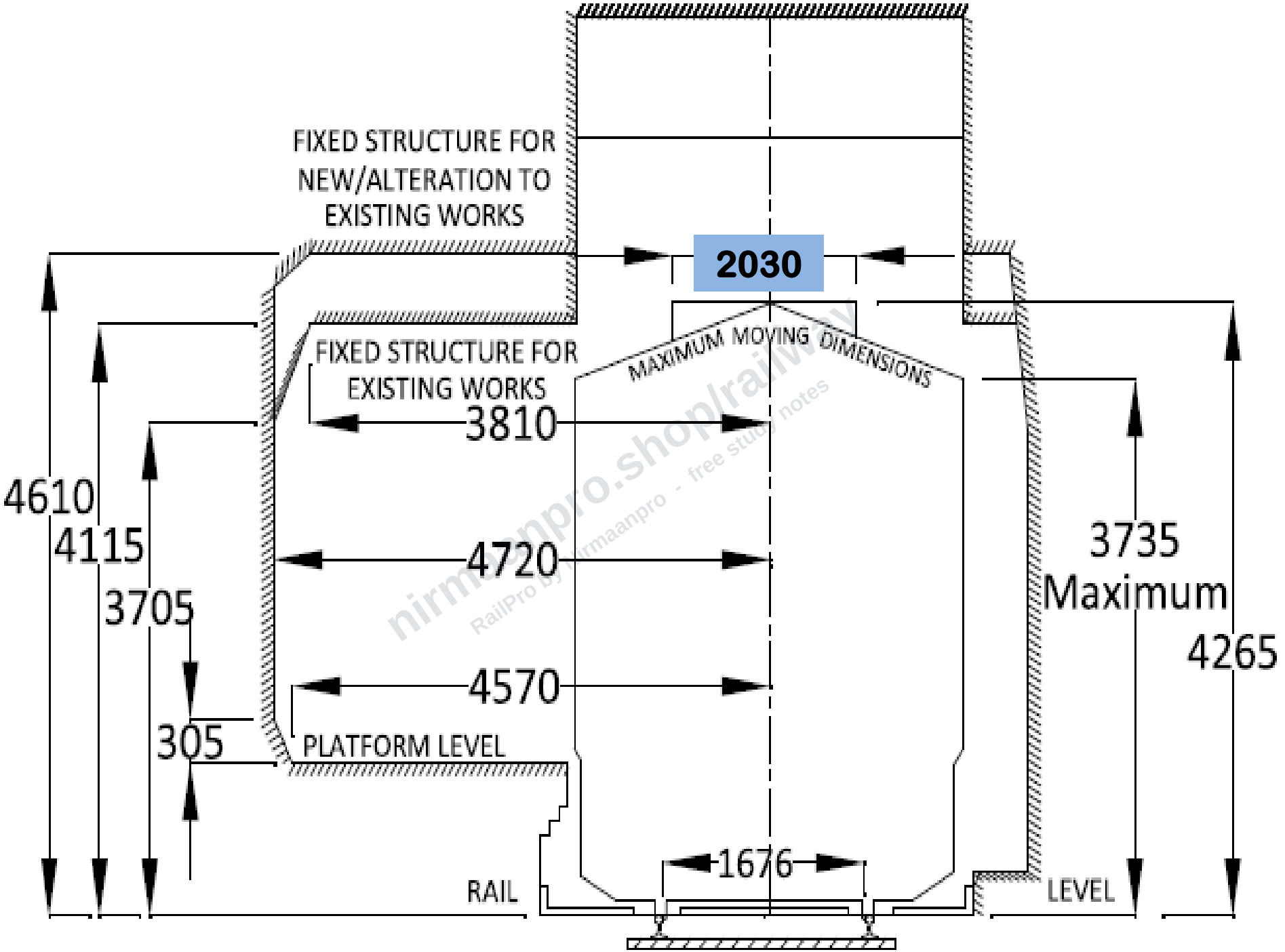
- Note.
- 1. Recommended distance allows for setting back the platform to make room for an additional track in future, without infringing minimum distance
- 2. Above distances should also apply to buildings and isolated structures not readily removable, erected on ground over which it is anticipated that a platform may be extended in future.
- 3. Minimum horizontal distance may be reduced to 5330mm in case of **foot over bridge at any station and/or provision of longitudinal boundary fence at D, E and F category** stations; subject to stipulation that if any **other pucca construction of** building/structure is done in future, provisions of above shall be followed
- **4. In Mumbai suburban section, for construction of new foot over bridge on the platform,** dimensions can be reduced by CRS on case to case basis

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- **Item no 8: Minimum horizontal distance from center line of track to a pillar, column, lamp of similar isolated structure on a passenger platform or any building on a goods platform. (< 3716 cm² in plan is called as column or pillar)**

Height	Horizontal Distance
From platform level to 305mm above platform level	4570mm increasing uniformly to 4720mm
From 305mm above platform level to 3705mm above rail level	4720mm
From 3705mm above RL to 4115mm above RL for existing works	4720mm decreasing uniformly to 3810mm
From 3705mm above RL to 4610mm above RL for new works or alteration to existing works	4720mm decreasing uniformly to 3810mm

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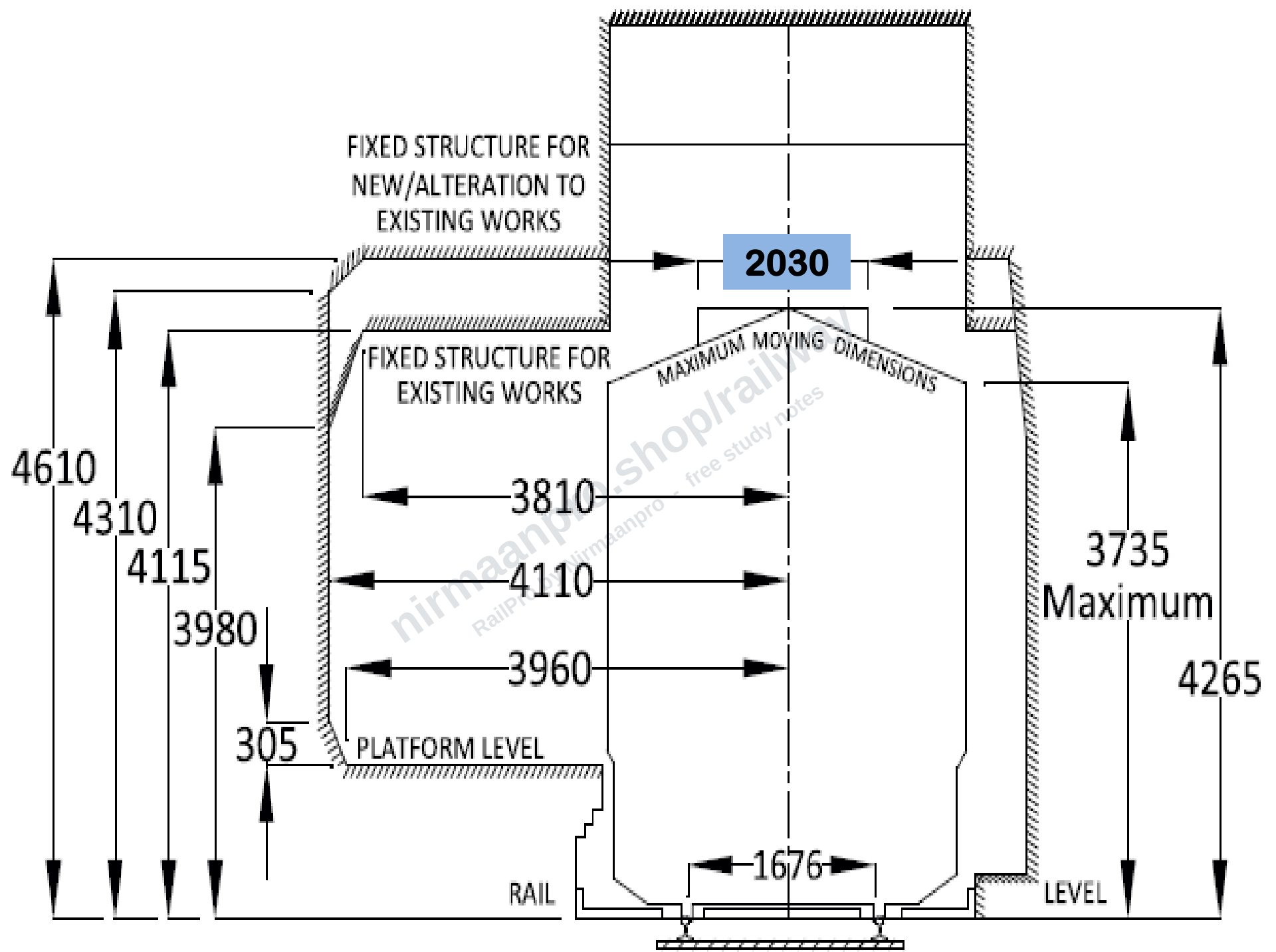


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- **Item no 8(A) Minimum horizontal distance from center line of track to a pillar, column, lamp of similar isolated structure on a goods platform. (< 3716 cm² in plan is called as column)**

Height	Horizontal Distance
From PF Level to 305mm above PF level	3960mm increasing uniformly to 4110mm
From 305mm above PF level to 4310mm above rail level	4110mm
From 3980mm above RL to 4115mm above RL for existing works	4110mm decreasing uniformly to 3810mm
From 4310mm above RL to 4610 mm above RL in case of new works and alterations to existing works	4110mm decreasing uniformly to 3810mm

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- **Item no 9: Height of overhead structures above rail level in a passenger platform**

Height	Minimum Height
Of tie rods or any continuous covering	
For a width of 1600 mm on either side of centre of track	6250 mm
For a width of 1370 mm on either side of centre of track on lines other than main lines where 25 KV AC electric traction is not likely to be used or the existing primary lines which are not likely to be electrified	6100 mm

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- Note.
- Does not apply to overhead piping parallel to track.
- A low roof that infringes i.e; less than 6250mm in height is permissible in the case of goods or transhipment shed on siding, provided it does not infringe the out line of the figure 1B Oof SOD for the minimum fixed structure.
- Extra vertical clearances of 275mm under overhead structures and overhead equipment in electrified section or proposed to be electrified on 25KV AC shall be provided to allow for any raising of track to permit modern track structure i.e; to cater increased ballast cushion, larger sleeper thickness and increased rail sections by using longer traction masts.

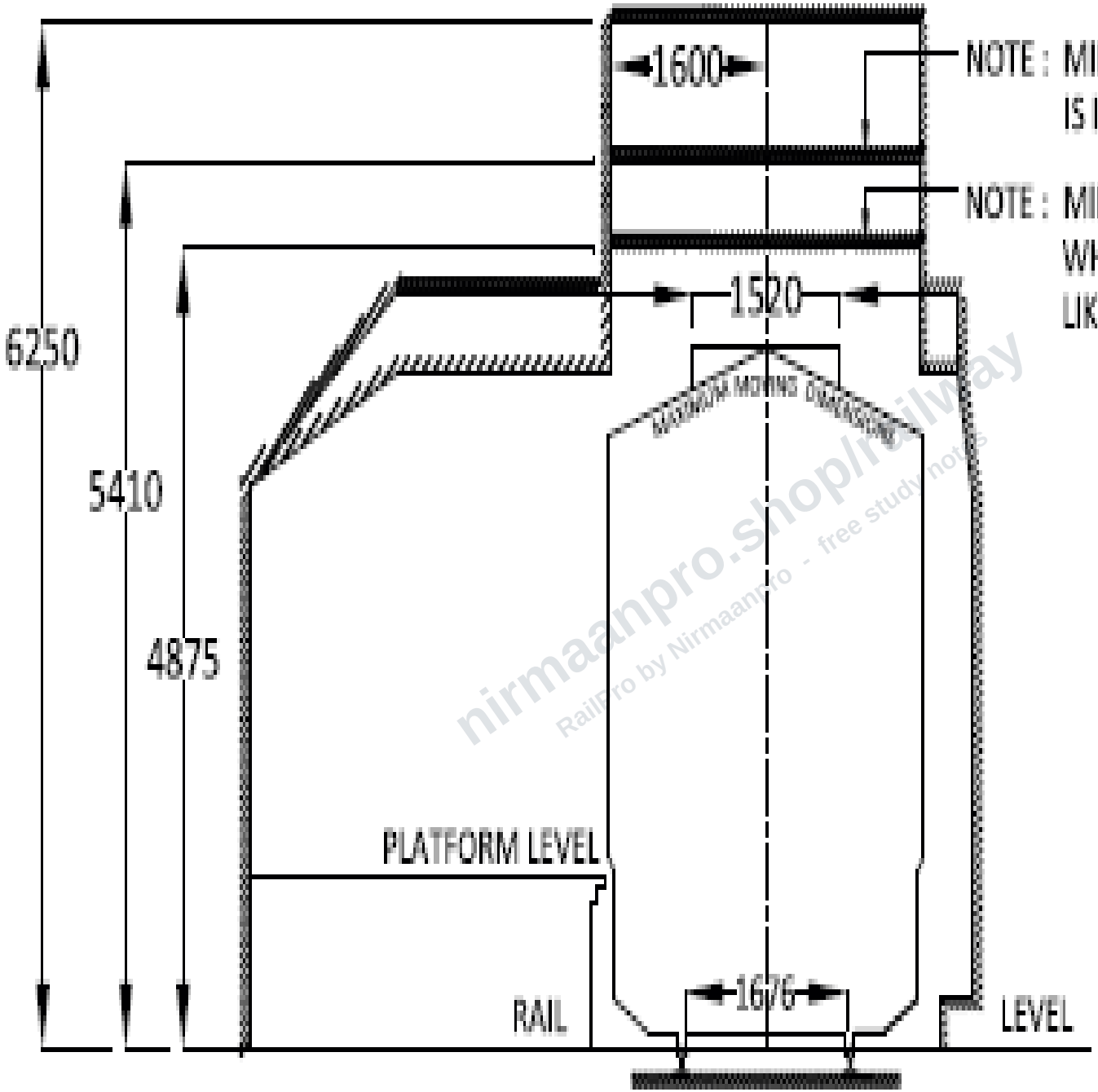
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- **Item no 10: Height of overhead structures of signal gantry or FOB above rail level**

Height	Minimum Height
Height above rail level for a width of 1600 mm on either side of centre of track in a passenger platform	6250 mm
Height above rail level when D.C electric current is in use or likely to be used	5410 mm
Height above rail level on secondary lines, where electric traction is not likely to be introduced,	4875 mm

This (Sl no 3 above) also applies to overhead piping arrangement parallel to track wherever provided which shall be changed over to ground hydrants when section is electrified.

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- Note.
- Where 25 KV A.C. traction is used or likely to be used

1. If any turnout or crossover is located under a heavy over head structure or within 40 mts from face, irrespective of position of LC the minimum height to be maintained is 6250mm.
2. In case if turnout or crossover is beyond 40 mts away, but LC is within 520 mts from heavy over head structures the minimum height to be maintained is 6250mm.

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- **Note.**
- **On lines existing or proposed to be electrified provision shall be made in over head structure and equipment, if necessary using longer masts and equipment to permit extra allowance of 275mm for raising of track in future to cater for modern track structure in form larger ballast cushion or larger sleeper thickness or deeper rail sections.**
- **Tunnel, through girder bridge and semi-through girder bridge in station yards shall be treated as heavy overhead structures, such as ROB for electrification works and the same dimensions above shall be ensured**

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For Mumbai suburban the height of FOB can be reduced from 6250 mm to 5750mm subject to

- Minimum of contact wire is 4800mm above RL.
- Special case study shall be done to cater contact wire height as 4800mm.
- No crossover or turnout within below FOB or 40 mts from face of the FOB.
- No LC within 520 mts from FOB.
- Max height of rolling stock restricted to 4420mm.
- In curves Height should be measured from higher rail.

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- **Para 11 (A) of chapter 2 Minimum horizontal distance from centre of track to any structure for existing works**

Height above RL	Max horizontal distance from track
From RL to 305mm above RL	1675 mm
From 305 mm to 3355 mm above RL	2135 mm
From 3355 mm to 4115 mm above RL	2135 mm decreasing to 1980 mm
From 4115 mm to 6250 mm above RL	1600 mm

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- **Minimum horizontal distance from centre of track to any structure for existing works**

Description	Existing works
Below RL and upto Formation level of the track on straight and curves upto radius of 875 M	2575 mm
Below RL and upto Formation level of the track on curves upto radius less than 875 M	2725 mm

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- **The above shall not be applicable in case of bridges. Tunnels, ballast-less track(including washable apron)**

- **Note**
- Extra clearances required on curves to be ensured.
- On lines other than main lines or existing main lines, where electric traction is not likely to be introduced; the horizontal distance of 1370mm for height from 4115mm to 6100mm above rail level may be allowed to continue.
- The clearance mentioned below RL will be applicable only in new Yards including its electrification works.
- The various fixture which are attached to the track like traction bonds etc. and are required to be fitted with the rail can be provided and the clearance as mentioned below RL to FL will not be applicable to these fixtures.

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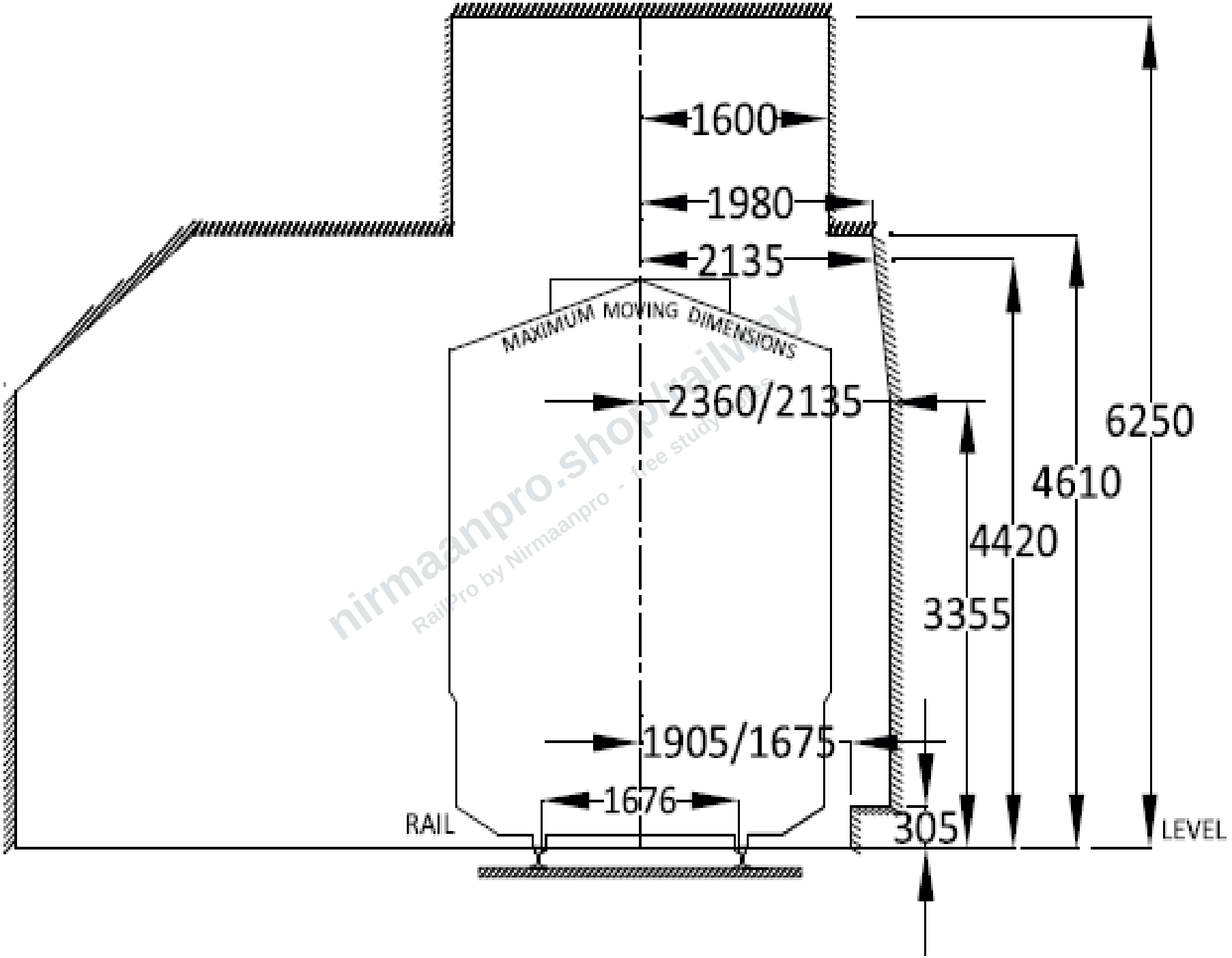
- In case of electrification works in existing yards no foundation / mast / signal post / any other structure shall be provided in between two tracks. In case it is inescapable the minimum distance from edge of foundation / mast / signal post/any other structure at and above formation level up-to rail level from centre of track, shall be 2360mm on straight track and curve having radius 875 Mts and more and 2510mm in curves having radius less than 875 Mts. after making full efforts for providing clearances of 2575mm / 2725mm, mentioned (ACS 26).s

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- **Para 11 (B) Minimum horizontal distance from centre of track to any structure for New works/alterations to existing works**

Height above RL	Horizontal distance from centre of track
From RL to 305mm above RL	1905 mm
From 305 mm to 1065 mm above RL	1905 increasing to 2360 mm
From 1065 mm to 3735mm above RL	2360 mm
From 3735 mm to 4420 mm above RL	2360 decreasing to 2135 mm
From 4420mm to 4610mm above RL	2135 decreasing to 1980 mm
From 4610mm to 6250 mm above RL	1600 mm

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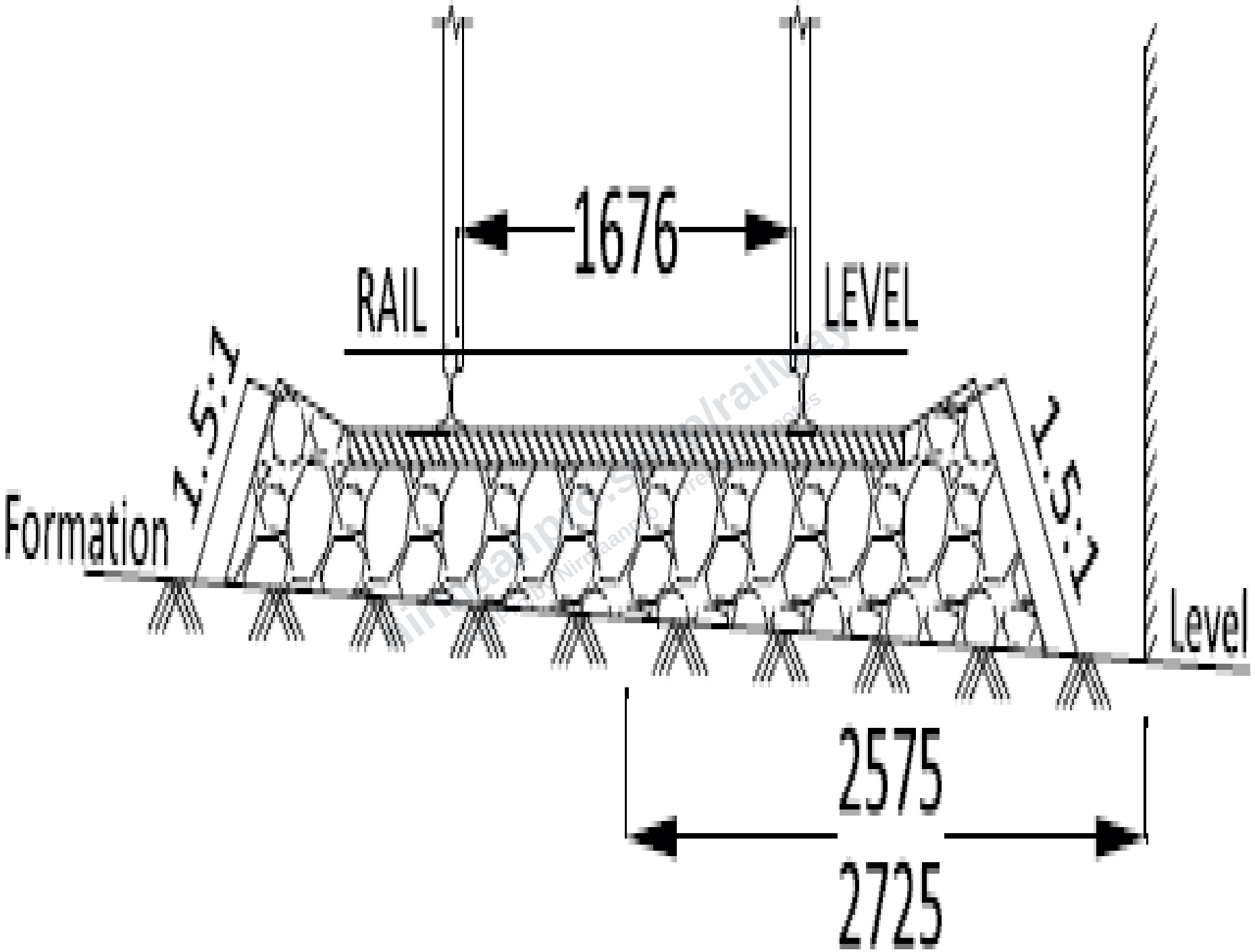
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- **Minimum horizontal distance from centre of track to any structure for New works/alterations to existing works**

Description	New works / Alterations to existing works
Below RL and upto Formation level of the track on straight and curves upto radius of 875 M	2575 mm
Below RL and upto Formation level of the track on curves upto radius less than 875 M	2725 mm

- **The clearance below RL shall not be applicable in case of bridges. Tunnels, ballast-less track (including washable apron) .**

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1676
RAIL
LEVEL
Formation
Level
2575
2725

- **Note**
- Extra clearances required on curves to be ensured.
- For addition/alteration to works in existing yard the minimum horizontal distance shall be maintained as 2360 mm on straight track and curve having radius 875 Mts and more and 2510mm in curves having radius less than 875 Mts. after making full efforts not possible for providing clearances of 2575mm / 2725mm, mentioned (ACS 26).
- The various fixture which are attached to the track like traction bonds etc. and are required to be fitted with the rail can be provided and the clearance as mentioned below RL to FL will not be applicable to these fixtures (ACS 26).

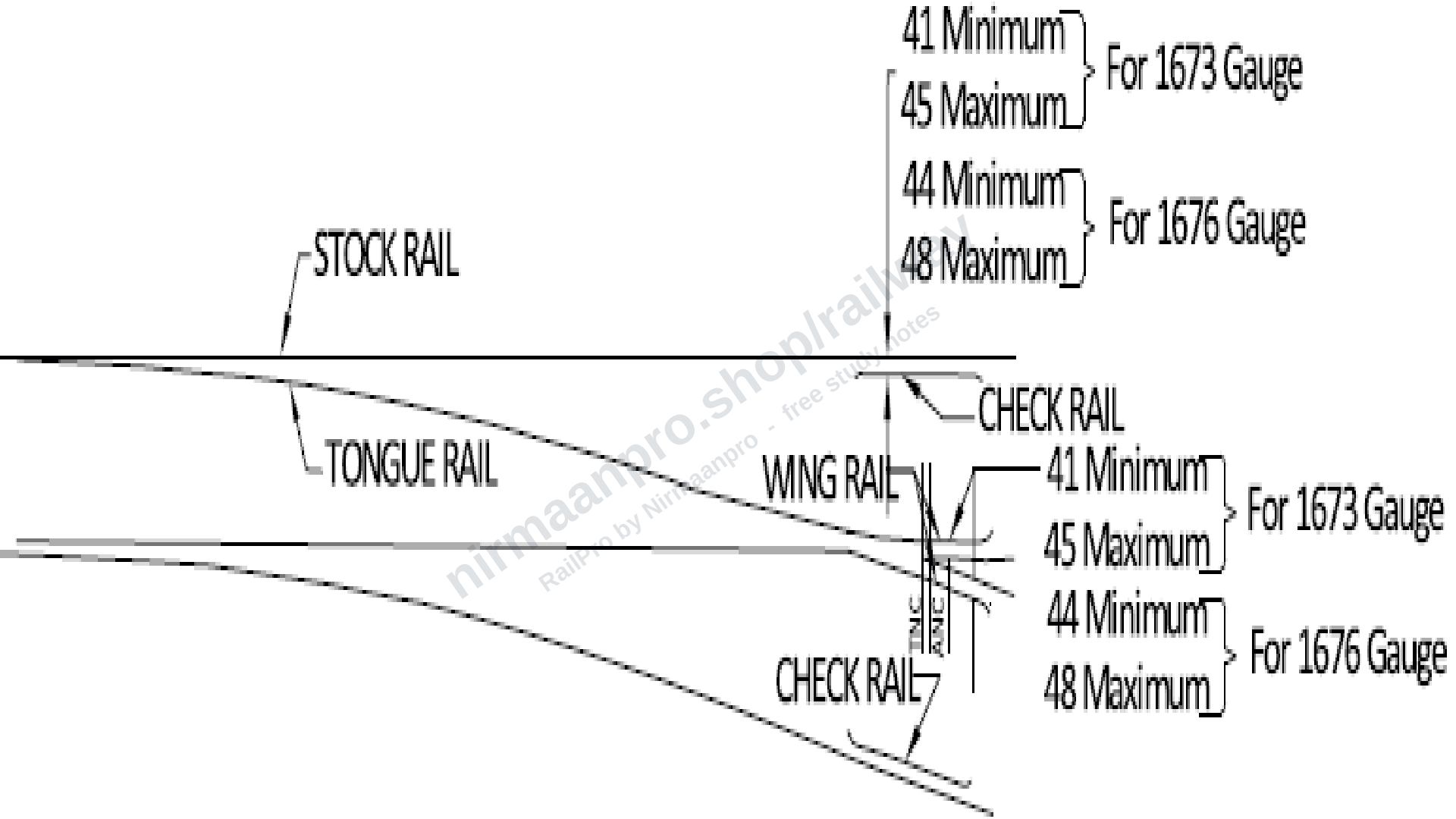
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- **Item no 12 to 16: Points and crossing**

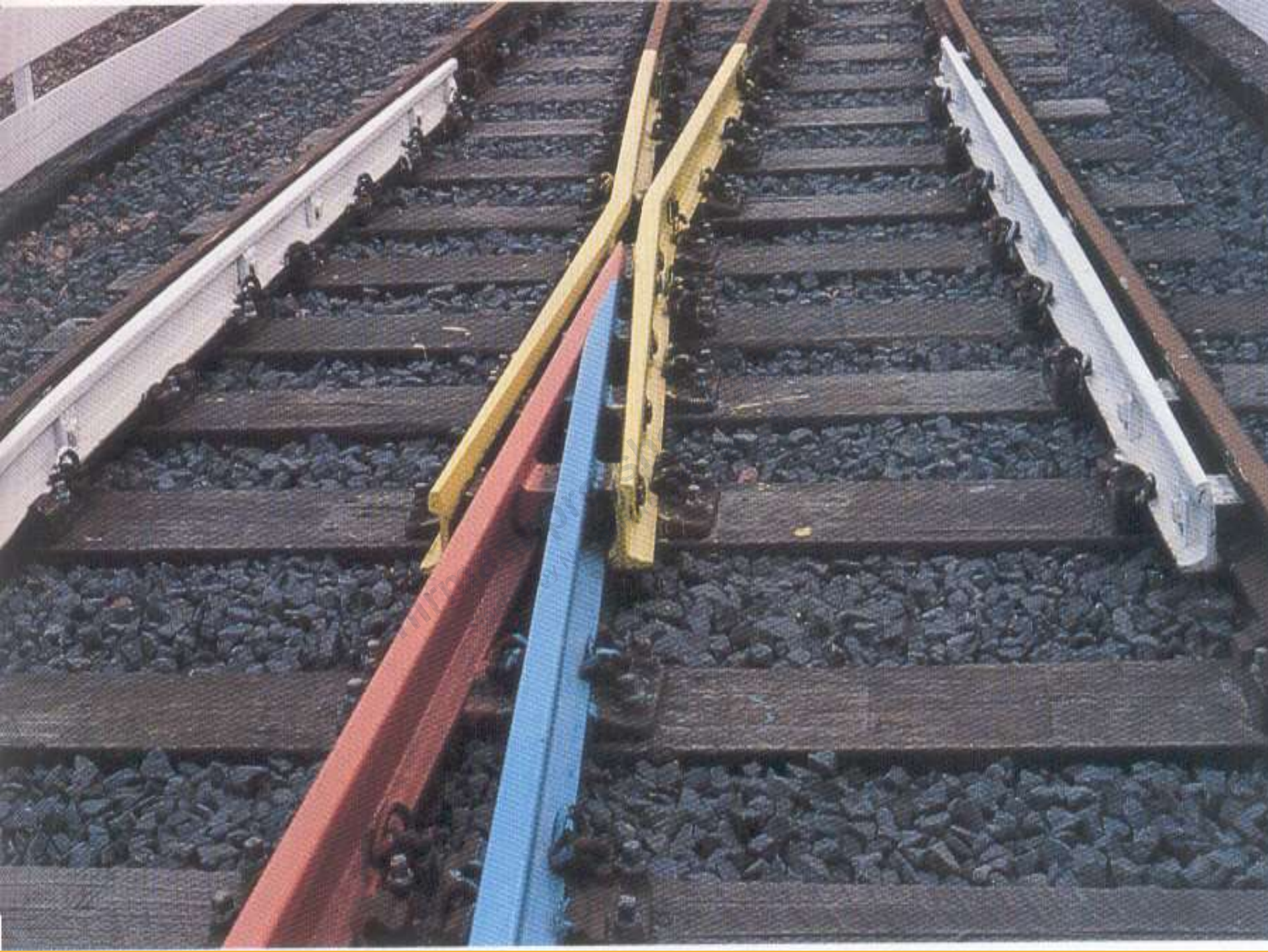
Item Description	Minimum	Maximum
clearance of check rail opposite nose of crossing for 1676 mm gauge	44 mm	48 mm
clearance of check rail opposite nose of crossing for 1673 mm gauge	41 mm	45 mm
clearance of wing rail at nose of crossing for 1676 mm gauge	44 mm	48 mm
clearance of wing rail at nose of crossing for 1673 mm gauge	41 mm	45 mm
Minimum clearance between toe of open switch and stock rail	For existing works – 95 mm	For New works or alterations to existing works - 115 mm

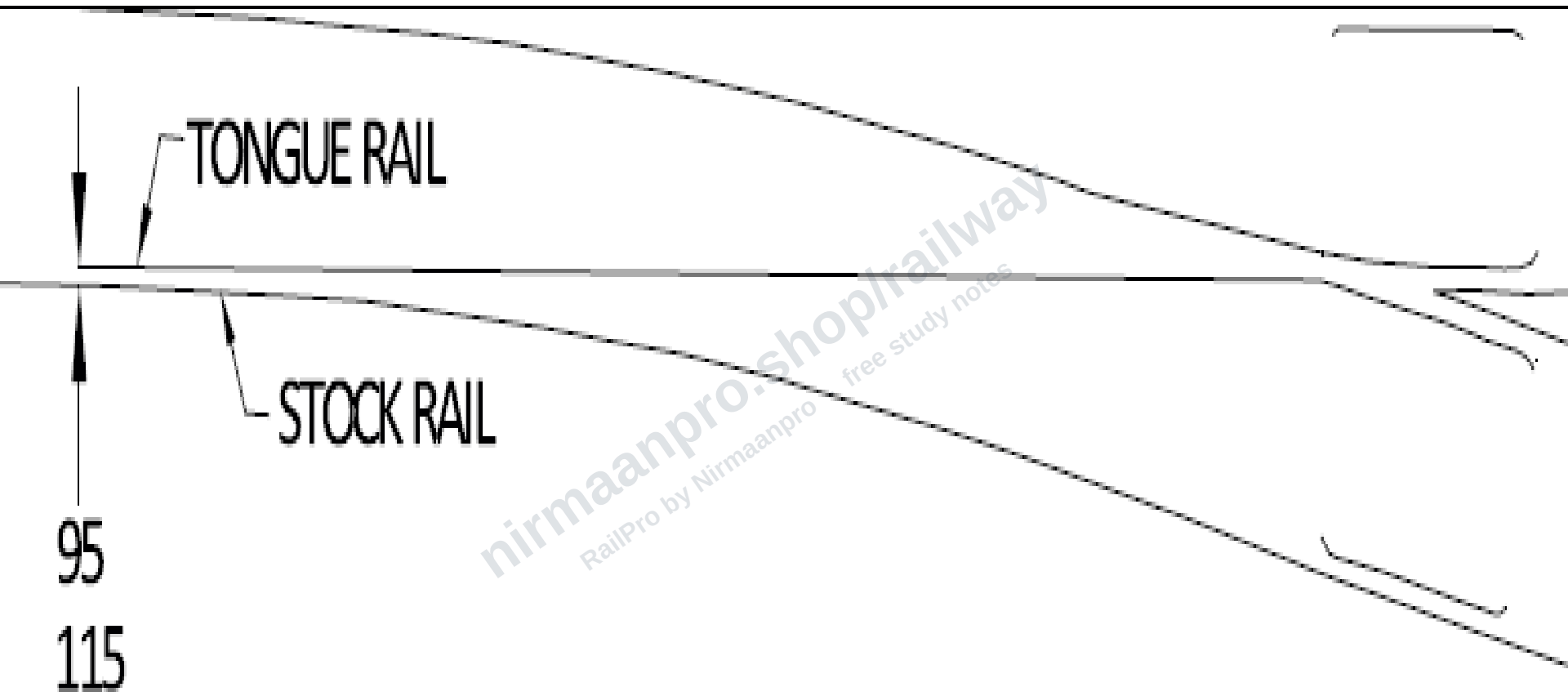
Note: The clearance can be increased upto 160mm in curved switches in order to obtain adequate clearance between gauge face of stock rail and back face of tongue rail.

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- **Item no 17 to 19: Points and crossing**

Item description	Minimum
Radius of curvature for slip points, turnouts of crossover road	218 metres (8 degree)
Note : In special cases mentioned below this may be reduced to not less than the minimum of (i) 213m radius in case of 1 in 8.5 BG turnouts with 6.4m over riding switch, and (ii) 175m radius in case of 1 in 8.5 scissors crossing to allow for sufficient straight over the diamond crossing between crossovers.	
Angles of crossing (ordinary)	1 in 16
Note: Crossings as flat as 1 in 20 will usually be sanctioned if recommended by the Commissioner of Railway Safety.	
Diamond crossings not to be flatter than	1 IN 8.5
Note: Diamond Crossings as flat as 1 in 10 will usually be sanctioned if recommended by the Commissioner of Railway Safety.	

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- **Item no 20 to 21: Points and crossing**

Item description	Minimum
Minimum length of tongue rail	3660 mm
Minimum length of train protection, point locking or fouling treadle bar	12800 mm
Note: There must be no change of super elevation (of outer over inner rail) between points 18m out side toe of switch rail and nose of crossing respectively, except in the case of special crossings leading to snag dead-ends or on curves with turnouts of contrary and similar flexure	

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- **Item no 22: Super elevation and speed in stations on curves with turnouts of contrary and similar flexure**

Main line : Subject to the permissible run through speed, based on the standard of. interlocking, the equilibrium super elevation, calculated for the speed of the fastest train, may be reduced by a maximum amount of without reducing the speed on the mainline.	75mm

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- Curves of contrary flexure
- Permissible negative cant on turnout (which is also the actual cant on main line) is 75 – C

  where C = GV^2 / 127 R

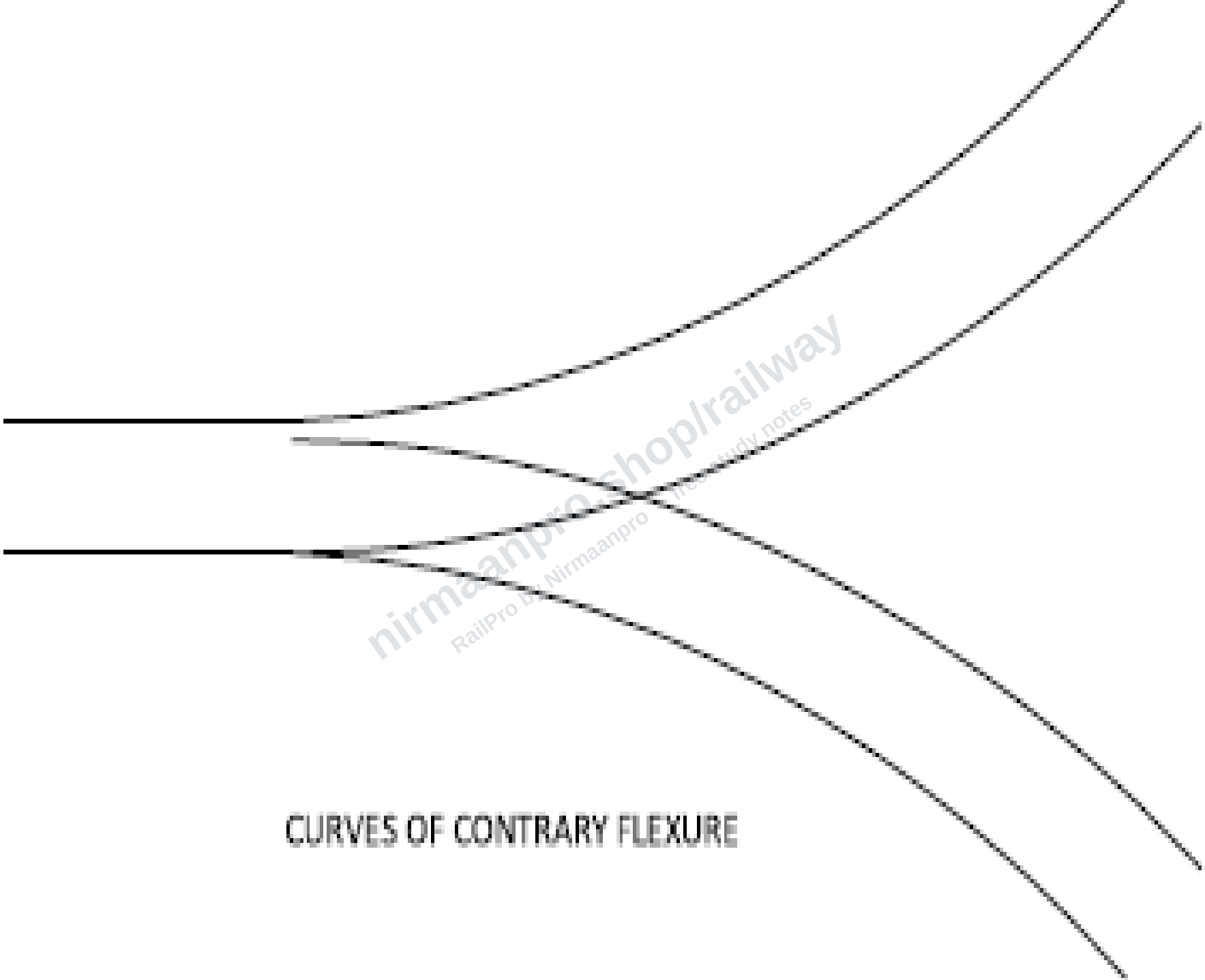
  C = Actual cant on turnout in mm

  G = Dynamic gauge in mm

  V = Design speed on turnout in KMPH

  R = Radius of turnout in mts.

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CURVES OF CONTRARY FLEXURE

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- Curves of similar flexure
- In the case of a reverse curve close behind the crossing of the turnouts, the super elevation may be run out at the maximum of 1 mm in 360mm (2.77 mm/mts)

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CURVES OF SIMILAR FLEXURE

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- **Item no 23: Length of sidings**

Clear available length of one siding at any station where it is intended to cross trains	Length of longest train permitted in the section plus 35 mts

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• Length of sidings

Although it may not be necessary till traffic develops to provide sidings for the largest possible train loads, land should be acquired for them and no building, level crossings or other obstructions should be permitted that will interfere with the crossing siding being lengthened on sections of the railway where ruling gradient is

On sections of the railway where the ruling gradients is	Minimum Clear Available Length of one siding for new works or Alteration to the Existing Works
1 in 100 or flatter	750metres
Steeper than 1 in 100	Length of the longest train permitted in the Section plus 35m

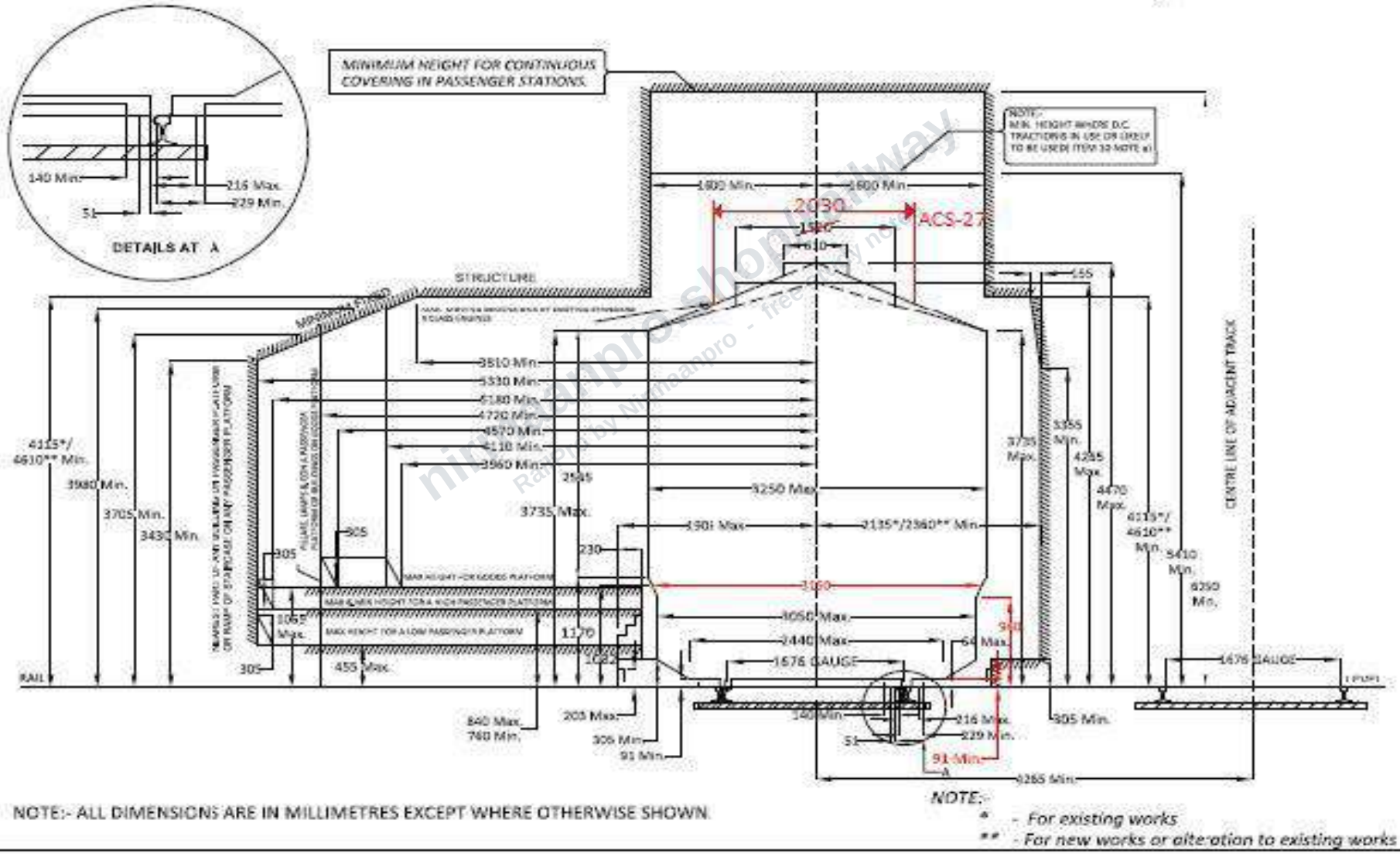
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Note: Clear available length denote:
(i) Distance between foot of the signal to Fouling Mark in the rear on the same line in case of Main line and Directional loop at Station yard.
(ii) In case of Common Loop at the stations, Clear Available Length/ Clear Standing Length shall be the distance between two starter signals of opposite direction on the same line.

DIAGRAM NO. 2
1676 mm GAUGE

STANDARD DIMENSIONS IN STATIONS
TO SUIT 25 kV.A.C. TRACTION SCHEDULE I-CHAPTER II

NOTE:- THE DISTANCES SPECIFIED. APPLY ONLY IN CASE OF STRAIGHT TRACK. CN CURVES. THE HORIZONTAL DISTANCE SHOULD BE INCREASED BY AN AMOUNT 'C' TO ALLOW FOR THE LEAN DUE TO SUPER-ELEVATION CALCULATED BY THE FOLLOWING FORMULA, WHERE 'H' IS THE HEIGHT OF THE CONTACT WIRE, 'S' THE SUPERELEVATION AND 'G' THE GAUG OF THE TRACK, ALL DIMENSIONS BEING IN METRES $D = \frac{H \times S}{G}$



NOTE:- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

NOTE:-
* - *For existing works*
** - *For new works or alteration to existing works*

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SCHEDULE OF DIMENSIONS

Schedule 2

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Schedule – 2

- **Existing infringements of Schedule I which may be permitted to continue on existing 1676mm gauge Railways.**
- **The following infringements of the dimensions prescribed in Schedule I may, subject to such restrictions of speed as are considered necessary, be permitted on existing railways (See diagram No. 3) it being understood that when structures are altered they will be rebuilt to comply with Schedule I, except in case of structures falling under item 7.**

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DIGRAM NO. 3 (FIG II)
1676mm GAUGE

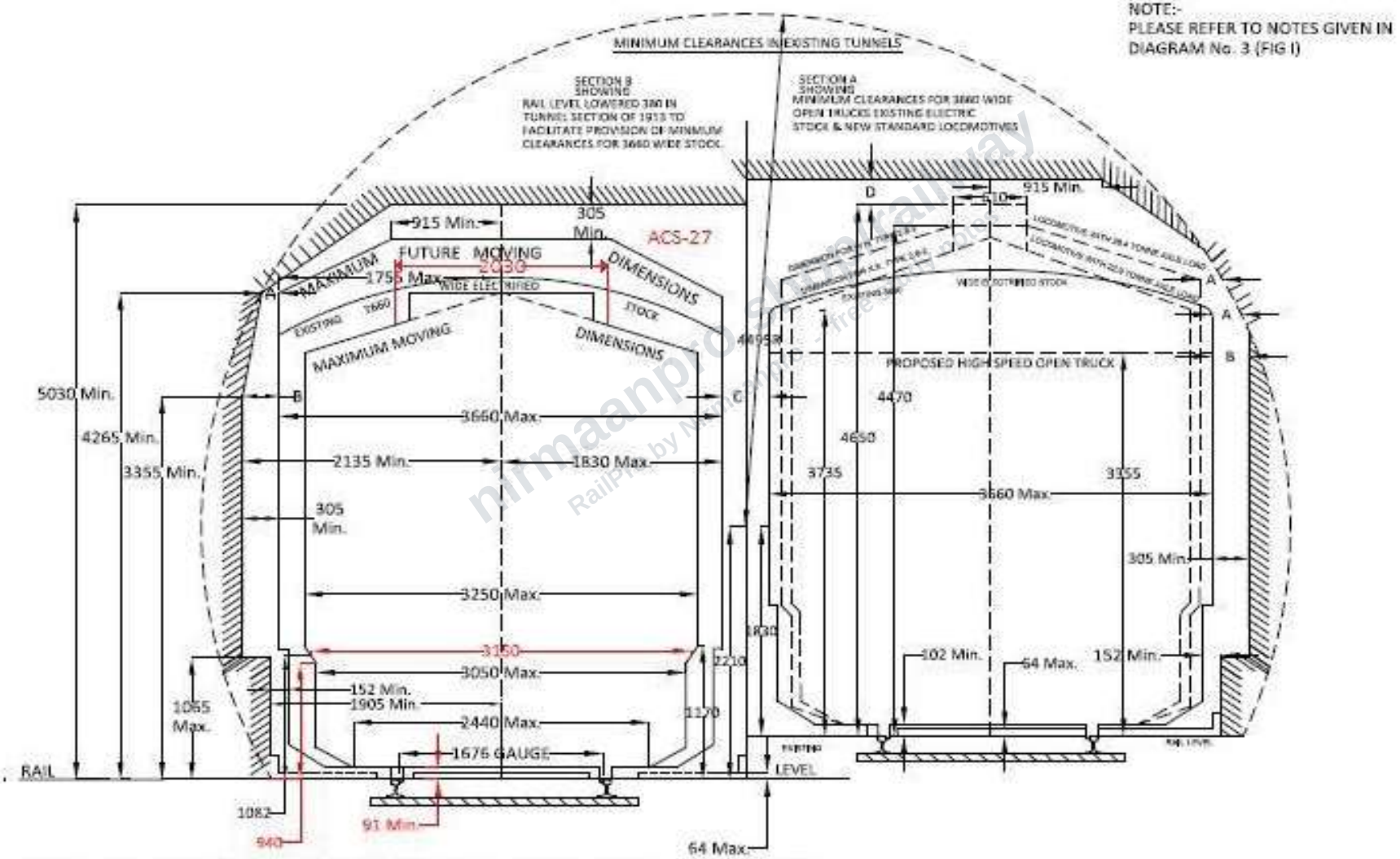
INFRINGEMENTS OF SCHEDULE - I

FOR 3660 mm GOODS STOCK & NEW STANDARAD LOCOMOTIVES IN EXISTING TUNNELS ONLY

PIERMTTED UNDER SCHEDULE-II

TUNNEL SECTION OF 1913

NOTE:-
PLEASE REFER TO NOTES GIVEN IN DIAGRAM No. 3 (FIG I)



NOTE:- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

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Schedule – 11 Existing infringements of Schedule I which may be permitted to continue

S. No	Item	For 3250 mm wide rolling stock (a)	For 3660 mm wide rolling stock (b)
1	Minimum distance centre to centre of tracks	3660 mm	4040 mm
2	Minimum clear horizontal distance from centre of track to any fixed structure from rail level to 1065mm above rail level.	1675 mm	1905 mm
3	Minimum clear horizontal distance from centre of track to any fixed structure from 1065mm above rail level to 3505mm above rail level.	1980 mm	-----
	Minimum clear horizontal distance from centre of track to any fixed structure from 1065mm above rail level to 3355mm above rail level.	-----	2135 mm

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Schedule – 11 Existing infringements of Schedule I which may be permitted to continue

S. No	Item	For 3250 mm wide rolling stock (a)	For 3660 mm wide rolling stock (b)
4	Minimum clear horizontal distance from centre of track at 4265mm above rail level.	2055 mm	-----
5	Minimum clear height above rail level for a distance of 305mm on 4420mm either side of centre of track.	4420 mm	-----
	Minimum clear height above rail level for a distance of 915mm on either side of centre of track.	-----	5030 mm

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Schedule – 11

- **Note:**
- **Items 2(a) – 1675 mm,**
  3(a) – 1980 mm,
  3(b) – 2135 mm and
  4(a) --2055 mm refer to structures outside station yards only.
- **Where speed is restricted to 16 km/h, the minimum clear horizontal distance under 4(a) – 2055 mm may be reduced to 1980mm.**

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- **Note:**
- **Where, as on girder bridges, ash pits, etc., the structure is not likely to be out of plumb and the super elevation (or level of rails) does not vary and where the speed is restricted to 16km/h, the above dimensions may be reduced to :**
- **For 3250 m wide stock**
  - **1(a) 3660 mm to 3580 mm**
  - **3 (a) 1980 mm to 1905 mm**
  - **4 (a) 2055 mm to 1980 mm**
  - **5 (a) 4420 mm to 4265 mm**
- **For 3660 m wide stock**
  - **1(b) 4040 mm to 3960 mm**
  - **3 (b) 2135 mm to 2055 mm**
  - **5 (b) 5030 mm to 4875 mm**

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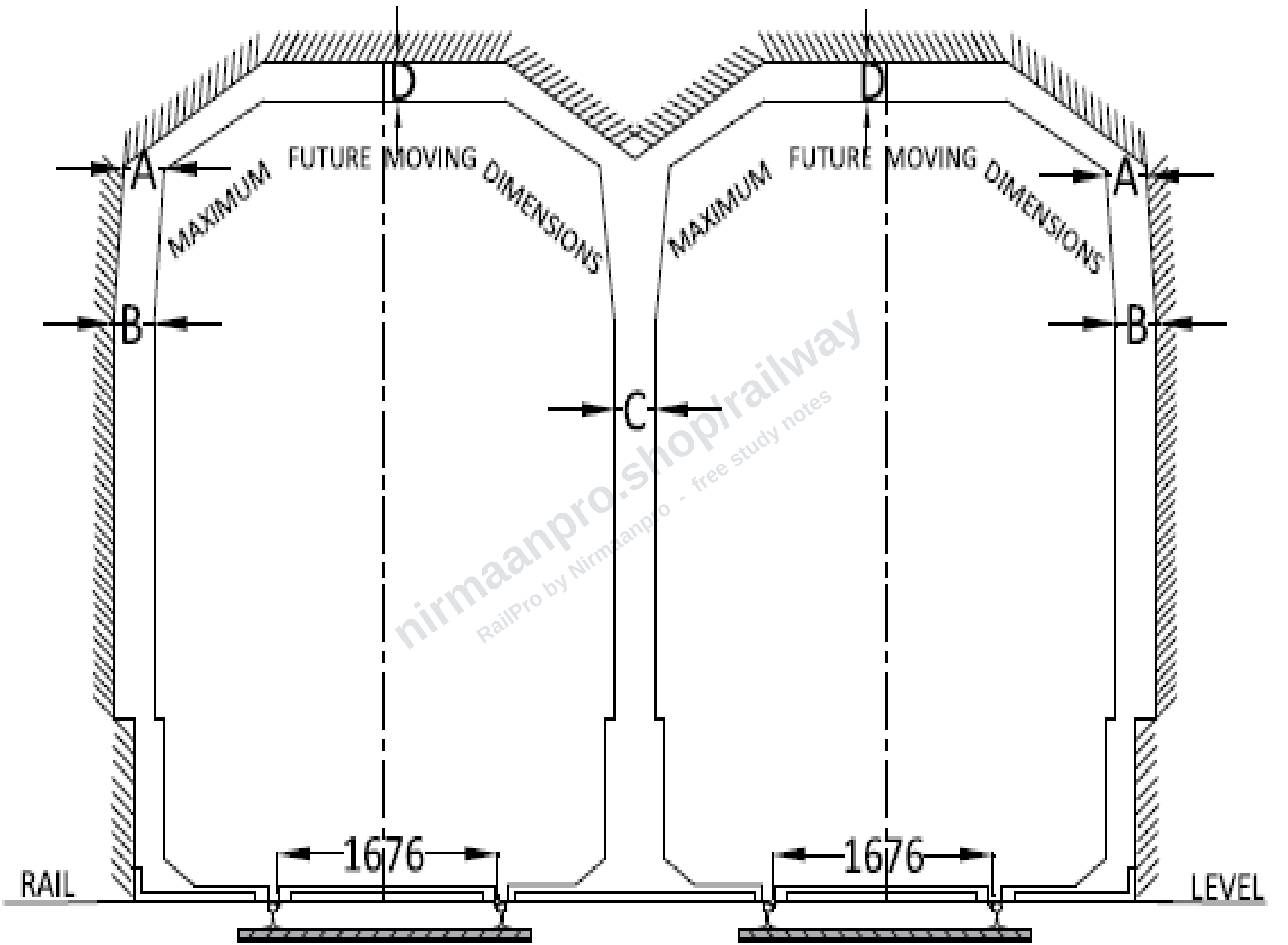
- **Note:**
- **To the horizontal distance given in item no1 to 5 must be added the extra allowance for curves(As Appendix).**
- **Where existing structures do not permit of these allowances being given, they may be reduced by limiting the super elevation to be allowed for outer over inner rail.**
- **When this is done a notice board should be erected against the structure, stating the maximum permissible super elevation.**

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Schedule – 11 Existing infringements of Schedule I which may be permitted to continue

S.No	Item	In Tunnels	On Girder Bridges
6 (i)	The minimum permissible clearances in existing tunnels and girder bridges shall be: Under any circumstances and subject to any restriction of speed which it may be considered necessary to impose		
	At Location A	229 mm	229 mm at top of sides of vehicles
	At Location B	305 mm	229 mm at sides of vehicles
	At Location C	380 mm	305 mm between moving vehicles
	At Location D	229 mm	152 mm above vehicles

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Schedule – 11 Existing infringements of Schedule I which may be permitted to continue

S.No	Item	In Tunnels	On Girder Bridges
6 (ii)	The minimum permissible clearances in existing tunnels and girder bridges for unrestricted speeds shall be		
	At Location A	380 mm	229 mm at top of sides of vehicles
	At Location B	535 mm	455 mm at sides of vehicles
	At Location C	610 mm	535 mm between moving vehicles
	At Location D	305 mm	229 mm above vehicles

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Schedule – 11 Existing infringements of Schedule I which may be permitted to continue

S. No	Item	In Tunnels	On Girder Bridges
	Where doors opening inwards or of the recessed or sliding type are provided the minimum clearances in tunnels and bridges may be reduced to		
	At Location B	380 mm	380 mm at sides of vehicles
	At Location C	455 mm	455 mm between moving vehicles

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Note: Extra clearances on curves must be added to all the above.

- Item no 7: Structures which have already been built in accordance with
- Items 10 and 13 of Chapter I,
- items 9, 10 and 11 of Chapter II and
- items 5 and 6 of Chapter III of Schedule I as contained in the 1958 reprint, reproduced in note below, may infringe the dimensions now shown against these items.
- Such infringements may continue and alterations for the removal of such infringements need be taken up only when 25 KV A.C. Electric Traction is undertaken when a study shall be made of each structure to limit the extent of alterations as indicated in Appendix A to Chapter V-A.

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- **Item 10 of chapter no 1**
  Height of road over bridges and foot over bridges

Description	Height in mm
Min. height above RL for a distance of 915mm on either side of the Centre of track for overhead structures	4875 mm
When D.C electric current is in use or likely to be used	5410 mm
Note: Extra clearances on curves must be added	

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Item no 13 of chapter 1: Minimum Horizontal distance centre to centre of track in tunnels, through and semi through girder bridges clearances prescribed

For Works	Horizontal distance from centre to centre of track
For new works/additions to existing works	4725 mm

- Note : Extra clearances required on curves to be added.
- When re-spacing existing lines, the minimum distance centre to centre of tracks may be reduced, from 4725mm to not less than 4495mm for the purpose of avoiding heavy alterations to tunnels or through or semi through girder bridges. The 4725mm dimension is to be adopted for all new works

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- **Minimum horizontal distance from centre of track to any structure n tunnels, through and semi through girder bridges clearances prescribed**

Height above RL	Max horizontal distance from track
From RL to 305mm above RL	1905 mm
From 305 mm to 1065 mm above RL	1905 mm increasing to 2360 mm
From 1065 mm to 3355 mm above RL	2360 mm
From 3355 mm to 4420 mm above RL	2360 mm decreasing to 2135 mm
From 4420 mm to 5410 mm above RL	2135 mm decreasing to 915 mm

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- **Note:**
- **Where electric traction is not likely to be used, over head bracing of bridges may be 5030mm above rail level for a distance of 1370mm on either side of the centre of track.**
- **Extra clearances required on curves shall be ensured.**

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structures above rail level in a passenger platform

Height	Minimum Height
Of tie rods or any continuous covering	
For a width of 1370 mm on either side of centre of track	6100 mm
Note : This item does not apply to overhead piping parallel to the track.	

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- **Item no 10 of chapter 11: Height of overhead structures of signal gantry or FOB above rail level**

Height	Minimum Height
Height above rail level for a minimum width of 1370 mm on either side of centre of track	4875 mm

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Note:

- This also applies to overhead piping arrangement parallel to track wherever provided which shall be changed over to ground hydrants when section is electrified.
- Where electric traction is likely to be introduced this minimum height should be 5410mm.

- **Item no 11 of chapter 11: Minimum horizontal distance from centre of track to any structure for existing works**

Height above RL	Max horizontal distance from track
From RL to 305mm above RL	1675 mm
From 305 mm to 3355 mm above RL	2135 mm
From 3355 mm to 4115 mm above RL	2135 mm decreasing to 1980 mm
From 4115 mm to 6100 mm above RL	1370 mm

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- **Note**
- **Extra clearances required on curves to be ensured.**

- Item no 5 of chapter 111 : Workshops and running sheds
- Minimum height above rail level to overhead tie bars, girders etc. in workshops and running sheds

Item description	Vertical height above rail level
Where electric traction is not likely to be used	5030 mm
Where electric traction is likely to be used	6176 mm

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- Item no 6 of chapter no 111: Workshops and running sheds
- Minimum height above rail level of doorways for a width of 1370mm on either side of centre of track in both workshops and running sheds :

Item description	Vertical height above rail level
Where electric traction is not likely to be used	4875 mm
Where electric traction is likely to be used	6176 mm

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- Item no 8: General - Out of stations
- Height of road over bridges and foot over bridges

Description	Height in mm
Min. height above RL for a distance of 1600mm on either side of the Centre of track for overhead structures	5410 mm

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- Extra clearances required on curves to be ensured.
- In case of restricted height of existing structures a special case study shall be done before introduction of 25 KV A.C. Accordingly the minimum height above rail level shall not be lower than

1. For Heavy overhead structures such as ROB and flyovers 5070 mm.

2. For Light over head structures such as FOB – 5270mm.

- In above two cases the minimum height of contact wire shall be 4800 mm above RL.
- OHE arrangements shall be made as per RDSO

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- Item no 9: General - For tunnels & through girder bridges.
- Minimum horizontal distance from centre of track to any structure n tunnels, through and semi through girder bridges clearances prescribed

Height above RL	Max horizontal distance from track
From 4420 mm to 5410 mm above RL	2135 mm decreasing to 915 mm

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- <u>Note</u>
- Extra clearances required on curves to be ensured.

- **Item no 10 : General – Station yards**
  Height of overhead structures of signal gantry or FOB above rail level

Height	Minimum Height
Height above rail level for a minimum width of 1600 mm on either side of centre of track	5410 mm

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Note:

- This also applies to overhead piping arrangement parallel to track wherever provided which shall be changed over to ground hydrants when section is electrified.
- Where electric traction is likely to be introduced this minimum height should be 5410mm.

- Extra clearances required on curves to be ensured.
- In case of restricted height of existing structures a special case study shall be done before introduction of 25 KV A.C. Accordingly the minimum height above rail level shall not be lower than

1. For Heavy overhead structures such as ROB and flyovers 5070 mm.

2. For Light over head structures such as FOB – 5270mm.

- In above two cases the minimum height of contact wire shall be 4800 mm above RL.
- OHE arrangements shall be made as per RDSO

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- **Item no 11: Minimum horizontal distance from centre of track to any structure**

Height above RL	Max horizontal distance from track
From 4115 mm to 6100 mm above RL	1370 mm

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- **Note**
- **Extra clearances required on curves to be ensured.**

- **Item no 12**

Item description	Minimum
Minimum height from rail level to the underside of contact wire	
Under bridges and in tunnels	4800 mm
In the open	5500 mm
At level crossings	5500 mm
In running and carriage sheds	5800 mm

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- Note:
- In cases where it is proposed to allow only locomotives or rolling stocks not higher than 4.42m, the minimum height of contact wire specified under bridges and in tunnels above may be reduced to 4.69 metre.

- **Note:**
- **In cases where it is proposed to allow only locomotives or rolling stocks not higher than 4.27m, the minimum height of contact wire specified under Item 2(i) above may be reduced to 4.54 metre. A board showing this restriction and specifying " locomotive s or stocks not permitted to ply on such sections ", shall be exhibited at the entrance to the same.**
- **For movement of over dimensional consignments, the height specified under 2(i) above, shall be increased by the difference between the height of the consignment contemplated and 4.42 m.**
- **In case such an over dimensional consignment is moved at speeds not exceeding 15 Km/h and is also specially escorted by authorized railway staff, the derived height of contact wire may be reduced by 50mm.**

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- **Note:**
- **On curves, all vertical distance specified in item 2 above, shall be measured above the level of the inner rail, increased by half the super elevation.**
- **Suitable prescribed gradient on the height of the contact wire shall be provided for connecting these wires installed at different heights.**

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Thank you

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1.1

Different types of turnouts : 1 in 8.5 , 1 in 12 & 1 in 16

Different types of switches – straight switches, Curved switches, Thick web switches, Derailing switches, symmetrical split Different types of crossings - ordinary built-up and CMS crossings, swing nose crossing, gapless/ machine joint Spring points

Periods 1

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Different Types of Turnouts

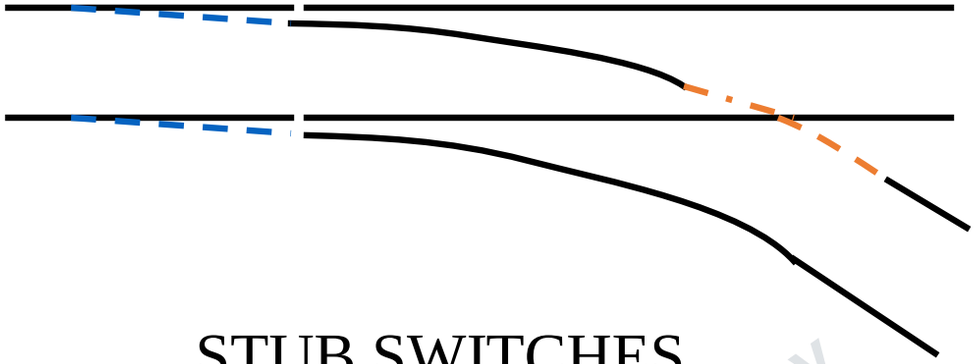
- Turnouts are designated according to their Crossing Numbers. Based on Crossing No. following Turnouts are being used on IR –
- 1 in 8.5
- 1 in 12
- 1 in 16
- 1 in 20

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HISTORICAL DEVELOPEMENT

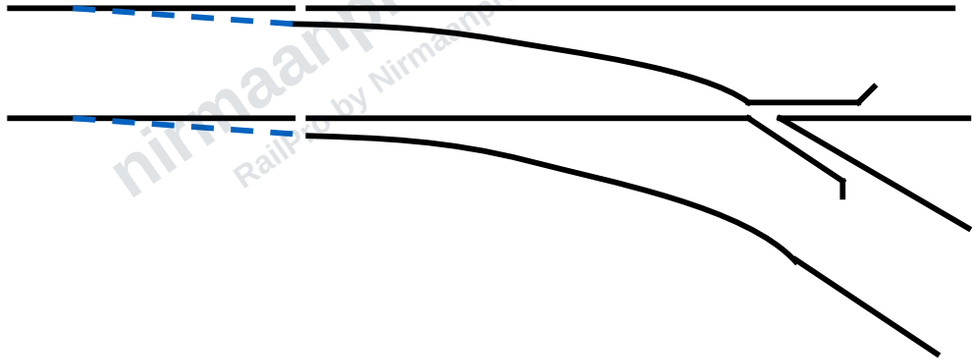
- STUB SWITCHES
- MODIFIED STUB SWITCHES
- SPLIT SWITCHES
- UNDERCUT SWITCHES
- OVERRIDING SWITCHES
- THICKWEB SWITCHES

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STUB SWITCHES

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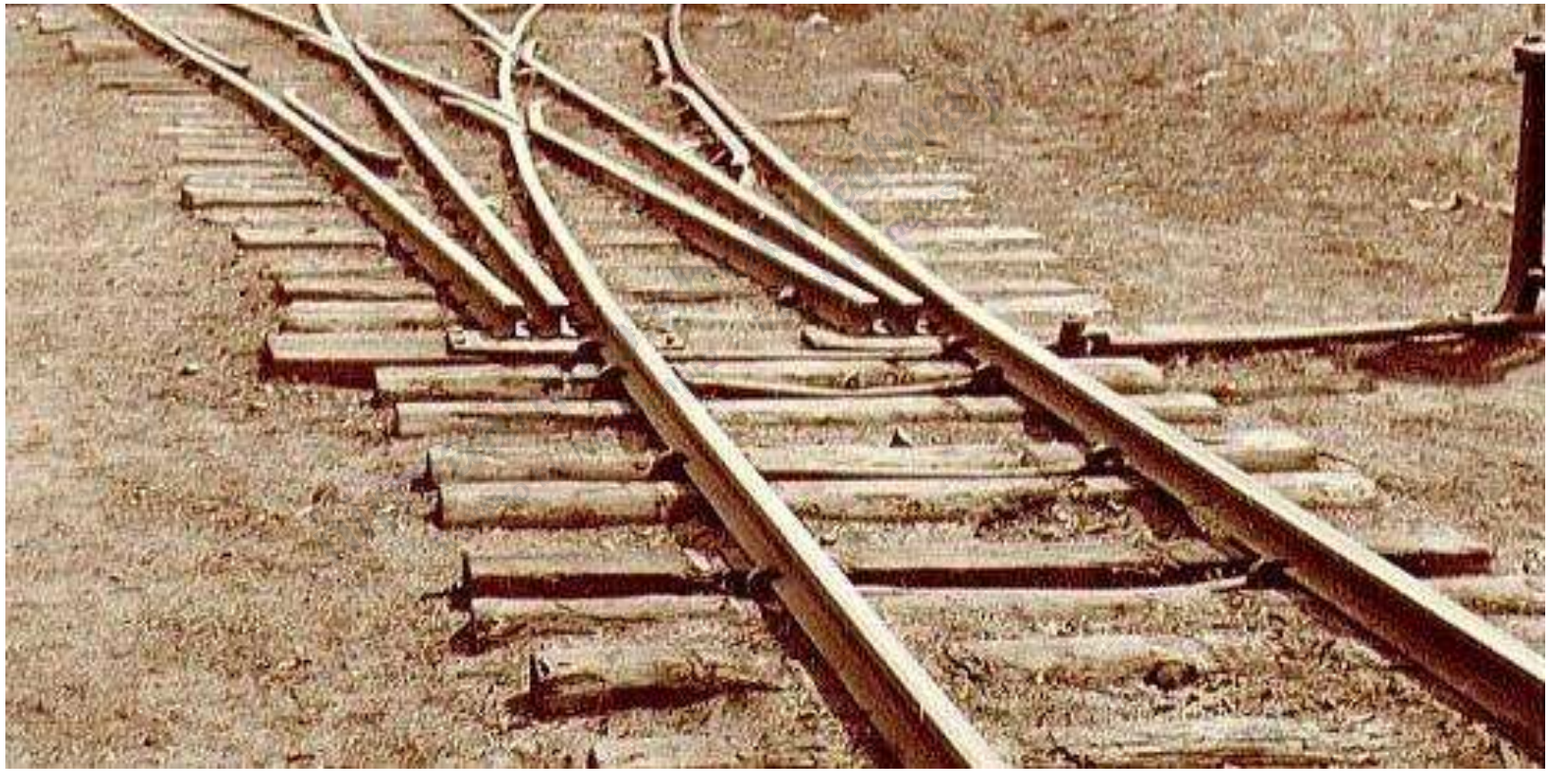


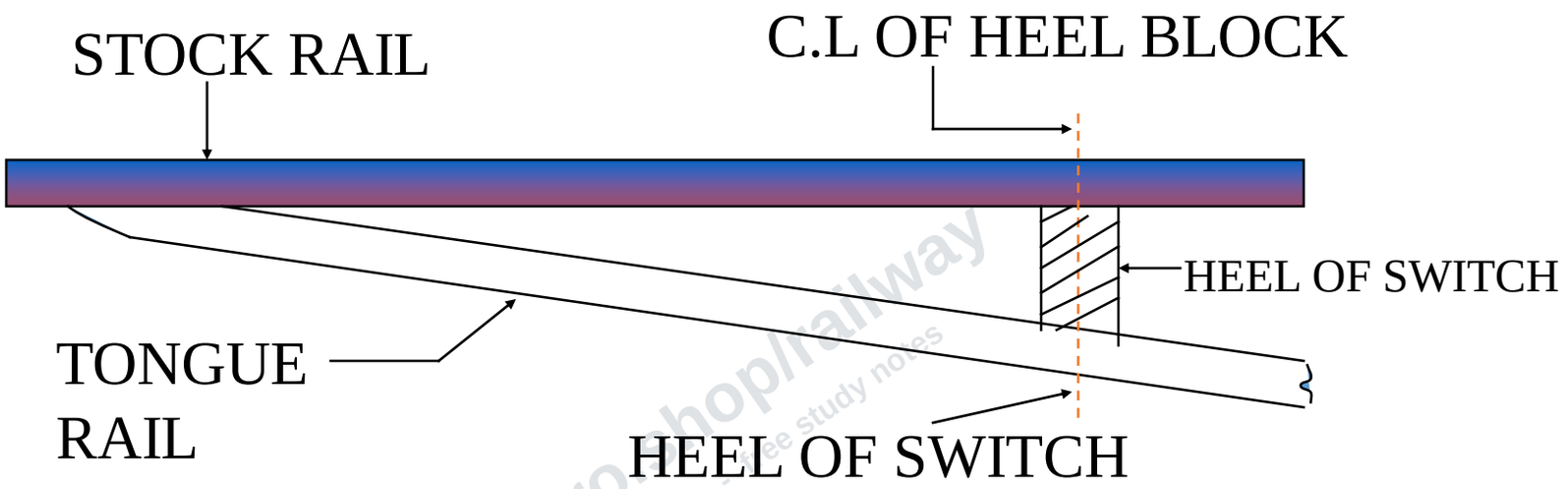
MODIFIED STUB SWITCHES

STUB SWITCH



MODIFIED STUB SWITCHES

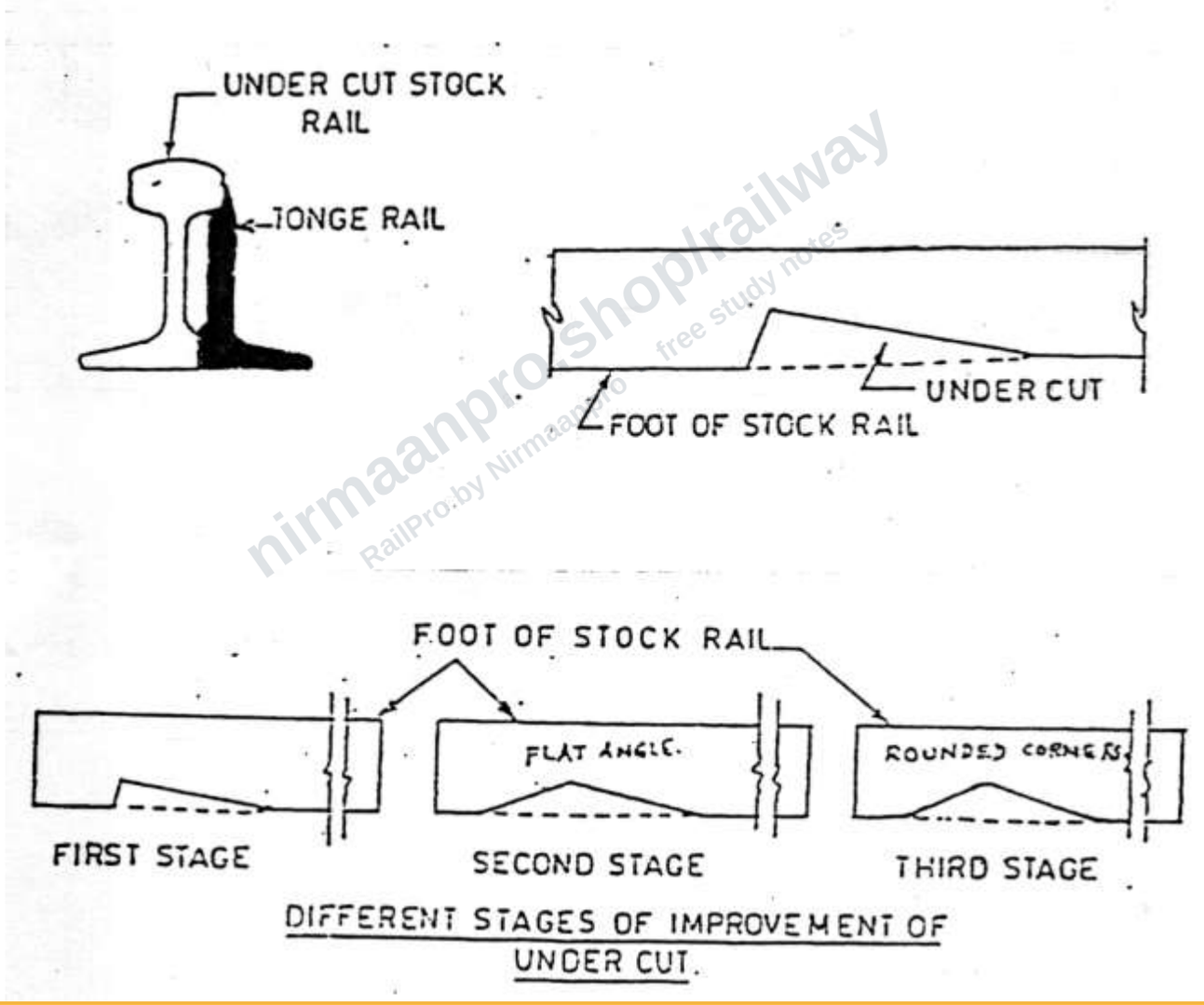




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SPLIT SWITCH

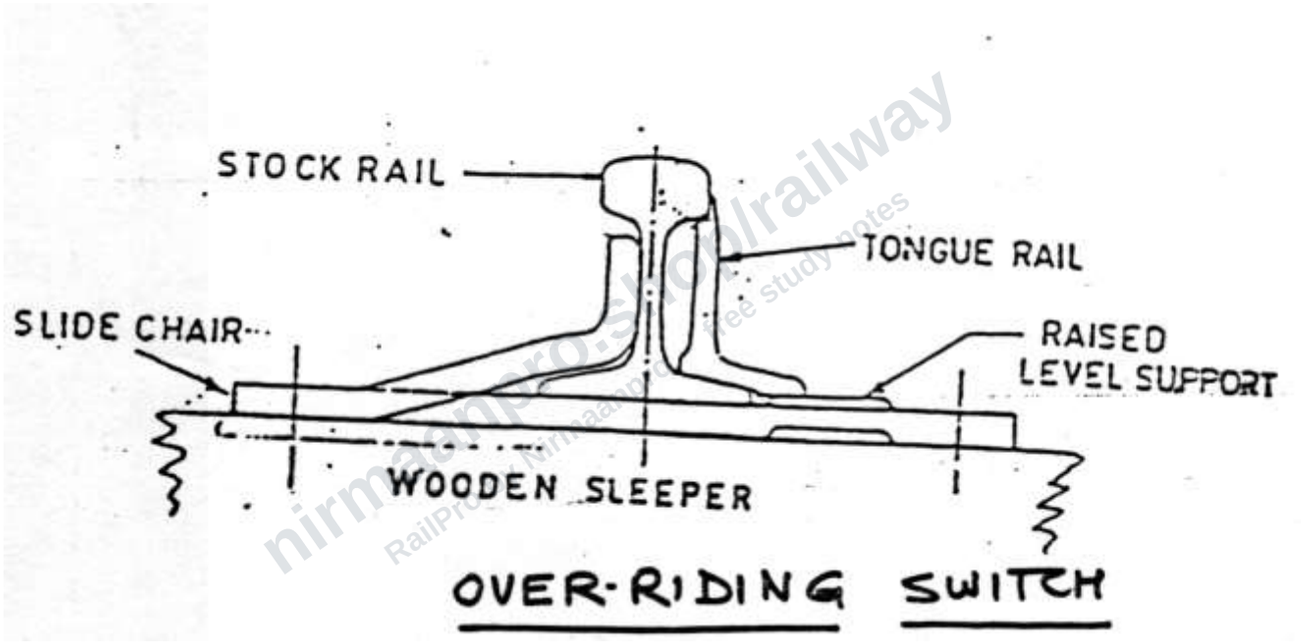
UNDERCUT SWITCH



DIFFERENT STAGES OF IMPROVEMENT OF UNDER CUT.

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OVERRIDING SWITCH

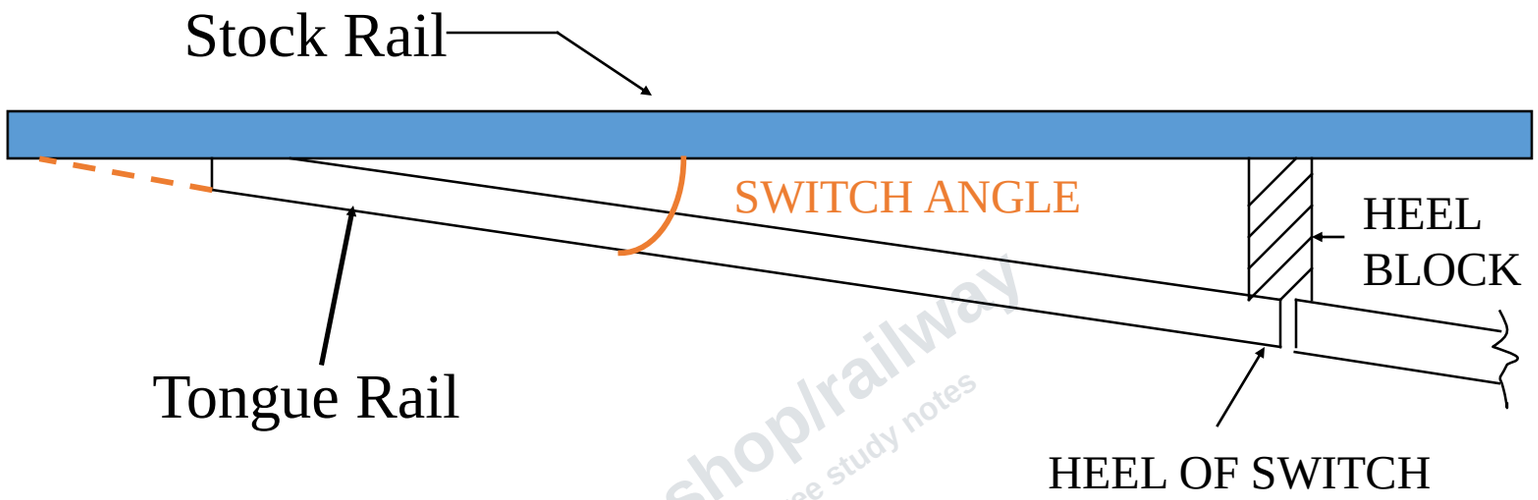


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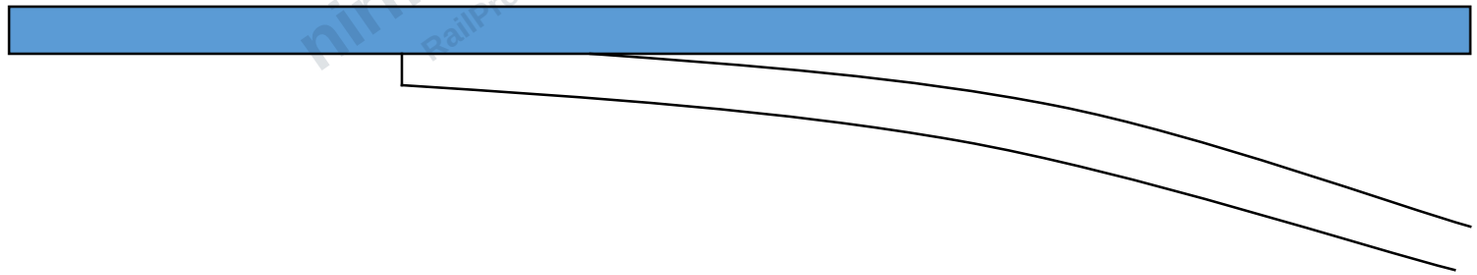
TYPE OF SWITCHES

- STRAIGHT SWITCHES : **The tongue rails of these switches are straight**
  - Advantage: same tongue rail can be used for RH and LH turnout
  - Limitation : Jerk due to abrupt change of direction
- CURVED SWITCHES : **The tongue rails of these switches are curved to provide smooth entry onto the turnout.**
  - Advantage : Discomfort to the travelling public is reduced. Wear is reduced.
  - Limitation : In case of 1 in 12 T/O, the clearance between tongue rail and stock is inadequate near JOH.

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STRAIGHT SWITCH



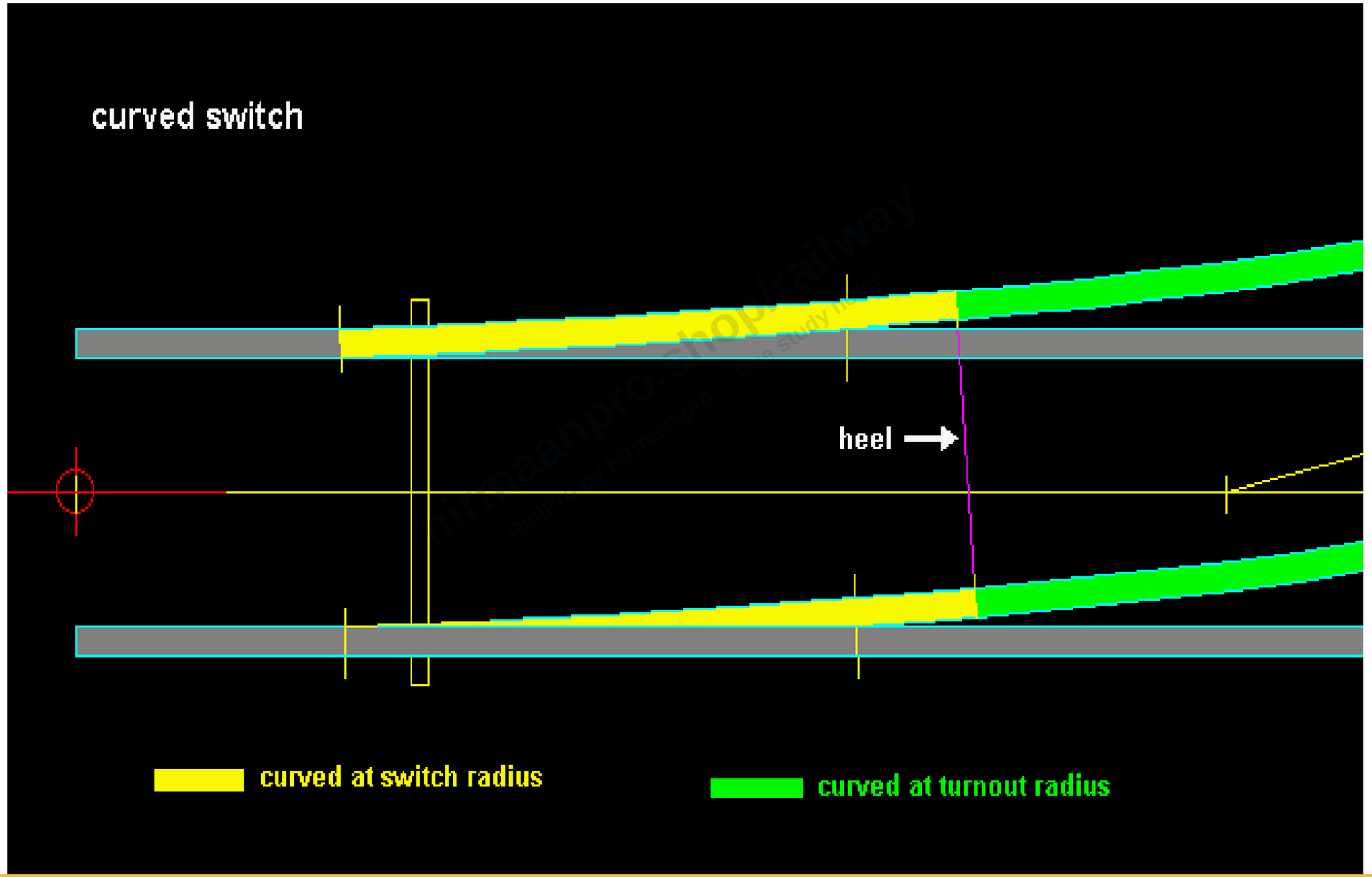
CURVEDSWITCH

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Curved Switch



Curved Switches – Features



Types of Over-riding Switches (contd.)

■Curved Switches :

The Tongue Rail of these switches are curved to provide smooth entry onto the turnout.

- Advantage : Discomfort to the Passengers is reduced.
  Wear is less.

- Limitation : In case of 1 in 12 Turnouts, the clearance between Tongue Rail and Stock Rail is inadequate near JOH.

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Salient Features of Curved Switches

- Curved tongue rails from heel to toe of switch
- Flatter switch entry angle
- Because of curvature LH and RH tongue rails are not interchangeable

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Salient Features of Curved Switches

- Flexural rigidity of curved tongue rail is less from ATS to JOH due to extensive machining

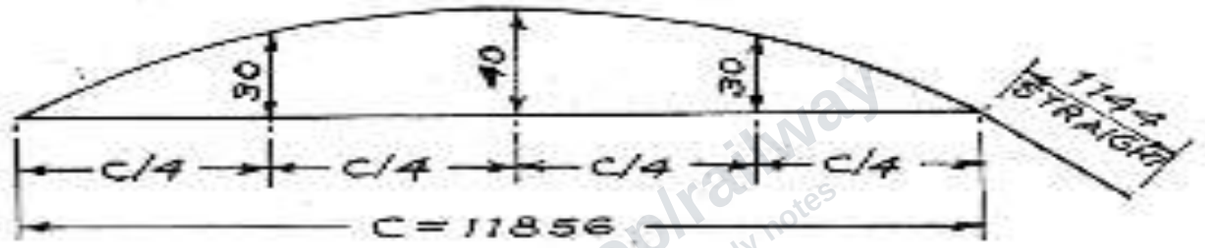
  To strengthen switch length > 6400mm, web stiffeners provided

- Pre-curving of stock rail and tongue rail

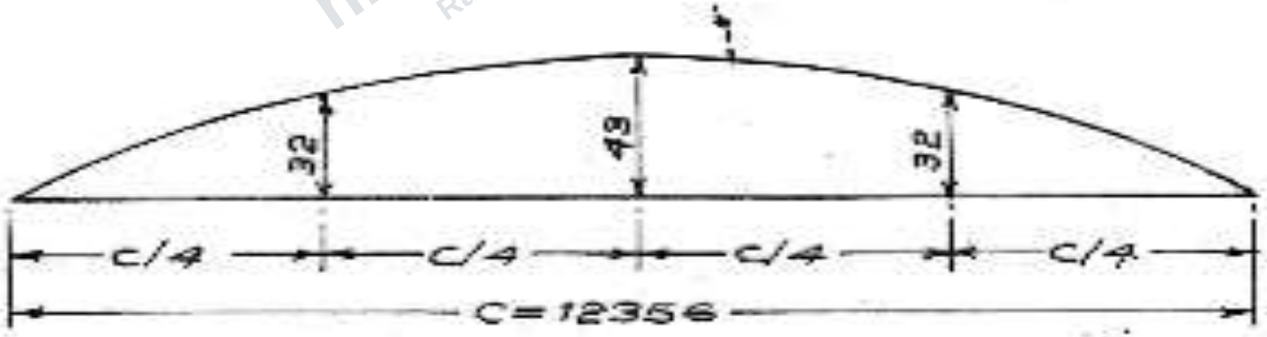
  Ordinates at quarter and mid point should be checked at the time of initial laying and during maintenance.

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1 in 12 Curved Switch
Pre-Curving of Tongue and Stock Rail



CURVED STOCK RAIL



CURVED TONGUE RAIL

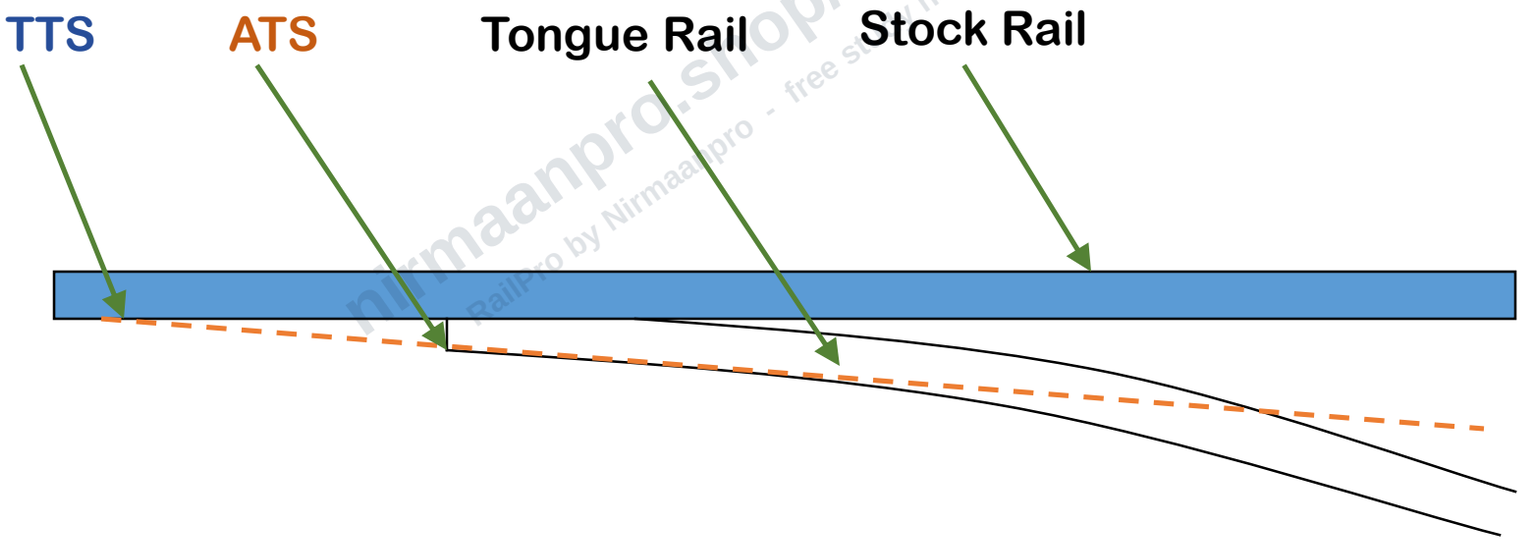
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Clearance at JOH for 1 in 12 Curved Switch

- Cause : Longer length of tongue rail (Flexibility)
- Effect : Grazing of back of tongue rail, vibrations in tongue rail and stretcher bars
- Remedy :
  - Double pull arrangement
  - Spring Setting Device
  - Increased Heel Divergence / Throw of Switch

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Curved Switch



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Distance between TTS to ATS

- TTS to ATS = t cot β
- t = thickness of tongue rail
- β = Switch entry angle
- For 1 in 8.5 it is 439 mm
- For 1 in 12 and 1 in 16 it is - 0 mm i.e ATS and TTS is at one location

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Components/Features of switch assembly

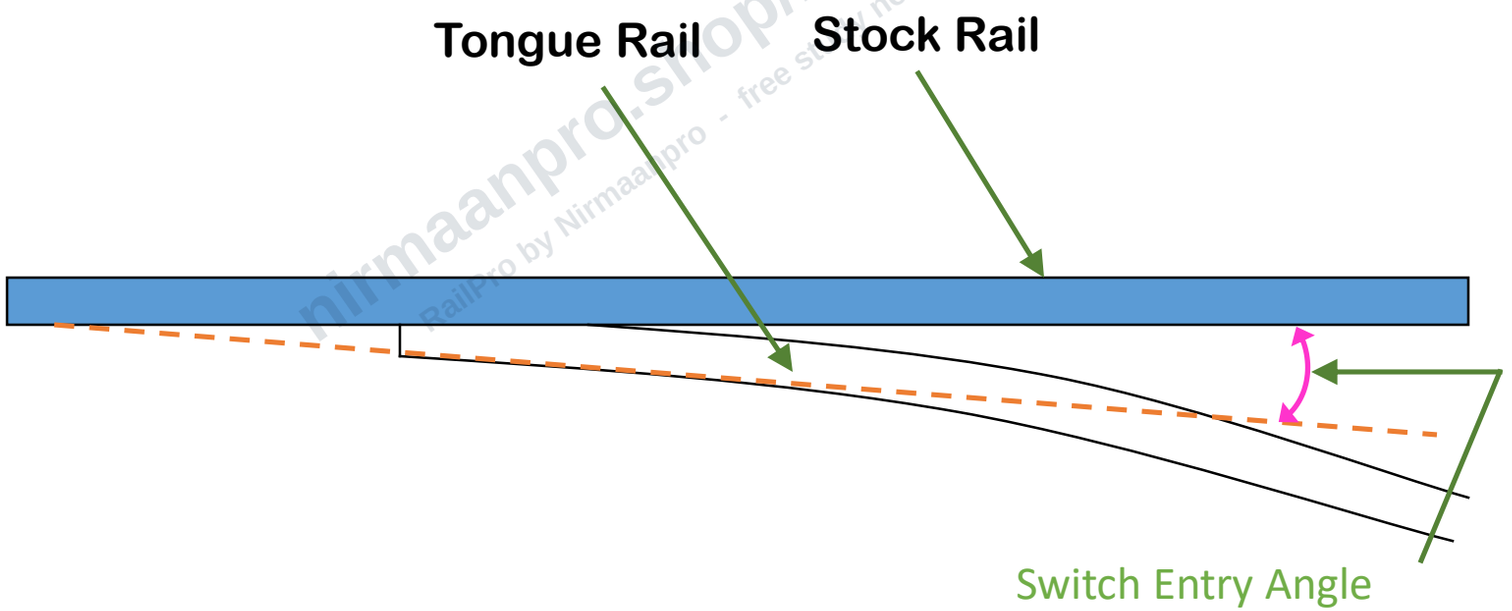
■Switch Entry Angle or Switch angle (SEA)

- For Curved Switches

  Angle contained between the gauge line of stock rail and imaginary tangent drawn at the toe of switch to the curved gauge line of the tongue rail

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Curved Switch



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Switch Entry Angle(SEA) for Switches on B.G

- 1 in 8.5 curved PSC — $0^\circ 46' 59''$
- 1 in 12 curved PSC/TWS — $0^\circ 20' 00''$
- 1 in 16 curved PSC/TWS — $0^\circ 20' 00''$
- 1 in 20 curved PSC/TWS — $0^\circ 20' 00''$
- SEA for curved switches on PSC is considerably reduced to increase speed on turnouts.

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Effect of SEA

- In normal, curve starts with transition followed by circular and transition and for smooth riding transition meet straight and circular tangentially.
- In turnout when a vehicle moves towards turnout side
- It Encounter curve immediately after straight without transition.
- In turnout circular meets straight at an angle i.e; SEA a jerk is felt when vehicle passes at ATS.
- Amount of jerk depends on SEA

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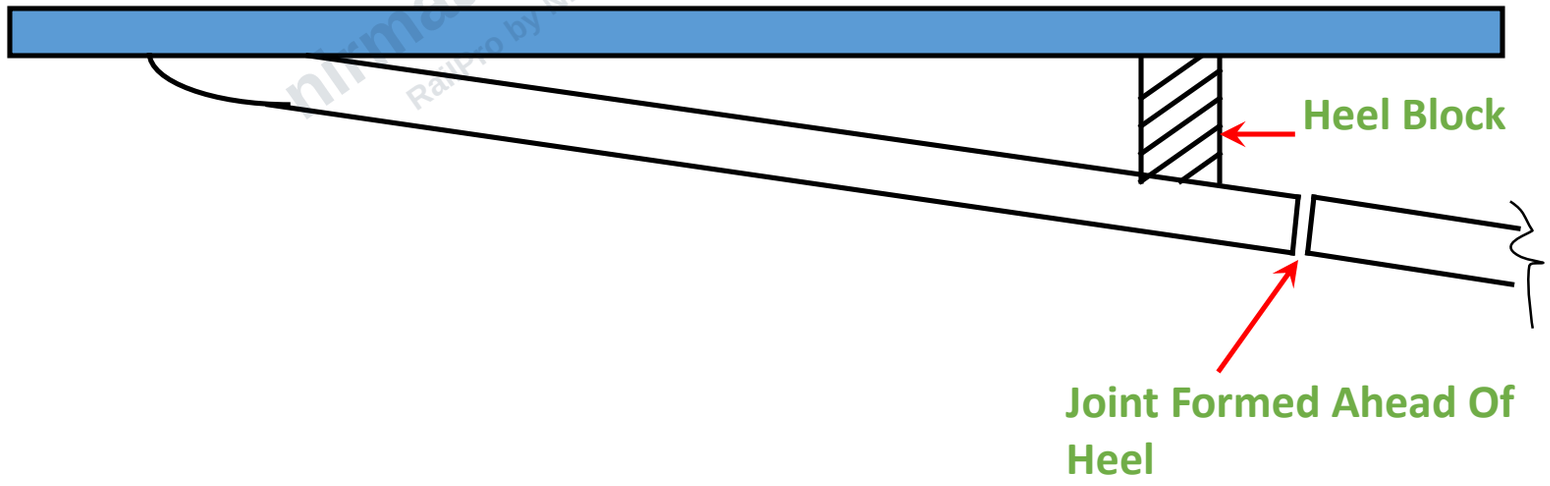
Fixed heel switch

- In this type tongue rail does not end at heel of switch but extends further and makes the joint with lead rail.
- The tongue rail is rigidly connected to the stock rail at heel of switch with web fit block and all bolts are spanner tight.
- The movement of thin end of tongue rail is made on account of flexibility being longer in length.

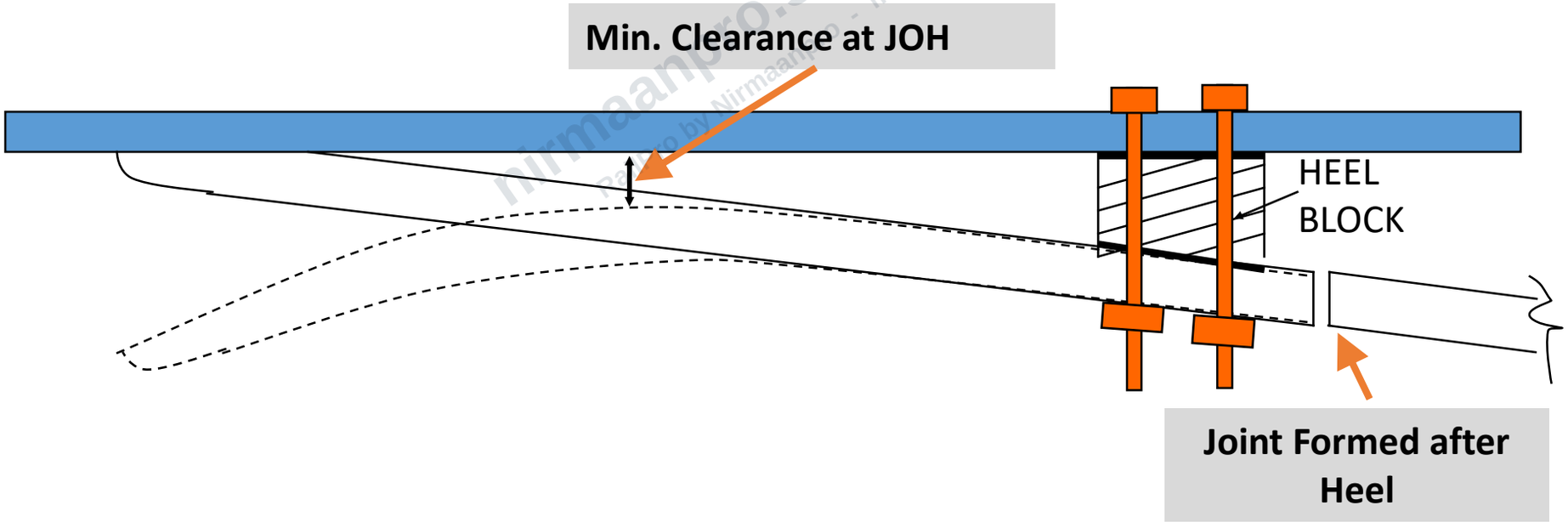
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Fixed Heel Switch

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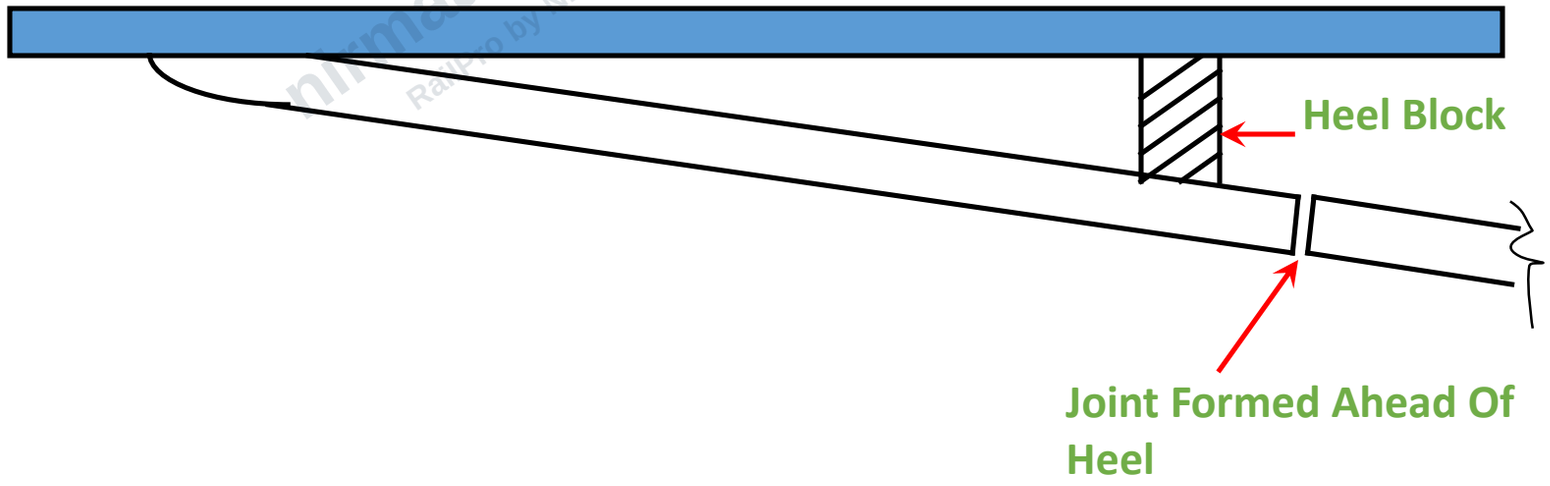
Fixed Heel Switch



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Fixed Heel Switch

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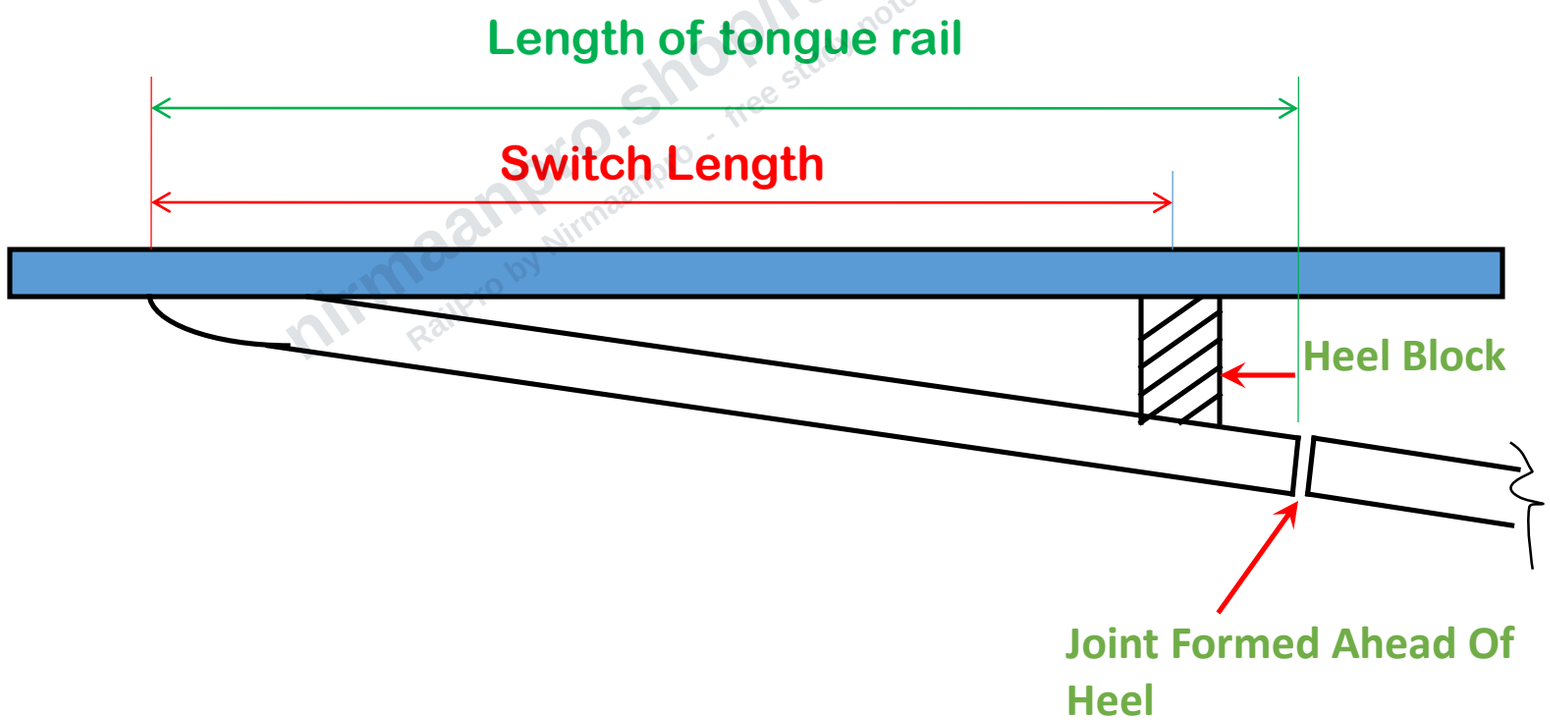


Components/Features of switch assembly

- **Switch Length or Length of switch:**
- **Switch length is the effective length of a tongue rail which moves laterally during setting of the points or it is distance from the heel of the switch to the actual toe of switch.**
- **Normally, length of switch should be more than the longest wheel base or the maximum distance between any two wheels of the adjacent wagons on safety consideration**
- **For Fixed heel Length of tongue rail > Switch length**

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Fixed Heel Switch



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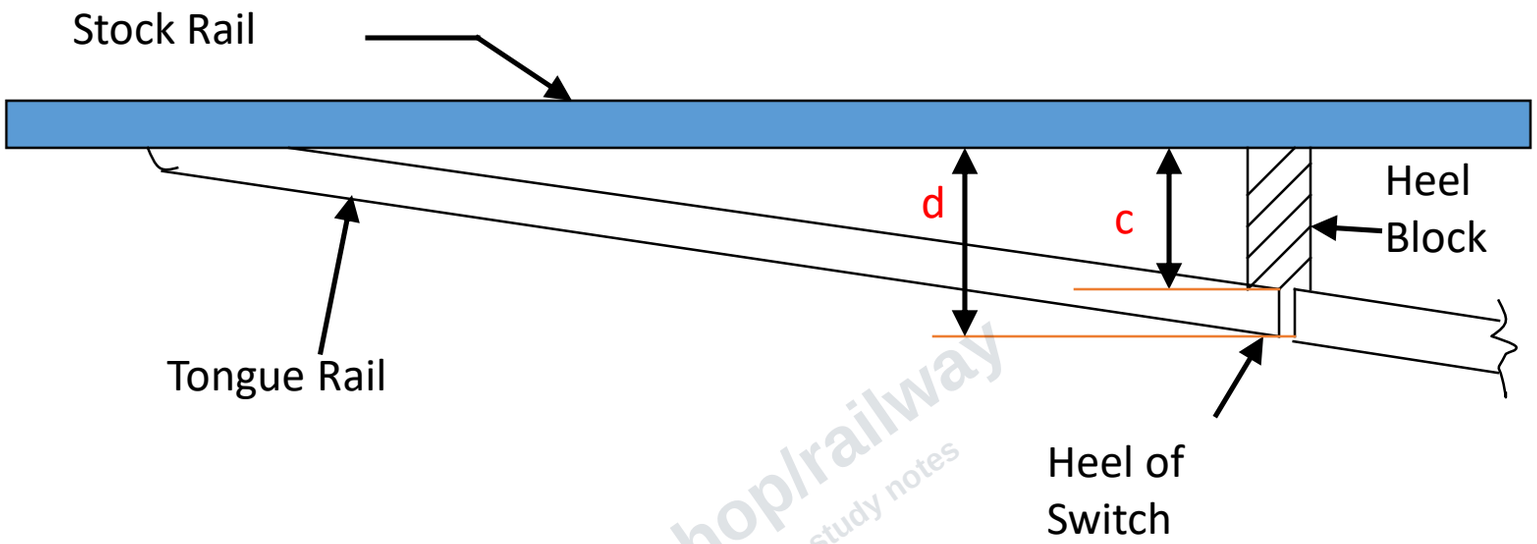
Components/Features of Points & Crossings

- **Heel Divergence**
  - The distance between the gauge line of stock rail and tongue rail at the heel of switch is called

    Heel Divergence
  - Measured at right angle to the gauge face of stock rail
  - Clear distance between the heads of tongue rail and stock rail is called **Heel Clearance**

■Heel Divergence = Heel Clearance + head width of Tongue Rail

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c = heel clearance

d = heel divergence

Heel Divergence

Components/Features of Points & Crossings

Heel Divergence

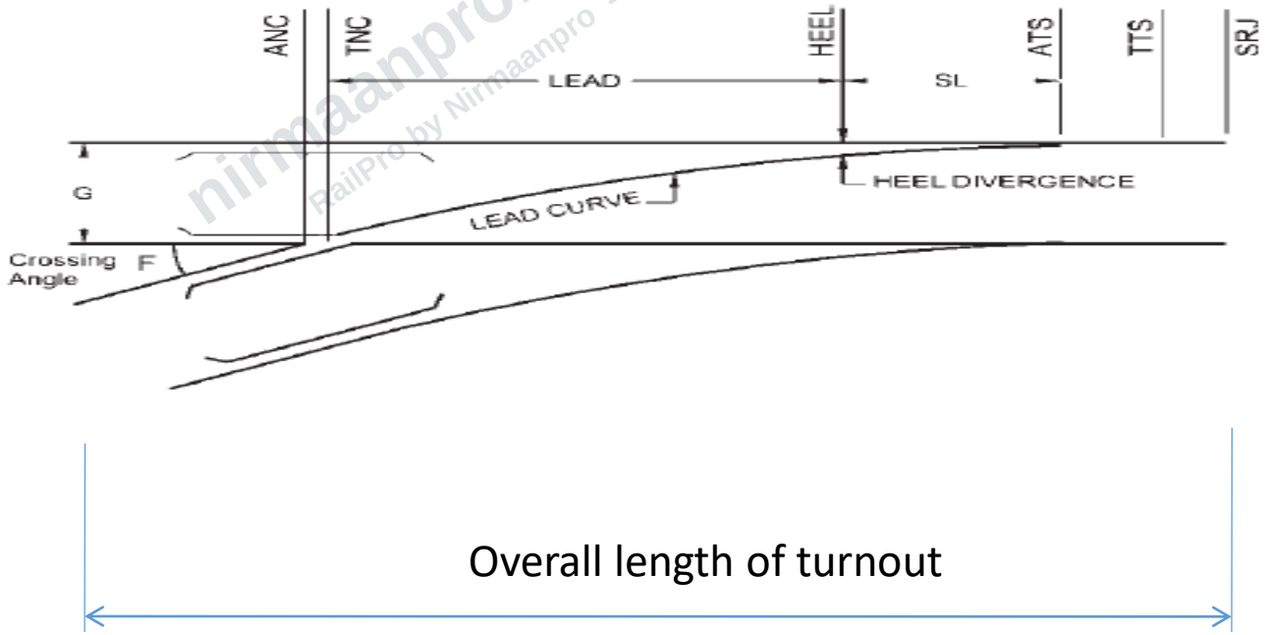
Gauge	Turnout	Straight / Curved incl TWS	PSC	Heel divergence
BG	1 IN 8.5	Curved incl TWS	PSC	182.5mm
BG	1 IN 12	Curved incl TWS	PSC	175mm
BG	1 IN 16	Curved incl TWS	PSC	145 mm

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Note: Heel divergence of 1 in 8 ½ & 1 in 12 curved switches on PSC sleepers is more because the heel is located at longer distance, at a place where the moveable length of tongue rail is flexible enough to be operated with a fixed heel.

- **Lead of turnout** : It is the track portion between heel of switch to the beginning of crossing assembly. Lead of turnout is measured from theoretical nose of crossing to the heel measured along the straight track of switch.
- **Overall length of turnout** : Overall length of turnout is the distance from stock rail joint to the heel of crossing measured along the straight.

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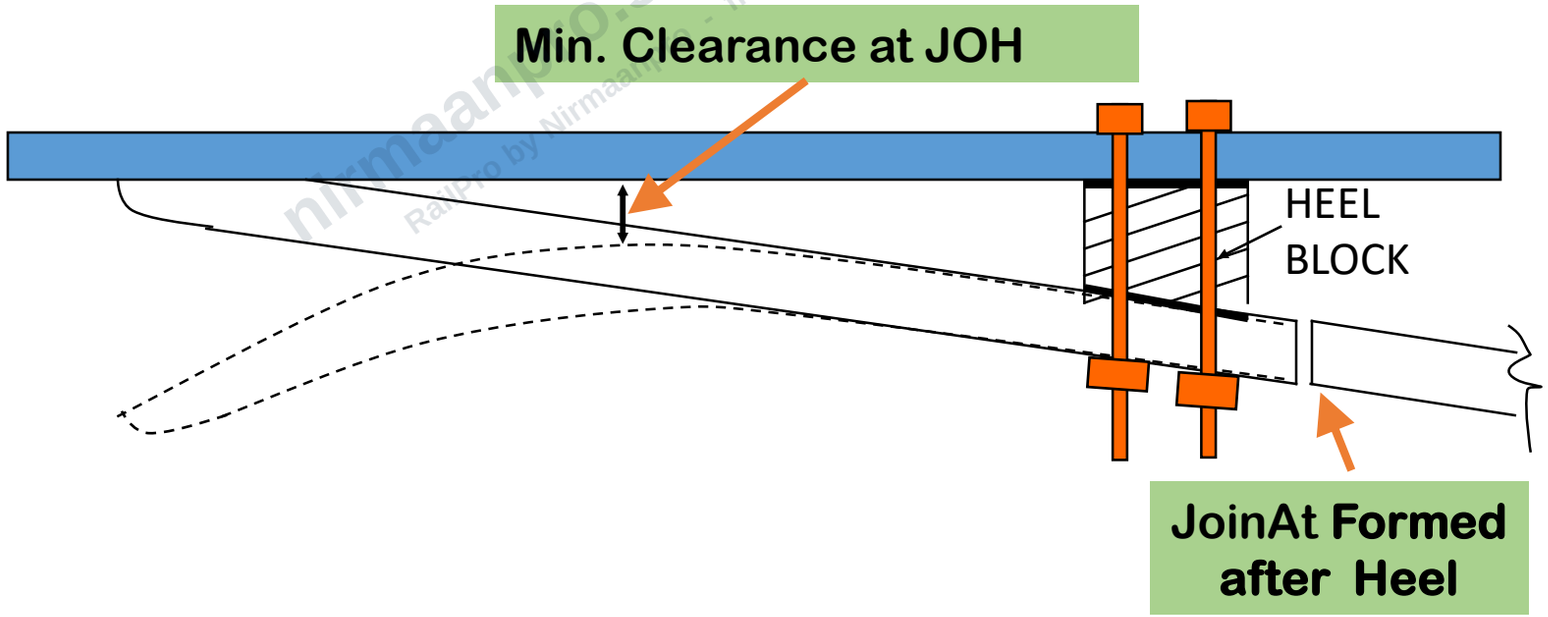


Junction of Heads (JOH)

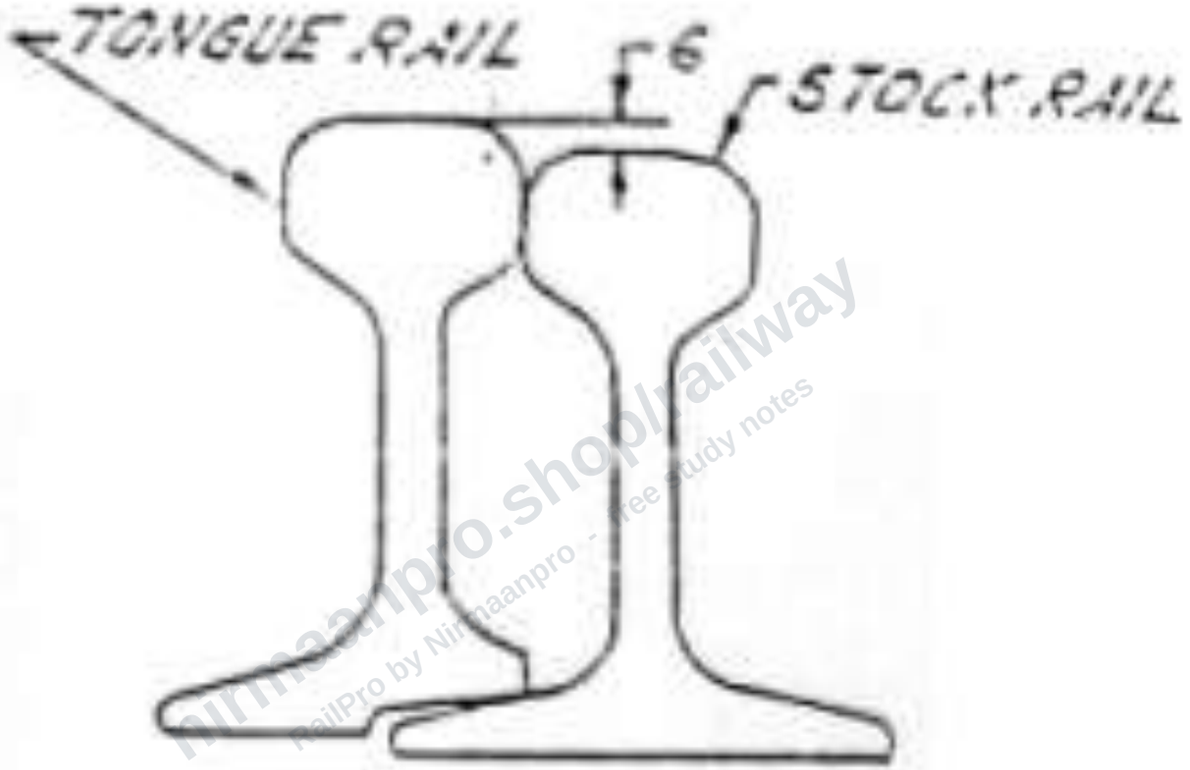
The location where tongue rail acquires full head width is called JOH. Minimum clearance at JOH is an important parameter in design & manufacture of tongue rail

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Fixed Heel Switch



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SECTION AT JOH

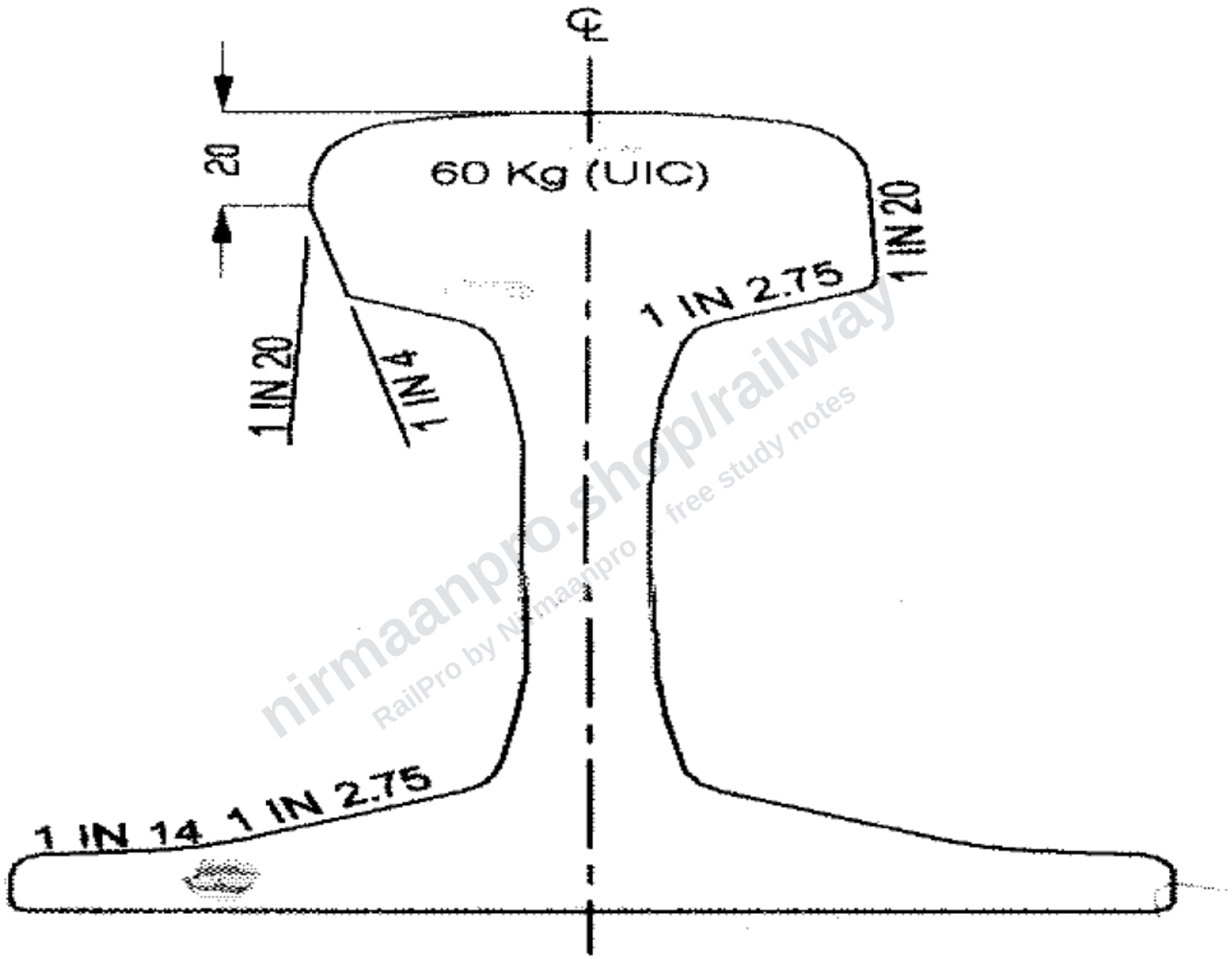
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Clearance at JOH for 1 in 12 Curved Switch

- Cause : Longer length of tongue rail (Flexibility)
- Effect : Grazing of back of tongue rail, vibrations in tongue rail and stretcher bars
- Remedy :
  - Double pull arrangement
  - Spring Setting Device
  - Increased Heel Divergence / Throw of Switch

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Showing planning of head of stock rail TWS



SECTION AT- C

SHOWING PLANING OF HEAD OF STOCK RAIL

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Versines on curved tongue rail for TWS

Curved → Tongue rail	Quarter ordinate in mm	Mid ordinate in mm	Quarter ordinate in mm	Chord length in mm
6400 mm TWS 1 in 8.5 Drg no RT-6279	23	31	23	7620
10125mm TWS 1 in 12 Drg no RT-6154	33	44	33	12480
11200 mm TWS 1 in 16 Drg no RT-7075	20	26.5	20	12935
Note: Versines should be within ± 2 mm from designed value.				

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Derailing Switch

- Derailing switches are provided on loop lines to isolate it from main line.
- The purpose is when a vehicle standing on loop line escapes and rolls down it will not infringe the main line and train operation will go on at normal speed.
- Derailing switch consists of two stock rails and one tongue rail.
- It may also be noted that derailing is a part of turn in curve.

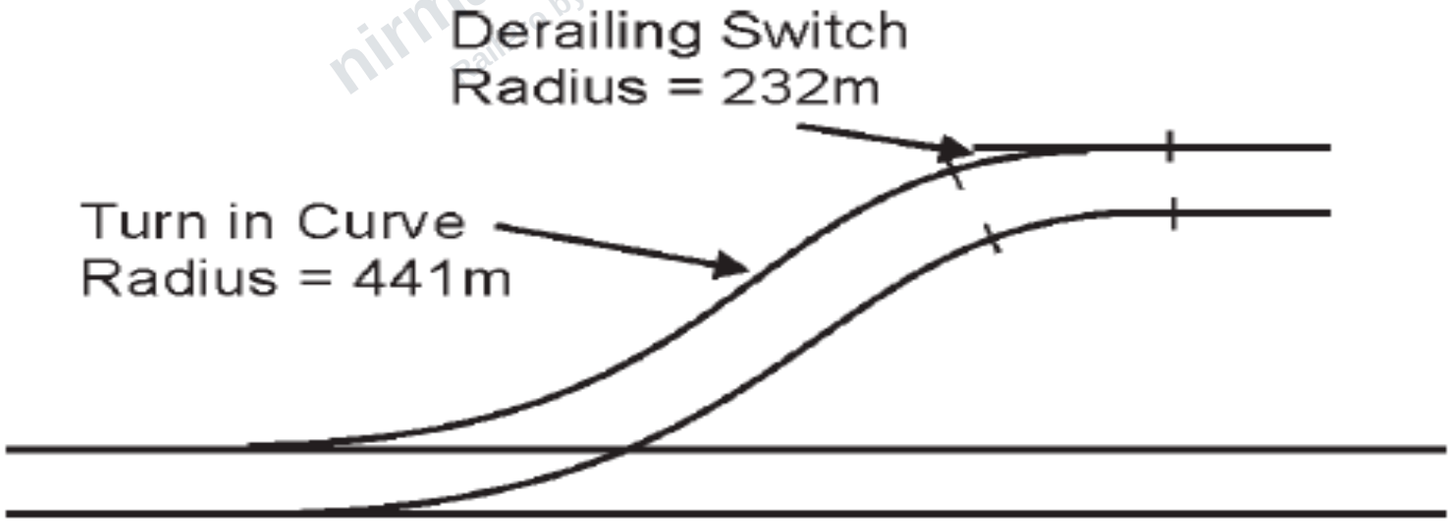
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54A
54 A

Derailing Switch

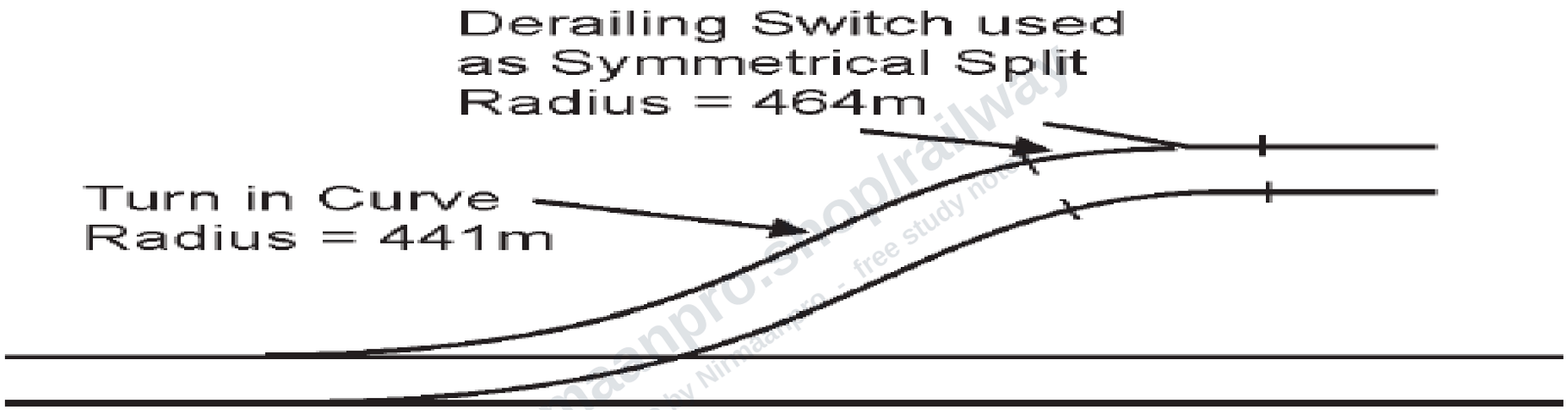
- As per RDSO T/5856, RDSO T/6068 derailing switch is a part of turn in curve. One of the stock rail and the only tongue rail is provided a pre-curvature of radius 232.260m.
- When turn in curve is provided with a radius of 441m, whereas radius of tongue rail of derailing switch is 232m.
- There is a need to provide derailing switch as symmetrical split if above designs are to be used.

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Derailing Switch

- By providing Derailing switch as symmetrical split radius of tongue rail of derailing switch will almost match with turn in curve radius



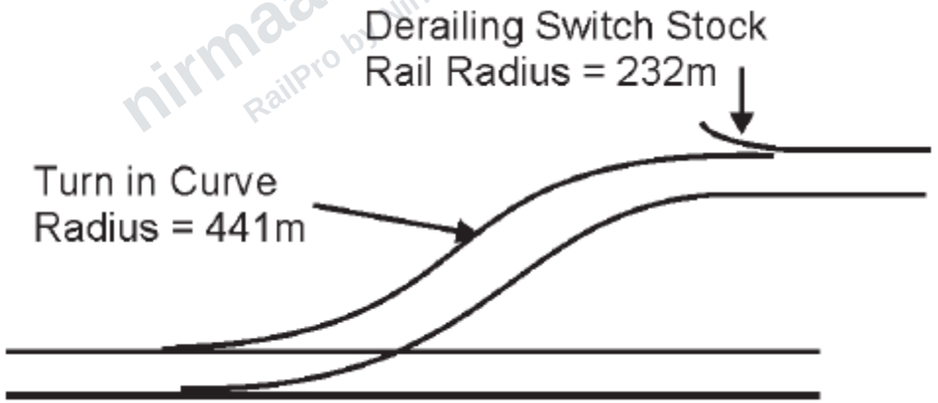
- RDSO have also issued drawings for laying derailing switch as symmetrical
- RDSO/T-8077 for 60kg, 6400mm over-riding curved derailing RH switch on BG on PSC sleepers.
- RDSO/T-8153 for 52kg, 6400mm over-riding curved derailing RH switch on BG on PSC sleepers.

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Derailing Switch

- Two more new drawings for derailing switch have been issued by RDSO-
- RDSO/T-7008, in which tongue rail as well as one stock rail is straight and the other stock rail have been given radius of 232m. Such derailing switches can be laid on straight after end of turn in curve. This design has an advantage that turn in curve is less disturbed, but length of loop line gets reduced by this design. Hence these cannot be used at all the places.

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Derailing Switch

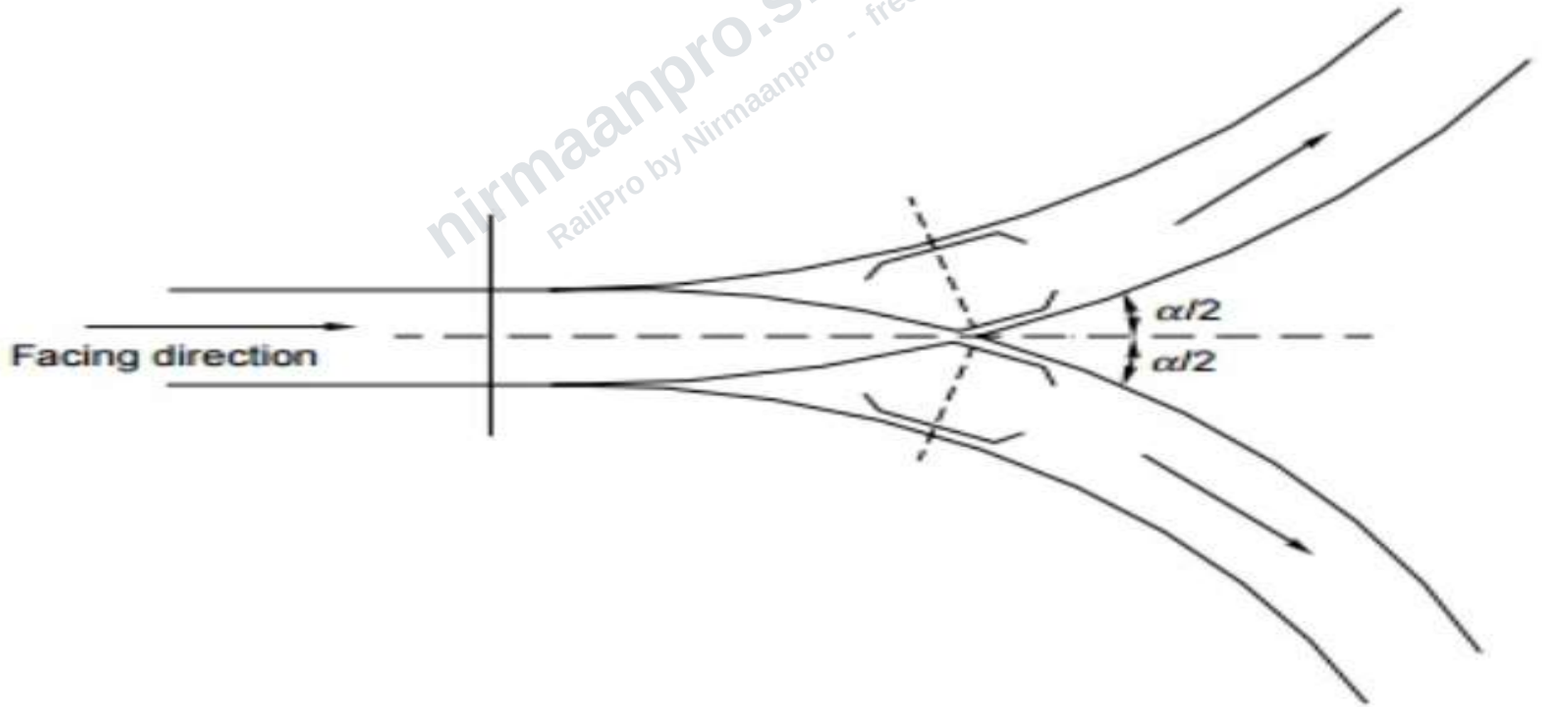
- RDSO/T-8089, in which tongue rail is made curved and a normal 60kg tongue rail of 1:12 curved switch of 10125mm switch length have been used. In this derailing switch tongue rail will be a part of turn in curve and radius will be of the order of 441m. So it will suit more to the turn in curve radius.
- Selection of design of derailing switch to be used will depend on whether enough space for accommodation of derailing switch on straight is available or not.
- If space is not available derailing switch of RDSO/T-8089, RDSO/T-5856 or RDSO/T-6068 should be utilized.

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Symmetrical split

- When a track splits up in two different directions with equal radii the layout is known as a Symmetrical split.
- Symmetrical split is a contrary flexure in which radii of two curves are same.

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- It consists of a pair of stock and tongue rails along with lead rails curved.
- It consists of one acute crossing.
- The layout is symmetrical to center line i.e; the radii of main line track and branching track are equal.
- Sleepers should be laid perpendicular to centre line of crossing
- The layout provides facilities for diverting vehicle both towards the left and right.
- It is suitable for locations with space constraints in yards as it occupies comparatively much less space than a turnout from straight track.
- It is suitable for increasing speed with space constraints in yards.

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Permissible speed on symmetrical split as per IRPWM Para no 410(4)

S.No	Type of turnout	Permissible speed
1	1 in 8.5 curved switch	15 KMPH
2	1 in 8.5 symmetrical split with curved switches	30 KMPH
3	1 in 12 curved switch	30 KMPH

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Crossing

- It is a device introduced to permit movement of wheel flanges at the intersection of two running rails.

- At crossings two gauge faces have to cross each other.

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Crossing

- Gaps to be provided in the track at this location for wheel flange to pass.
- The flanges of wheel jump in this gap i.e from throat to Actual nose of crossing.
- To guide wheel set so that it will nose is not hit with other wheel.
- Check rails are provided opposite the nose of crossing.



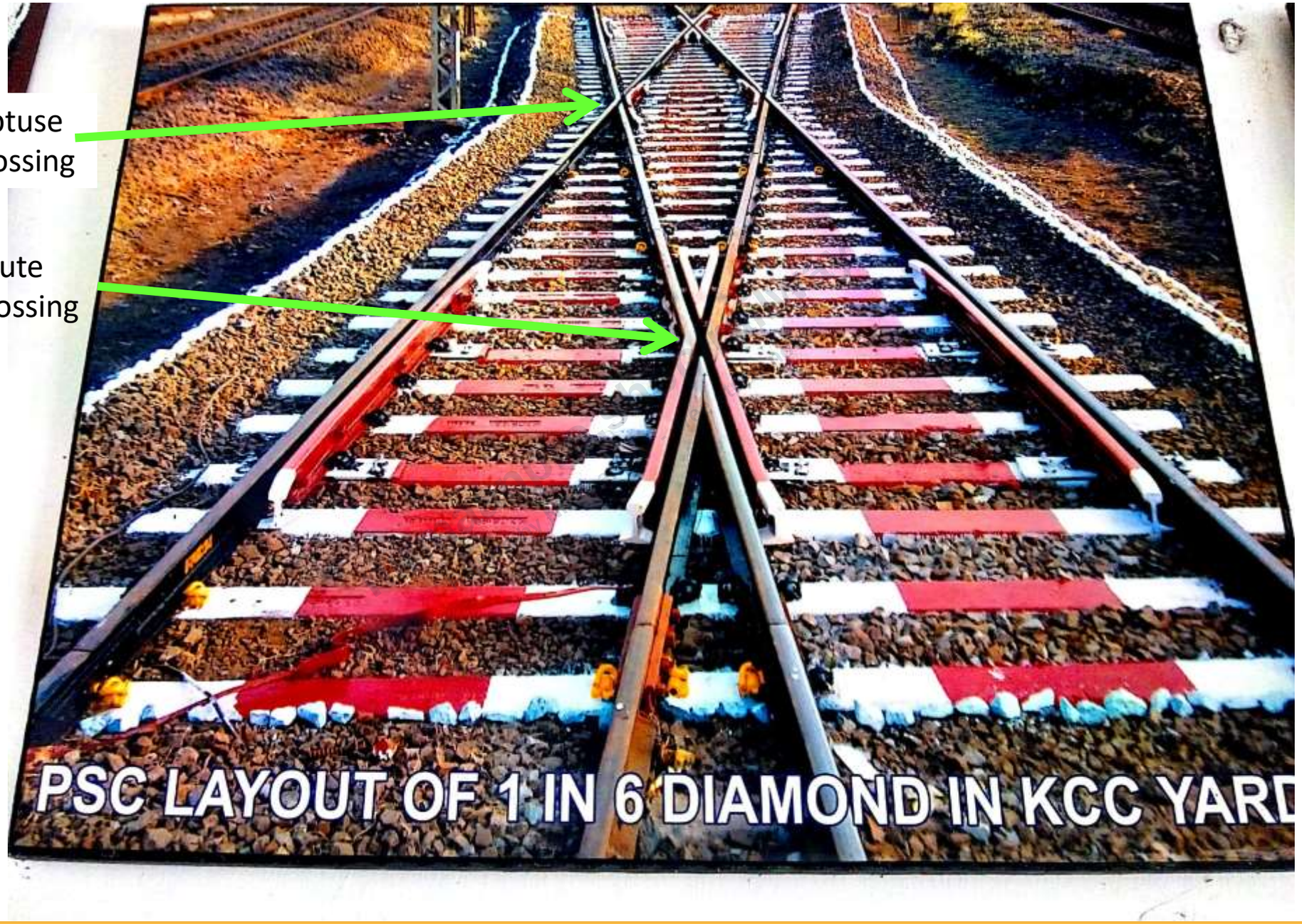
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Types of crossing

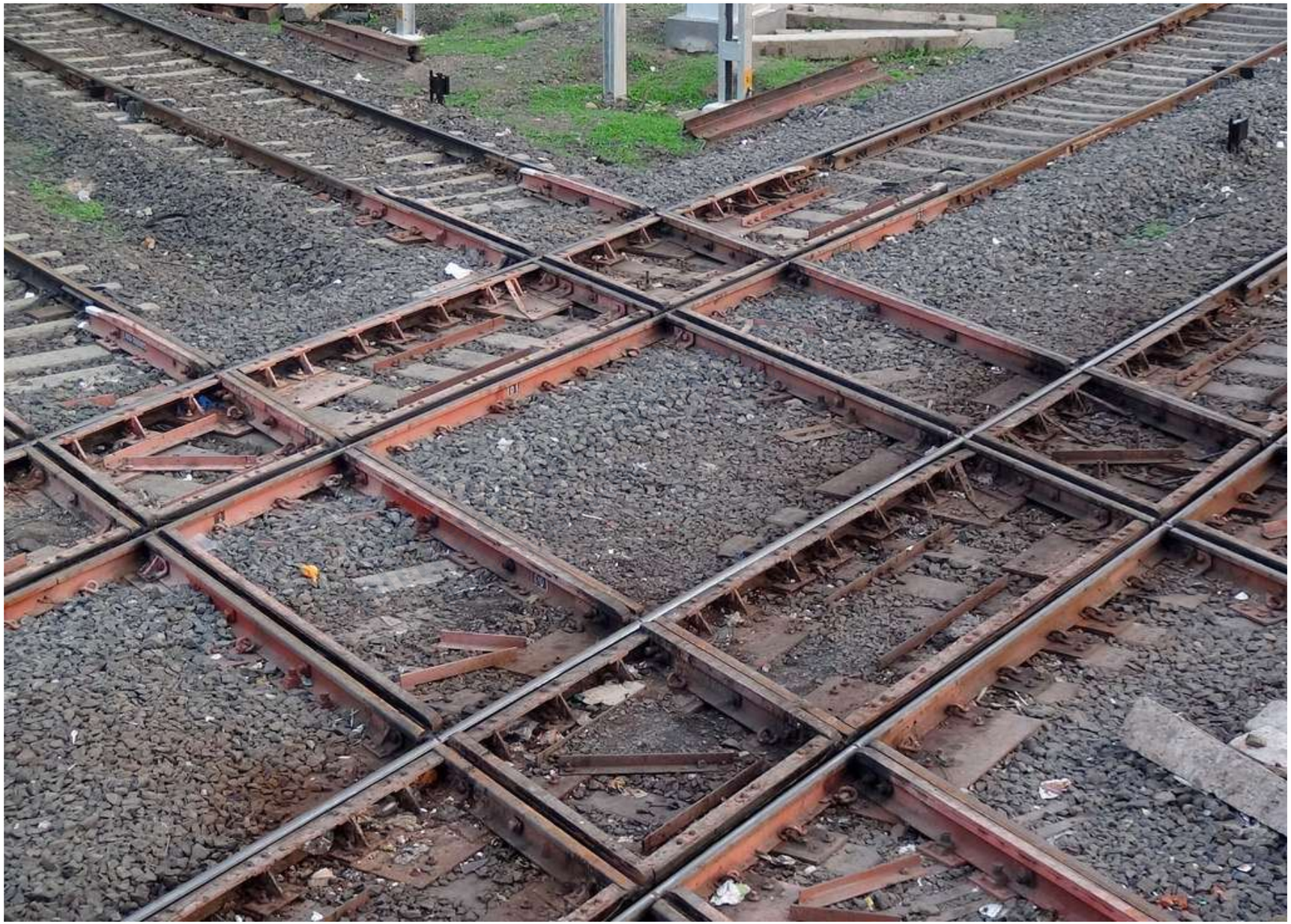
- Based on geometry
- Acute crossing : The angle between gauge lines of intersecting rail is acute the crossing are called as acute crossings.
- Obtuse crossings : The angle between gauge lines of intersecting rail is obtuse the crossing are called as acute crossings.
- Square crossing : When the gauge lines intersect at right angles the crossing is called as Square crossing.
- Diamond crossing : When one track crosses another track it forms a parallelogram/rhombus named diamond at their intersection. A diamond crossing consists of two acute crossing and two obtuse crossing.

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Diamond crossing



Square crossing



Types of crossing

Based on manufacturing process

- Built up crossing
- Cast Manganese crossing
- Weldable CMS crossing
- Heat treated welded crossing
- Swing nose crossing

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Crossings

- Types
  - Built-up Crossing



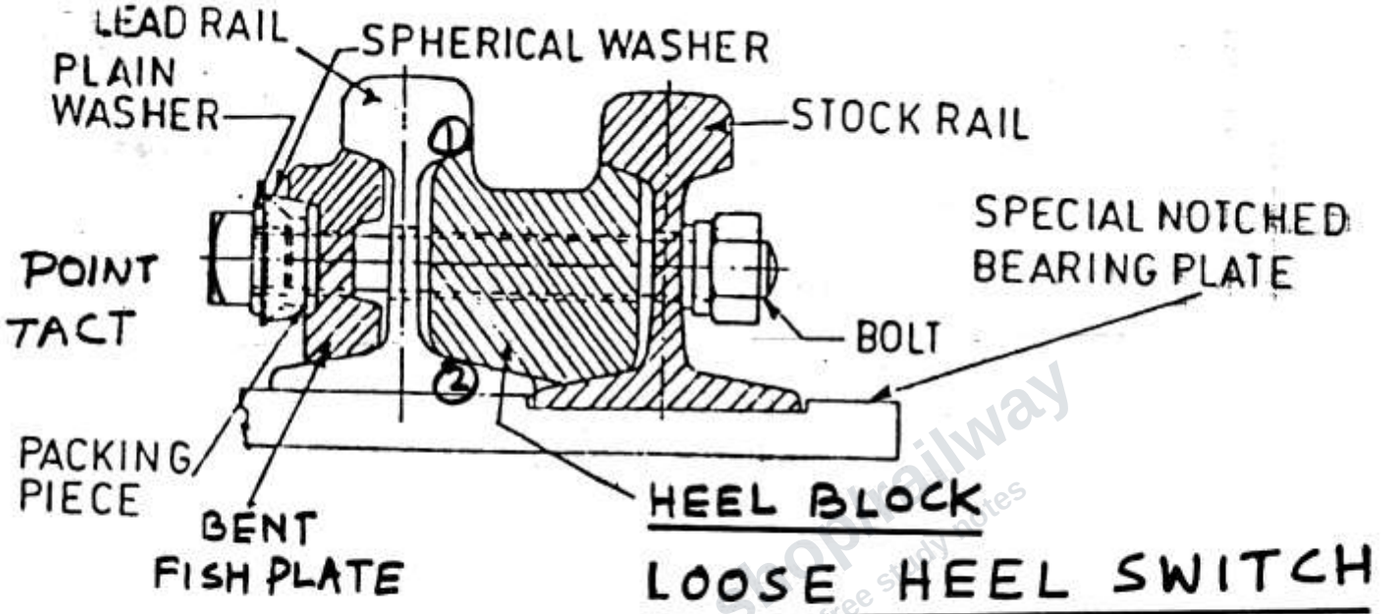
  - Cast Manganese Steel (CMS) Crossing



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(A)

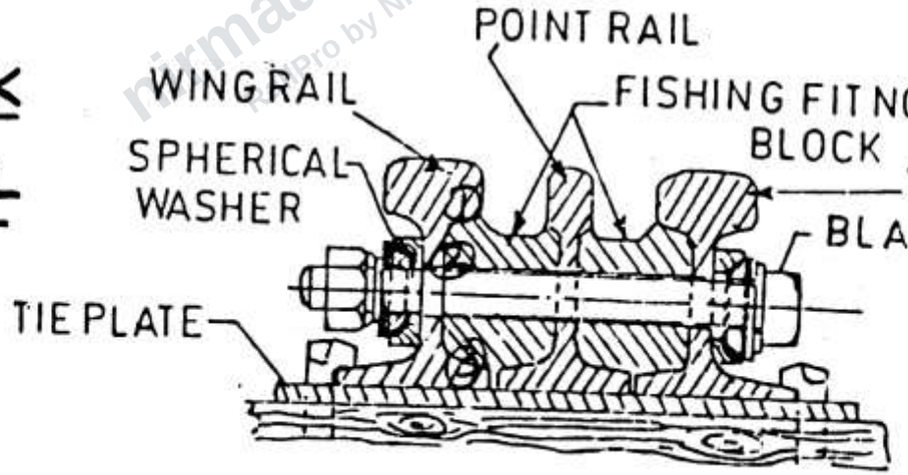
TWO POINT CONTACT



LOOSE HEEL SWITCH

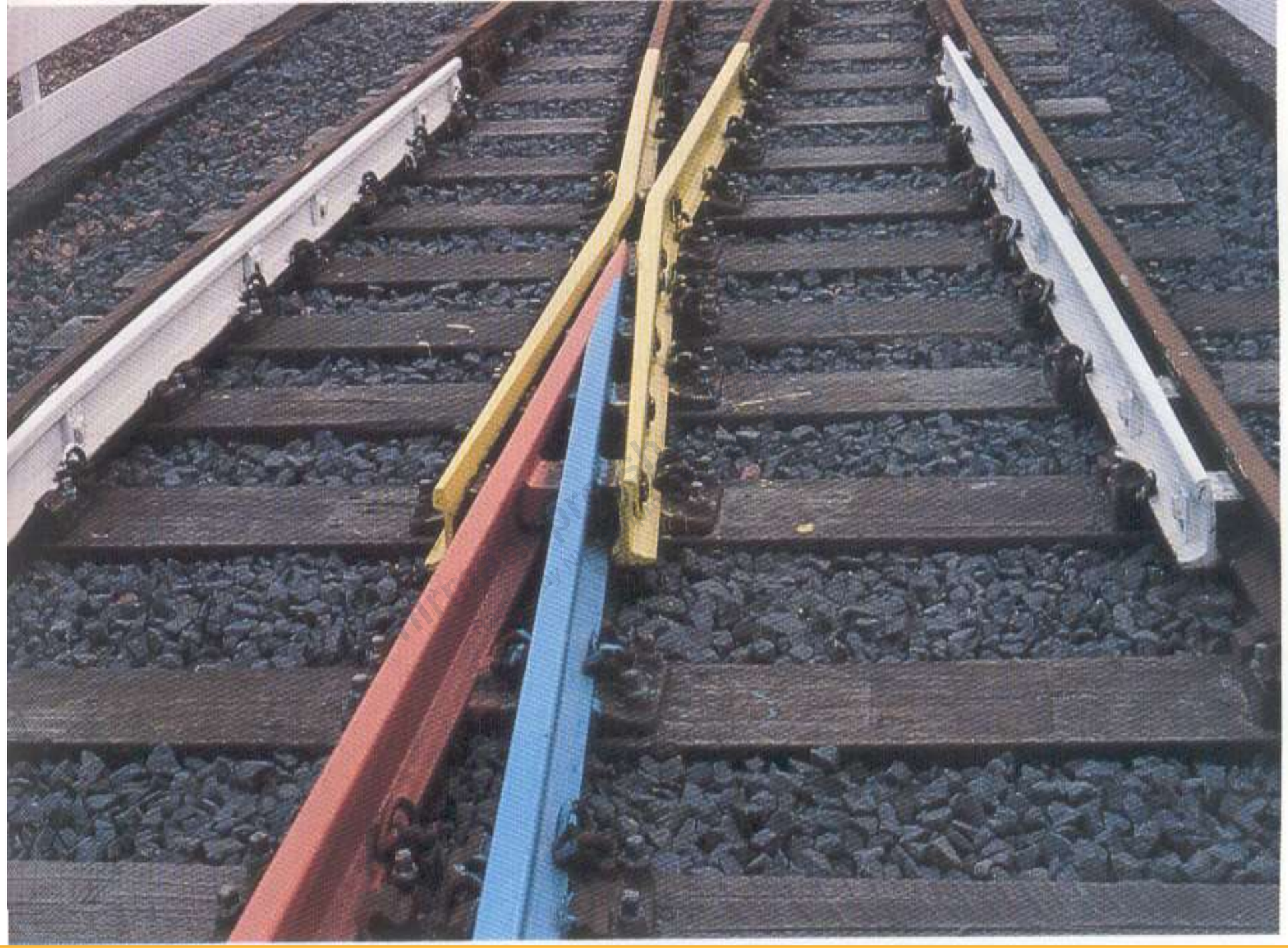
(B)

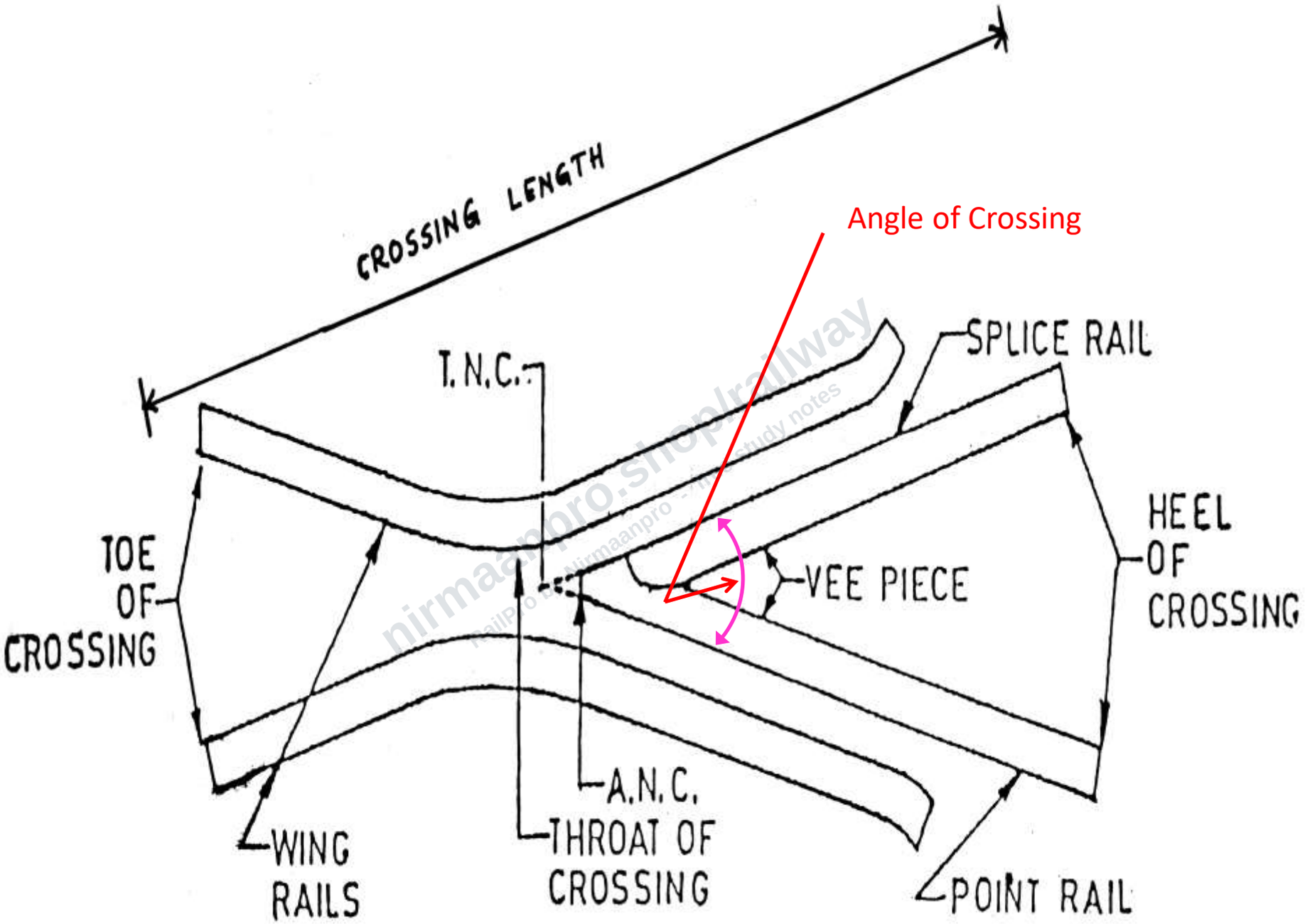
NOSE BLOCK OF VEE RAIL



THREE SURFACE CONTACTS (FISH+WEB) FIT

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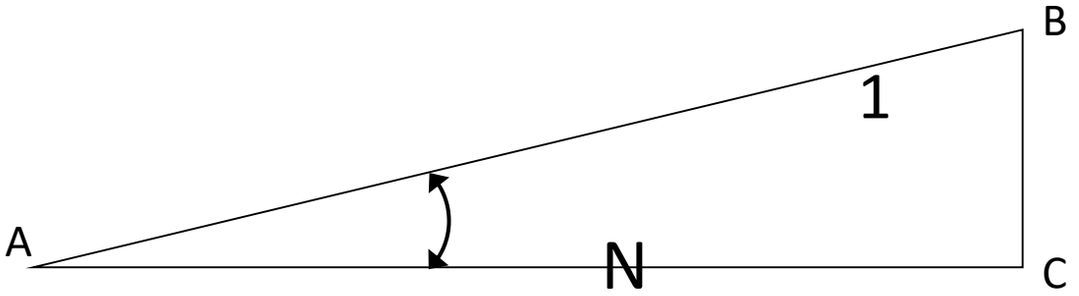
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Important terms related to crossing

- **Theoretical Nose of Crossing (TNC) :** It is an imaginary Point of intersection of two gauge lines of the vee piece when produced, intersect. This is used for calculations.
- **Actual Nose of Crossing (ANC) :** It is the front pointed end of the point rail which is located at a point where the distance between the gauge lines of vee piece is equal to thickness of web of the rail is known as actual nose of crossing (ANC) The nose is tapered down by 6 mm in a length of 90 mm to avoid hitting of nose.
- **Throat of Crossing:** Point where wing rails of crossing are the closest to each other

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NUMBER OF CROSSING



- In triangle ABC

  A = TNC
  BC = **1**
  AC = **N**
  Angle A = crossing angle say **(F)**
  Angle C = 90°

  AC/BC = Cot F

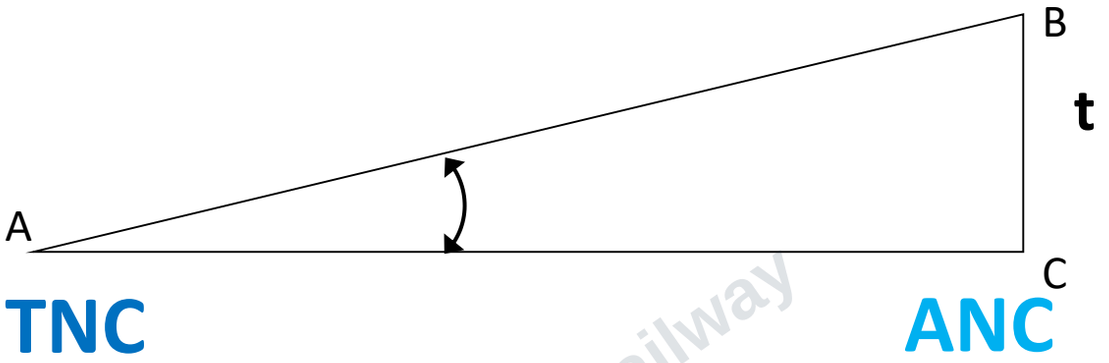
  AC = BC Cot F = 1 Cot F = Cot F i.e; N = Cot F

- Crossing are designated as

  1 in N (**N** being the number of crossing)
  (**N** defined as N = cot F)

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TNC to ANC



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- In triangle ABC

  A = TNC

  BC = ANC = Thickness of web of rail **(t)**

  Angle A = crossing angle say F

  Angle C = 90°

  AC/BC = Cot F

  AC = BC Cot F = t Cot F

- **Angle of Crossing :** Angle contained between the gauge lines of vee piece. This angle is measured at TNC

  Typical angles of crossing are

  1 in 8.5 - 6° 42' 35"

  1 in 12 - 4° 45' 49"

  1 in 16 - 3° 34' 35"

  1 in 20 - 2° 51' 45“

- **Number of Crossing :** It is cotangent of the angle of the crossing. These are designated as 1 in N where N is number of crossing.

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Distance between TNC to ANC

- **TNC to ANC = t cot F**

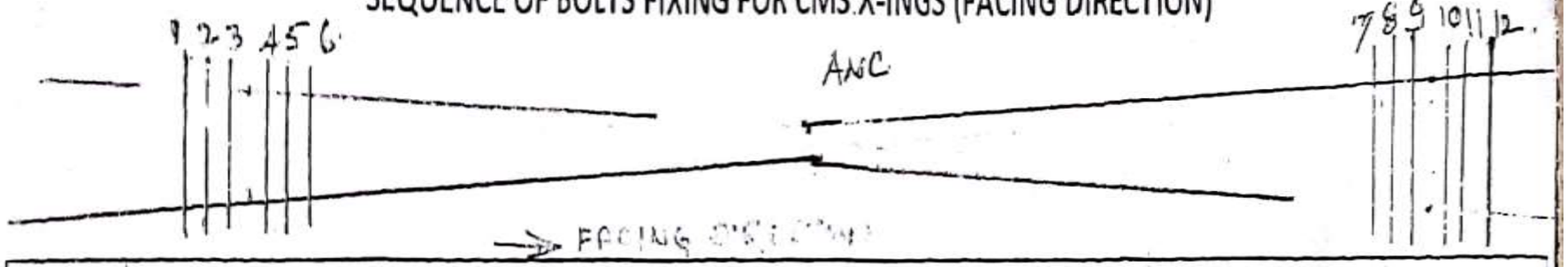
Layout	Rail	TNC to ANC
1 IN 8.5	52 KG	132 MM
1 IN 8.5	60 KG	141 MM
1 IN 12	52 KG	186 MM
1IN 12	60 KG	198 MM
1 IN 16	52 KG	248 MM
1 IN 16	60 KG	264 MM

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- **Toe of crossing :** It is the end of the front leg of crossing. It is the joint where wing rails of crossing meets to lead rail. Fish plated with 6 bolts is provided and made machined joint to reduce excessive hammering.
- **Heel of crossing :** It is the end of the back leg of crossing.It is the last fish plated joint with 6 bolts at the end of nose of crossing. This joint also shall be made machined joint to reduce hammering effect of wheel.
- **Length of Crossing :** It is the inclined distance between toe and heel of crossing.

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SEQUENCE OF BOLTS FIXING FOR CMS X-INGS (FACING DIRECTION)



ANGLE	TOC						HOC					
	1	2	3	4	5	6	7	8	9	10	11	12
1 in 8½ 52kg T4867	40 (T11535)	38 (T11533)	36 (T11531)	34 (T11529)	32 (T11527)	31 (T11526)	30 (T11525)	32 (T11527)	34 (T11529)	36 (T11531)	38 (T11533)	40 (T11535)
1 in 8½ 60kg T4967	41 (T11536)	39 (T11534)	37 (T11352)	35 (T11530)	33 (11528)	31 (T11526)	30 (T11525)	32 (T11527)	34 (T11529)	36 (T11531)	38 (T11533)	40 (T11535)
1 in 12 52kg T4734	40 (T11535)	38 (T11533)	36 (T11531)	34 (T11529)	32 (T11527)	31 (T11526)	31 (T11526)	32 (T11527)	34 (T11529)	36 (T11531)	38 (T11533)	40 (T11535)
1 in 12 60kg T4220	40 (T11535)	38 (T11533)	37 (T11532)	36 (T11531)	34 (T11529)	33 (T11528)	29 (T11524)	30 (T11525)	32 (T11527)	33 (T11528)	34 (T11529)	36 (T11531)
1 in 16 60kg T5693	--	--	36 (T11531)	35 (T11530)	34 (T11529)	33 (T11528)	32 (T11527)	33 (T11528)	34 (T11529)	35 (T11530)	--	--

Note 1: Fixing of bolts from 1 to 12 in facing direction of ANC.

2: T3930 Tapered washers to be provided on both sides, Tapered washers higher thickness to be placed towards ANC.

3: T10773 Spring washers tobe provided at Nut side only.

4: Pitch between two adjacent bolts is 166mm, dia of drill bit 27mm, half of the pitch is 83mm for gapless joints.

5: Relation between length of the bolt and Drg. No. is TO ADD 5 TO LAST TWO DIGITS OF DRG. NO. TO GET THE LENGTH OF THE BOLT IN CM.
(Ex: T11535 = 35+5 = 40CM LENGTH)

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- **Cast Manganese crossing CMS**
- Shorter length in length and Monolithic in construction.
- These are cast hollow at the bottom with cross ribs keeping metal thickness enough to suit the load.



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Crossings Comparison

Sl. No.	Description	CMS Crossings	Built-up Crossings	Built-up Crossings
1	Specification	IRS - T -29 74TH	T- 12 -88 GR. 710	T - 12 (1996) GR.880
2	Metallurgy	%	%	%
	C	1.4	0.45 - 0.60	0.80
	Mn	11 - 14	0.95 - 1.40	0.80 - 1.30
	Si	0.50 (Max.)	0.04 - 0.50	0.10 - 0.50
	S	0.03 (Max.)	0.05 (Max.)	0.035 (Max.)
	P	0.06 (Max.)	0.05 (Max.)	0.035 (Max.)
3	UTS (KG/MM^2)	82 -91	71	88
4	Hardness (BHN)	185-200 (Initial) 400 (After Work Hardening)	220 - 240	260

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- **Advantages of CMS crossing**
- These are monolithic in nature due to which wheel load coming is distributed over a larger area.
- More number of sleepers bearing the load due to which deformation and damage to ballast packing is less.
- Running surface gets work hardened after passage of 10 GMT therefore subsequent wear is less.
- There are no fittings or blocks so less maintenance and less packing.

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- **Advantages of CMS crossing** .
- Cost of CMS crossing is 2 to 2.5 times more than BUP crossing but life is 5 to 6 times more compared to BUP crossing.
- Crack propagation is very slow hence even if crack has developed in the crossing it can be continued in the traffic under observation.

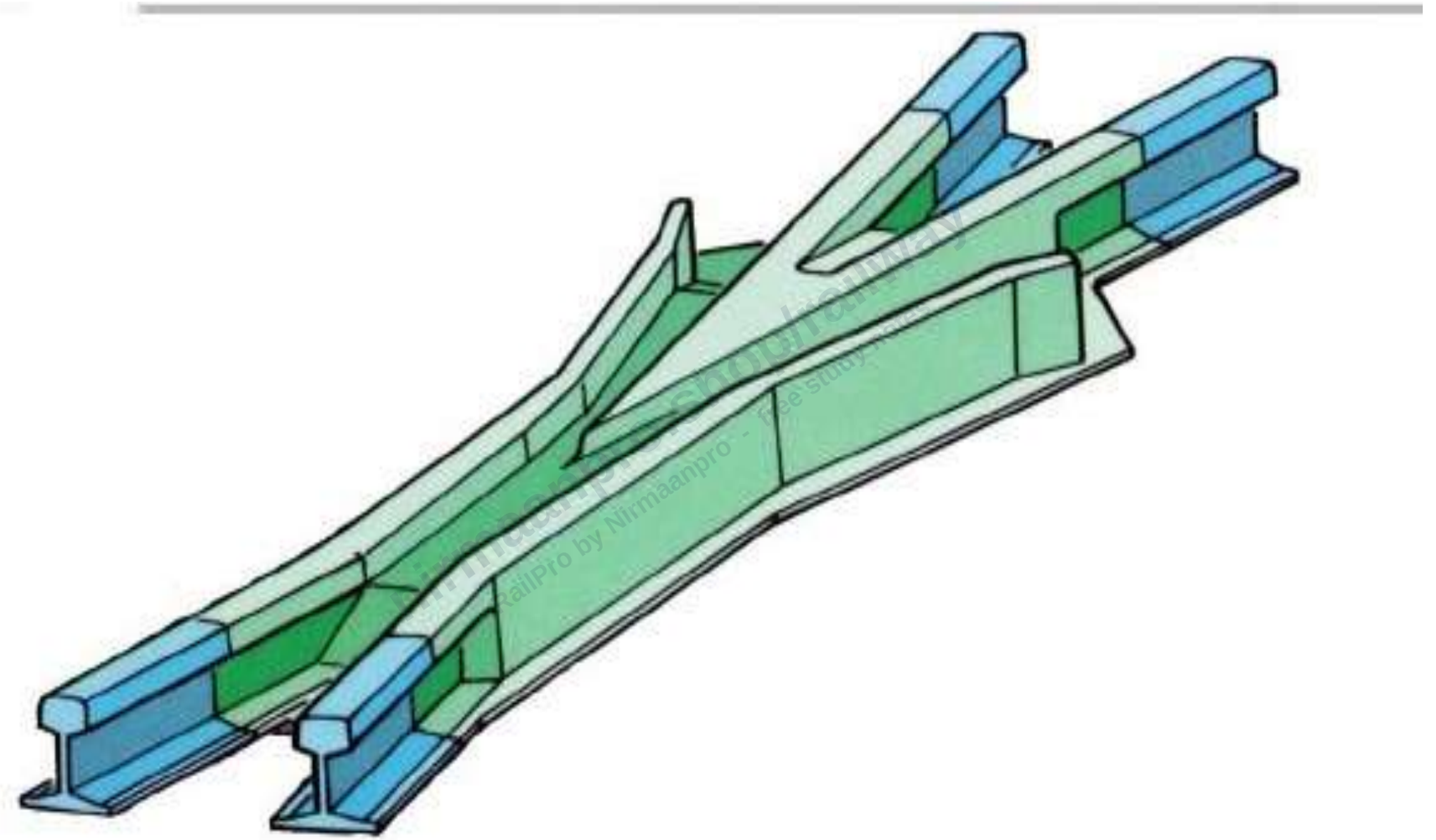
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Crossings Comparison (contd.)

Layout	Length of Built-up Crossings (mm)	Length of CMS Crossings (mm)
1 in 8.5	4800	3330
1 in 12	5970	4350
1 in 16	7000	5400

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Weldable CMS crossing



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Heat treated welded crossings



Swing nose crossing

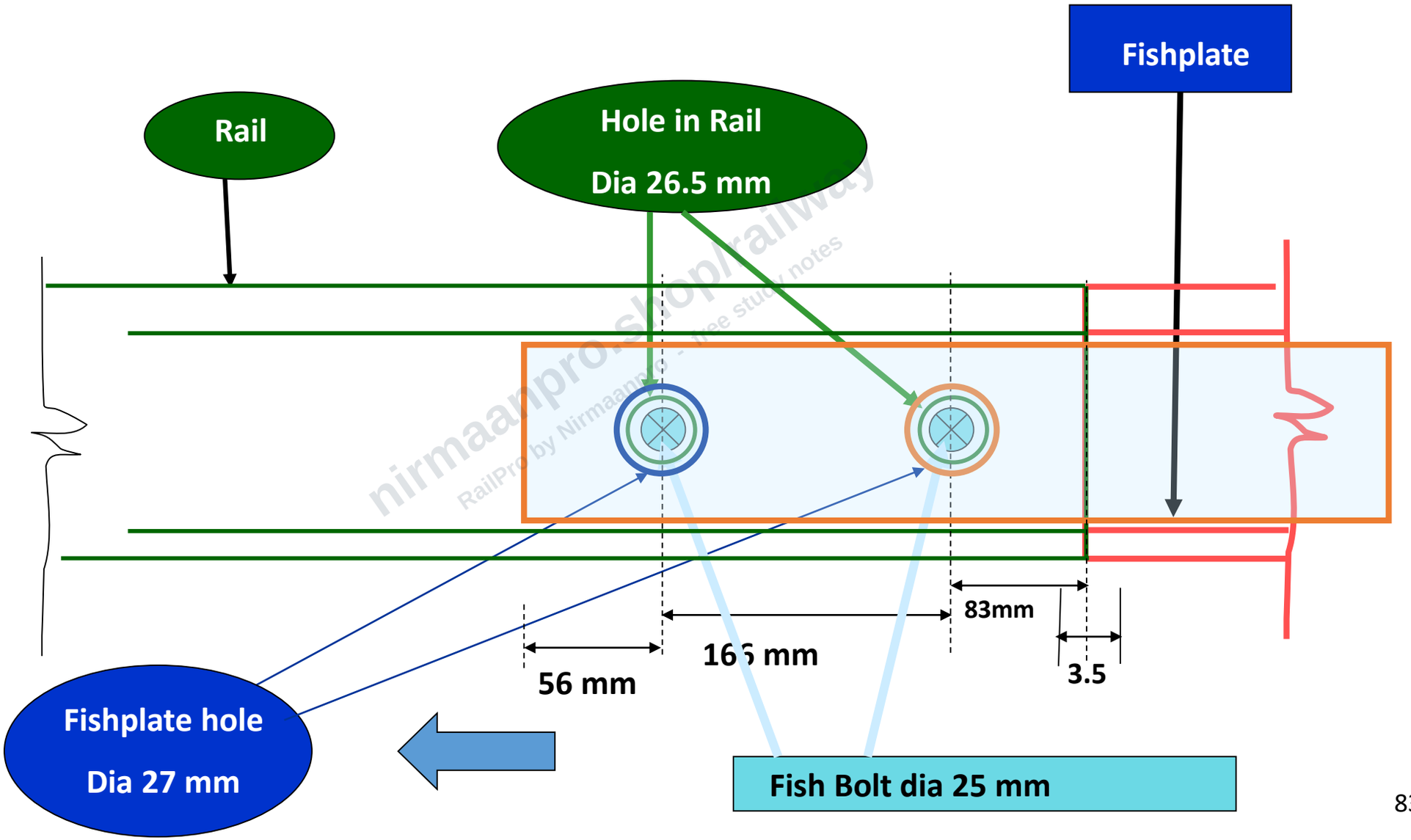


Gapless Joint/ Machine Joint

- Diameter of Rail Holes
  - 26.5 mm *(32 mm in normal rail joints)*
- Initial gap = Zero.
- Distance of center of first and second bolt hole from rail end *(for 52 kg and 60 kg Rail Sections)*
  - 83 mm and 249 mm
    (80 mm and 246 mm in case of normal joints)

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Gapless Joint



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Various Types of Turnouts with Curved Switches and CMS Crossings on Fan shaped PSC Sleepers BG (60/52 Kg)

Rail Spec / Sleeper	Layout	T/O Drawing No	Switch Drawing No	Crossing Drawing no
52 KG /PSC	1 in 8.5	RT 4865 (Alt 6 21.7.17)	RT 4866 (Alt 6 21.7.17)	RT 4867 (Alt 8 21.7.17)
60 KG / PSC	1 in 8.5	RT 4865 (Alt 6 21.7.17)	RT 4966 (Alt 5 21.7.17)	RT 4967 (Alt 7 21.7.17)
52 KG /PSC	1 in 12	RT 4732 (Alt 4 27.2.17)	RT 4733 (Alt 5 27.2.17)	RT 4734 (Alt 5 27.2.17)
60 KG / PSC	1 in 12	RT 4218 (Alt 6 02.11.16)	RT 4219 (Alt 6 02.11.16)	RT 4220 (Alt 5 02.11.16)
60 KG /PSC	1 in 16	RT 5691 (Alt 3 05.2.18)	RT 5692 (Alt 3 05.2.18)	RT 5693 (Alt 1 05.6.03)
60 KG /PSC	1 in 20	RT 5858	RT 5859	RT 5860
52 KG /PSC	1 in 8.5 S/S	RT 5353 (Alt 2 21.4.98)	RT 5354 (Alt 3 01.5.10)	RT 4867 (Alt 8 21.7.17)
60 KG / PSC	1 in 8.5 S/S	RT 5353 (Alt 2 21.4.98)	RT 5354 (Alt 3 01.5.10)	RT 4967 (Alt 7 21.7.17)

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Various Types of Turnouts with Curved Switches and CMS Crossings on Fan shaped PSC Sleepers BG (60/52 Kg)

Rail Spec / Sleeper	Layout	T/O Drawing No	Switch Drawing No	Crossing Drawing no
52 KG /PSC	1 in 12 S/S	RT 5553	RT 5554	RT 4734 (Alt 5 27.2.17)
60 KG / PSC	1 in 12 S/S	RT 5553	RT 5554	RT 4220 (Alt 5 02.11.16)
60 KG / PSC TWS	1 in 8.5	RT 6279	RT 6280	RT 4967 (Alt 7 21.7.17)
52 KG / PSC TWS	1 in 12	RT 5268	RT 5269	RT 4734 (Alt 5 27.2.17)
60 KG / PSC TWS	1 in 12	RT 6154 (Alt 3 12.12.17)	RT 6155 (Alt 5 08.6.18)	RT 4220 (Alt 5 02.11.16)
60 KG / PSC TWS	1 in 16	RT 7075	RT 7076	RT 5693 (Alt 1 05.6.03)

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Spring Points

- Spring Points were being used at Slip Sidings in trailing direction movement. The switch is always connected to siding by spring pressure and wheels of train go through in trailing direction by making flange-way clearance itself through switch. Now a days these are not used.

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Turnouts on Concrete Sleepers

- **Breakthrough**
  - In 1990 – Development of Fan-Shaped Layout

- **Features**
  - Inter changability for LH as well as RH Turnouts
  - Lead portion Sleeper spacing
    - More on outer side than on inner side

      measured along gauge faces of Main Line rails
    - Resemble fan → "Fan Shaped Layout"

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Salient Features of Fan Shaped Layout

- Gauge - 1673 mm
- SRJ to TNC - (Distance same as that of IRS Layout)
- Joints - Welded/Machined
- Approach Sleepers
  - Special sleepers on Approach (2750) and Exit (2550);
  - One sleeper for Signal fitting (Lock Bar) 60 S (2750)
- Total No. of sleepers
  - 1 in 12 - 96 - 83 + ((3 x 4) + 1)
  - 1 in 8.5 - 67 - 54 + ((3 x 4) + 1)
  - 1 in 16 - 114 - 101 + ((3 x 4) + 1)

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Salient Features of Fan Shaped Layout

- **Fittings**
  - **Switch Portion-**
    - **Dowel & Screw system with rubber sole pad and spring washer.**
  - **Lead Portion-**
    - **ERC with GR Pad and Liner**
  - **Crossing Portion-**
    - **ERC with GR Pad and Liner**

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Salient Features of Fan Shaped Layout

- **Crossing-**
  - Cast Manganese Steel or
  - Heat treated
  - Weldable CMS

- **Check Rails-**
  - Machined Head Check Rail;
    - No Flare Required;
    - Same check blocks are used at different locations

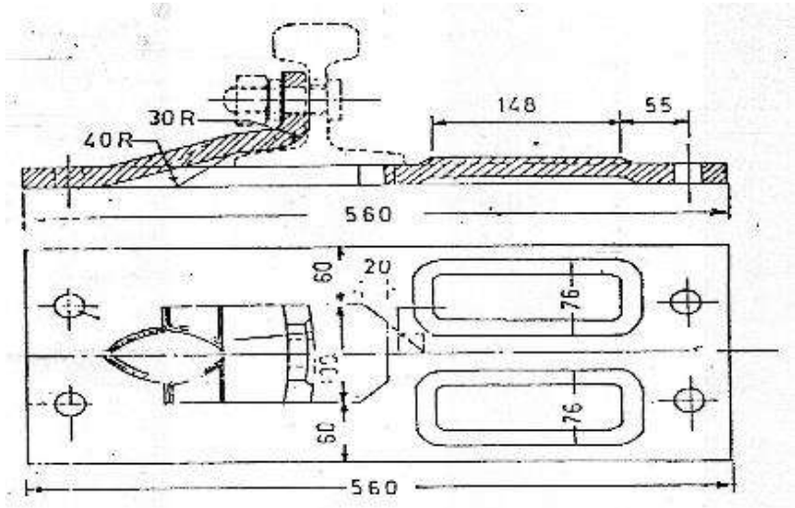
- **Interchangeability of sleepers**
  - Same set for RH & LH Turnouts
  - RE to be on right side

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Salient Features of Fan Shaped Layout

- **Switch**
  - Overriding switch/Thick web switch (1 in 12)
  - For 1 in 12 - High Speed Switches
    - Longer Switches (10125 mm)
    - Increased Heel Divergence (175 mm)
    - Lesser SEA (0˚ 20’ 0”)
    - 3 Following stretcher Bars.

- **Slide Chairs**
  - Specially designed



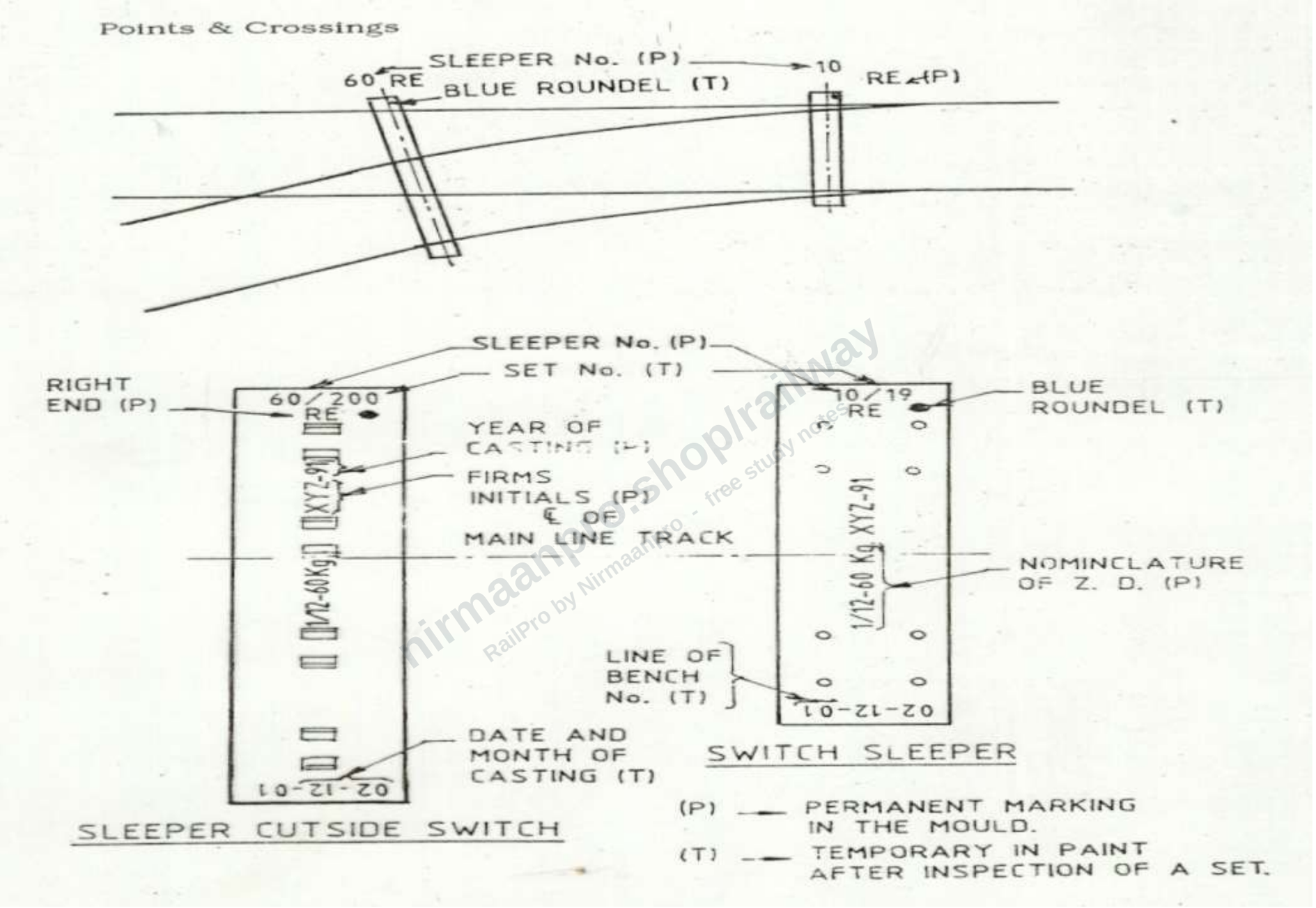
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Salient Features of Fan Shaped Layout

- **Sleeper Sets**
  - Trapezoidal cross-section with width of 240 *(at top)*, 260 mm *(at bottom)*, and 210 mm *(height)*
  - Designed for 60 kg, **BG**
  - Can be used for 52 kg **BG**

    with,
    - Different slide chair/bearing plate arrangement in switch portion
    - Combination liners in lead portion
    - Normal liners in crossing portion
    - Check rail will have T-3708 on both side
    - Bearing plates after heel will have GFN liner for 52 Kg

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Marking on PSC Sleepers for Points and Crossings

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Components of Points and crossing on PSC

- Turnout consists of many components that include
- Tongue rails, Stock rails, Lead rails
- Crossing with blocks and bolts
- Check rails with Check blocks with bolts and washers
- Slide chairs
- Plate screws
- Stretcher bars with lugs and bolts
- Spherical washers , Tapered washers
- Heel Blocks, Distance blocks with bolts
- Switch stops or Slide block with bolts
- Various types of liners, Rubber pads, ERCs etc.

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Components of Points and crossing

- Because of complicated assembly, if any of the fitting is missing, it is impossible to get correct track parameters on turnout assembly.
- Before assembling turnout a check list of all the components required must be made available along with their relevant drawings.
- A check list of various components for most popular turnouts
- Methods of laying
- In situ linking
- Pre assembly of complete turnout adjacent to track and replacement as a unit with T-28 cranes.
- Slewing of preassembled switch and replacements of rest of turnout part by part (by manual)

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Selection of method of laying.

- Factors depend for selection of method of laying.
- Whether T-28 machines is available for replacement.
- Space for assembly of full turnout is available or only switch can be assembled in the available space near the track.
- Space for unloading and stacking of sleepers and other assemblies.
- Whether Obstructions like OHE mast, signaling installation, bridges are to cause obstructions during lateral shifting of turnout during traffic block from place of assembly to place of laying.
- Availability of traffic block also affects method of laying.

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Pre requisites before actual work of laying

- Adequate space for stacking of turnout components and assembly of turnout.
- Availability of adequate quantity of correct size of bolts, nuts and fittings.
- Proper tools required for assembly and lateral shifting of turnout.
- Standard drawings for different layouts.
- Check list of components and their drawing number.
- Availability of Trained artisans, trained supervisors and unskilled Manpower.
- Availability of small track machines in good working order.
- Availability T-28 machine, if mechanized replacement is planned.
- Availability of block for laying of point.

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Checking of P&C assembly components before assembly

- Each turnout requires many components availability of components should be made before work of replacement of turnout is taken.
- Following items to be checked
- SWITCH
- Whether, the turnout material is of proper design.
- Whether the layout requires RH curved or LH curved switch, since RH curved switch cannot be inserted where LH curved switch is required and vice-versa.
- All the nuts, bolts, washers, plate screws , spherical washers are available as per drawing.

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Checking of P&C assembly components before assembly

- **CROSSING**
- **Whether the crossing received is of required design (i.e. 1 in 8½ or 1 in 12, 52 kg/60 kg) and whether this is matching with the switch.**
- **Whether check rails are of suitable design.**
- **Whether all the bolts of required size and spherical washers/taper washers are available.**
- **GFN liners of proper design are available as per section of rail for use in lead and crossing portion.**

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Checking of P&C assembly components before assembly

- **SLEEPER SET**
- Sleeper set should be complete i.e;
  for 1 in 12 - 83 nos + 13 no's Approach
  for 1 in 8.5 – 54 nos + 13 no's Approach
  for 1 in 16 – 101 nos + 13 no's Approach
- Each set should have approach sleepers – 13 nos (5+4+4)
  5 sleepers at approach of SRJ and 4+4 at exit of point sleepers
- Crossing sleepers shall be matching as per design.
- If any sleeper of the set is missing/damaged, same should be arranged before taking work in hand.

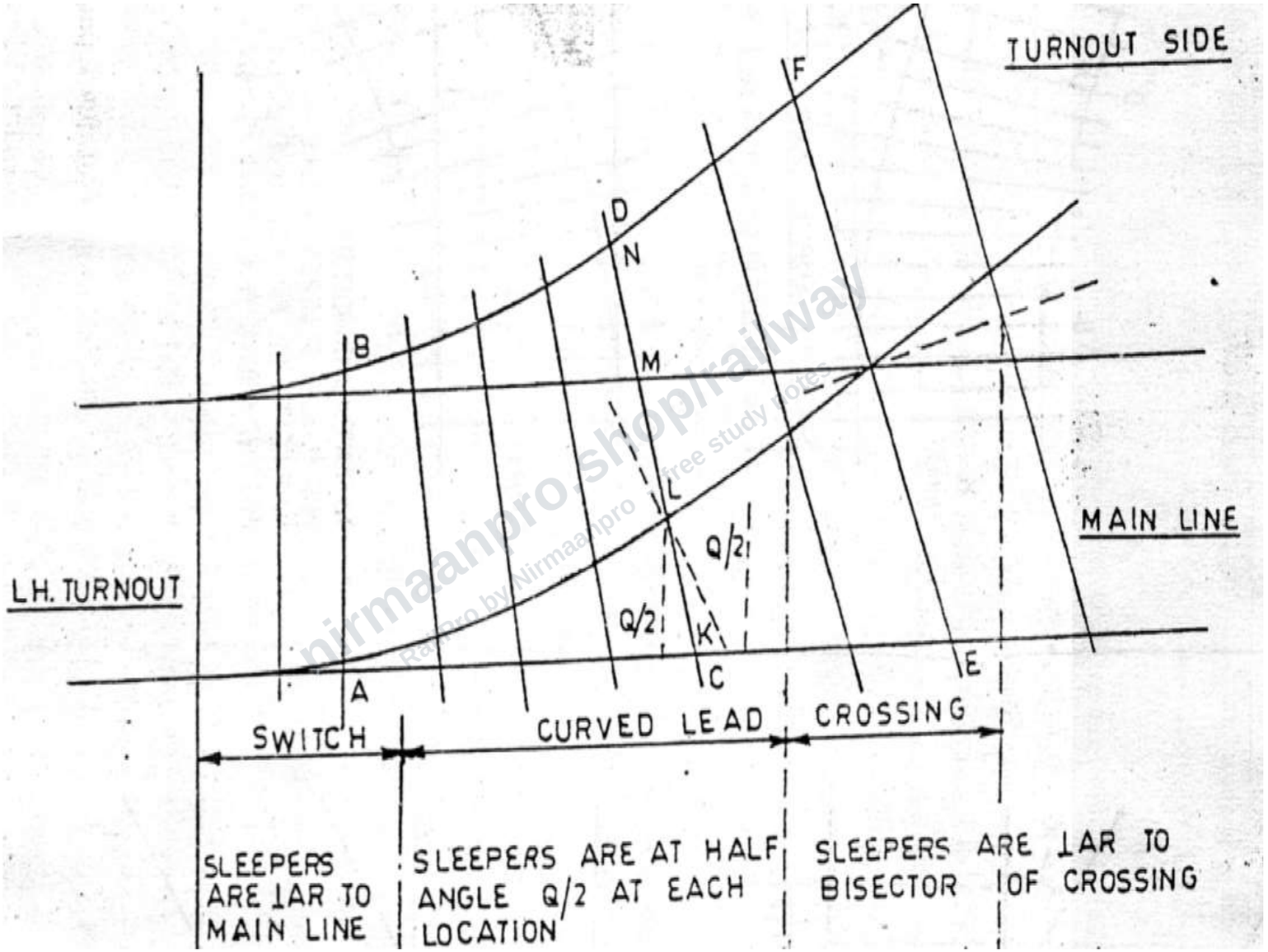
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Turnouts on Concrete Sleepers

- **Orientation**
  - **Switch Portion-**
    - **Perpendicular to main line**
  - **Lead Portion-**
- **Laid with sleeper axis along direction of bisector of perpendiculars drawn to the mainline and to the turnout side. at an angle of $\theta/2$ where, θ is the angle between the perpendicular to main line and the perpendicular to the tangent drawn on gauge face of outer rail of turnout at that point (θ goes on increasing towards crossing)**
  - **Crossing Portion-**
    - **Sleepers axis perpendicular to bisector of crossing angle.**

      (spacing along the bisector of crossing angle)

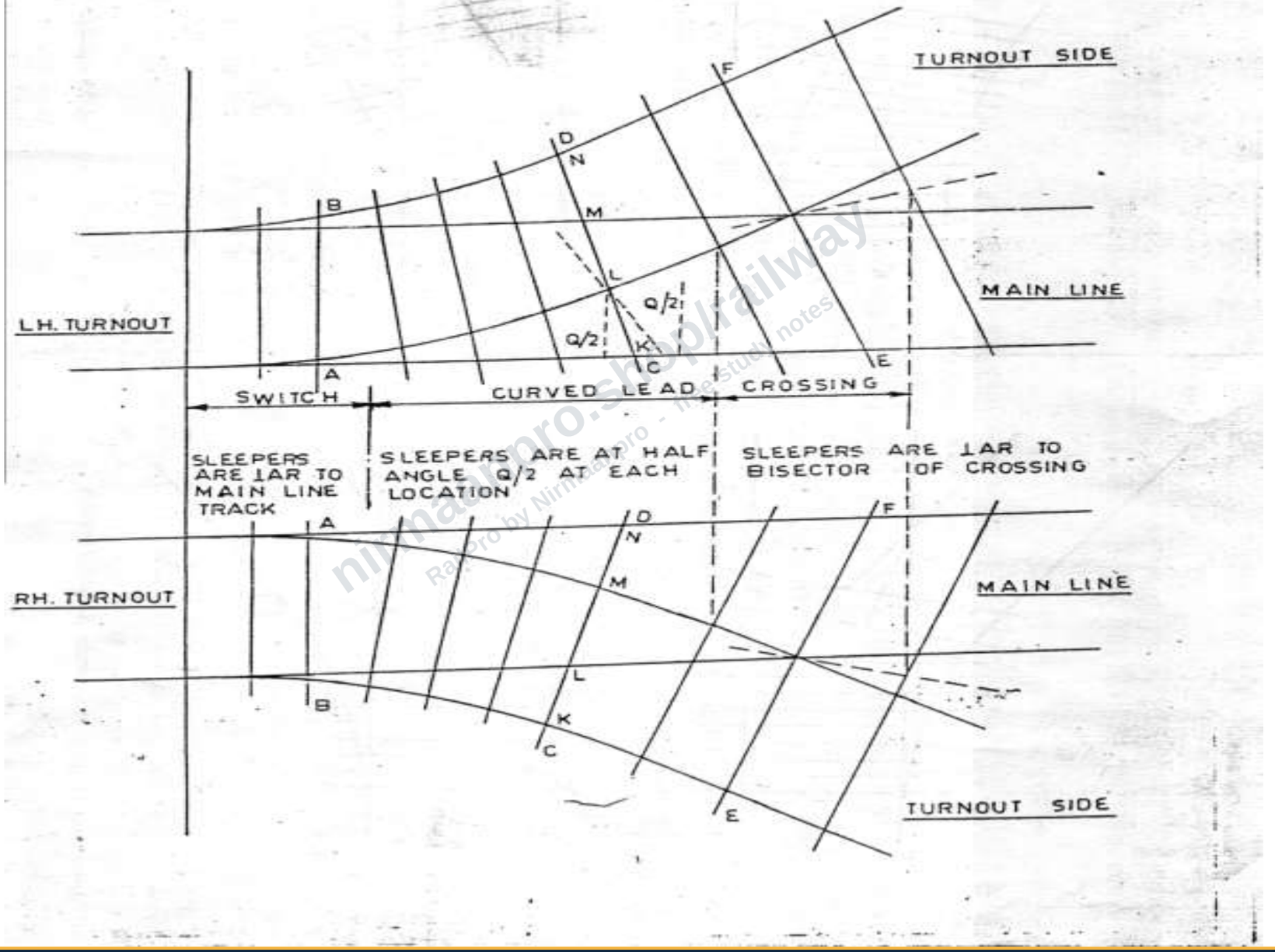
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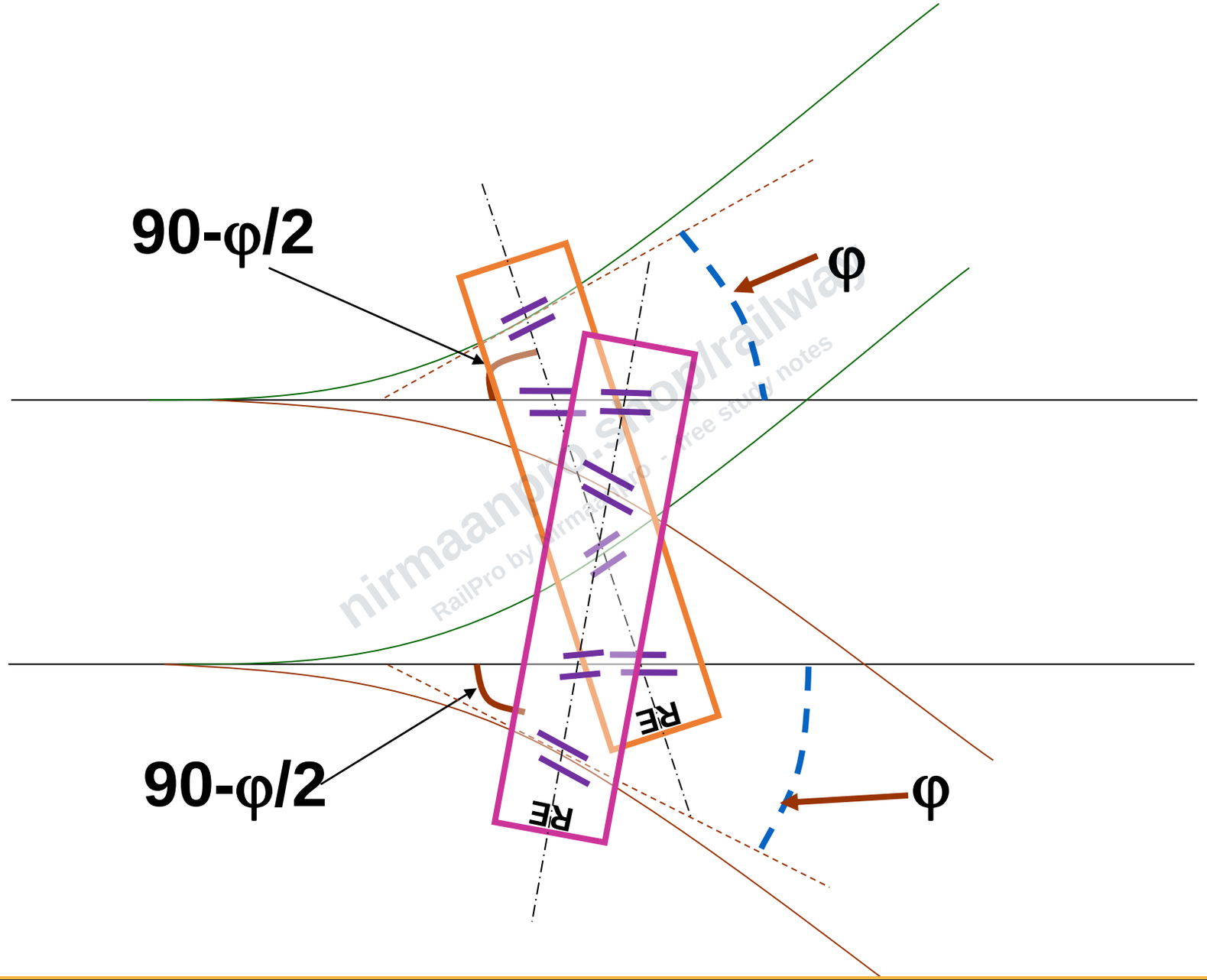
FAN SHAPED TURNOUT

DISPOSITION OF SLEEPERS



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Interchangeability of Sleepers on LH/RH Turnouts



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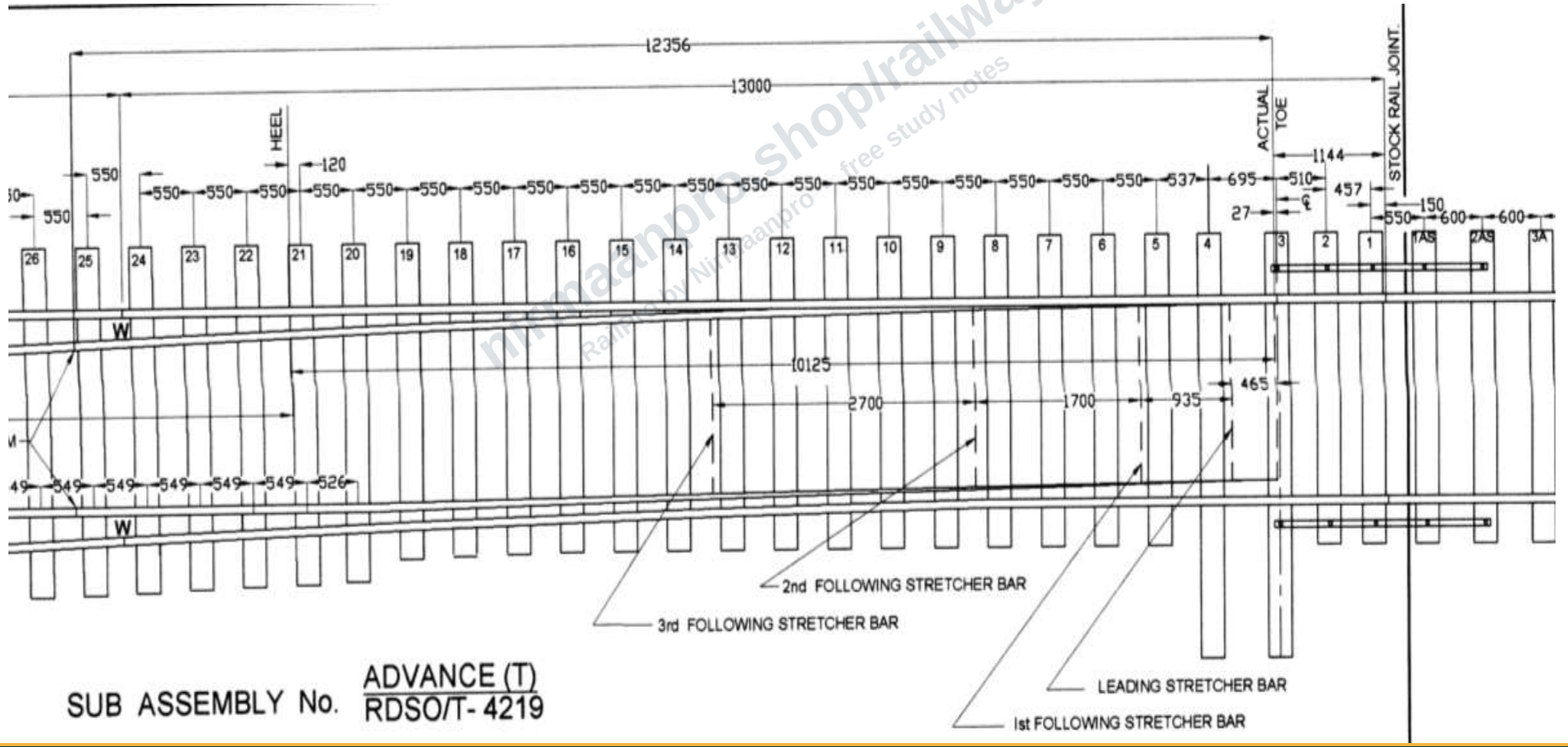
Orientation of Sleeper in Fan Shaped Layout

Type of layout	Area X	Area Y	Area Z
	Switch area sleepers laid perpendicular to main line	Lead area sleepers laid along the direction of bisector	Crossing area sleepers laid perpendicular to centre line of crossing
1 in 12	1 to 20	21 to 65	66 to 83
1 in 8.5	1 to 13	14 to 41	42 to 54

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Features of Turnouts on Concrete Sleepers

- **Spacing of sleepers in switch portion**
  - **Uniform spacing except for the sleepers near ATS (to accommodate S & T fittings)**



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Precautions during assembling

- Compatibility of material.
- Spreading of sleeper as per drawing (“RE” mark which indicates the right end of sleeper should be kept always on Right Hand Side irrespective of whether it is right or left hand turnout.)
- Cleaning of dowels
- Checking of pre-curvature of tongue rail or stock rail.
- Pre-bending of stock rail at TTS (In case of 1:8.5turnouts TTS is 439mm away from ATS, so at SRJ the bending should be by 14.5mm the gauge between stock rails at the location of ATS is equal to nominal gauge + 6mm“).
- Correct fixing of switches (absence of force at JOH gap cannot be made zero, keeping in view minimum setting up to 4 sleepers for 1 in 12 turnouts and up to 3 sleepers for 1 in 81/2 turnouts to be ensure.

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Precautions during assembling

- **Correct fixing of switches (absence of force at JOH gap cannot be made zero, keeping in view minimum setting up to 4 sleepers for 1 in 12 turnouts and up to 3 sleepers for 1 in 81/2 turnouts to be ensure).**
- **Difficult to correct setting for 4 or 3 sleepers as required, it could be because one or more of the following reasons**

➢ **Pre-curvature of tongue rail not provided properly.**

➢ **While fixing stretcher bar, back to back distance between the webs of tongue rails have not been maintained as per design.**

➢ **Stretcher bars should be of standard length.**

➢ **Inadequate throw of switch.**

➢ **Non fixing of stretcher bar at half throw.**

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Precautions during assembling

- **Fixing of stretcher bar.**
- Fixing of stretcher bar at half throw.
- 2 holes of leading stretcher bar are required to be drilled in situ to fix other tongue rail in such a way that back to back distance of the web/web stiffener of tongue rails is maintained as per drawing.
- There should be a clearance of 1.5mm to 3mm between the bottom of Stock Rail and top of stretcher bar.
- Stretcher bar should not be bent.
- All stretcher bar bolts must be provided.
- In track circuited territory, stretcher bar should be insulated.

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Back to back distances between webs of tongue rails in mm					
Turnout	1 in 12		1 in 8.5		1 in 16
	60 KG	52 KG	60 KG	52 KG	60 KG
Leading S. Bar	1530	1530.5	1558	1559	1526
1st Following S.Bar	1544	1545	1577.5	1578	1543
2ND Following S.Bar	1566	1566	1596.5	1596.5	1546
3rd Following S.Bar	1576	1579	-----	-----	1593

Precautions during assembling

- Throw of switch to be maintained as 115 ± 3 mm.(ORS)
- For TWS 160 ± 3 mm
- **Provision of proper stud bolts -** Ensure that for the initial few sleepers only half headed stud bolts are used, so as not to present any obstruction between web of stock rail and tongue rail while butting against each other.
- **Use of slide chair with defective lugs -** The horizontal piece of lug is connected to the slide chair with the help of welding. This welding may get cracked because of carelessness during handling. This should be checked and if required welding may be resorted to.
- **Use of proper distance block and special bearing plate:** Maintenance of gauge and alignment in this part depends on use of proper distance block. So all such blocks should be checked as per drawing and the actual offset of tongue rail should also be checked to ensure proper fixing.

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Precautions during assembling

- **Provision of proper stud bolts.**

- There are two types of stud bolts used in switch assembly for fixing the stock rail with the slide chairs.
- One with the thinner head known as ‘half headed’ stud bolt and other with normal size of head called stud bolt.
- Ensure that for the initial few sleepers only half headed stud bolts are used, so as not to present any obstruction between web of stock rail and tongue rail while butting against each other.
- In case of breakage of such bolts, it should be replaced by half headed bolts only.

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Precautions during assembling

- Use of slide chair with defective lugs.
- The stock rail is fastened to the lugs of slide chair with the help of stud bolts.
- The horizontal piece of lug is connected to the slide chair with the help of welding.
- This welding may get cracked due to carelessness handling. This should be checked and if required welding may be resorted to.
- In new design rivet is also provided to hold the plates together, and has shown better performance.

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Precautions during assembling

- **Use of proper switch stops and slide blocks –** These are provided to transfer lateral force exerted by wheel on the tongue rails to stock rails. Switch Stops or slide blocks of proper design are required to be provided as per drawing. Switch stops are bolted to tongue rail whereas slide blocks are bolted to stock rail.
- In 1 in 8 ½ turnouts switch stops are provided, whereas in 1 in 12, 1 in 16 and 1 in 20, slide blocks are provided.
- **Welding of SRJ -** It is recommended practice to weld SRJ to the extent possible. If it is not possible to weld SRJ, it should be made as machined joint.

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Precautions during assembling

- **Machined/gapless joint**
- Due to running of heavy axle loads, there is severe hammering action at the joints between CMS crossing and adjoining rails by the wheels of running trains.
- **Effect**
  - ➢ Loosening of bolts and nuts of fish plates of CMS crossing.
  - ➢ Damage to concrete sleepers.
  - ➢ Frequent wear and tear of rails,
  - ➢ Battering of joints
- **Solution –** provision of Machined / gapless joint
- Joints in turnouts are to be either made machined/gapless or welded as per drawing.

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Precautions during assembling

- **Machined/gapless joint -**
- CMS crossing and adjoining rails diameter of hole is kept 26.5 mm.
- Centre of 1st hole from rail end is 83 mm.
- Centre to centre distance between 1st and 2nd hole is 166 mm.
- Centre to centre distance between 2nd and 3rd hole is 166 mm.
- As per above arrangement joint are made gapless joint

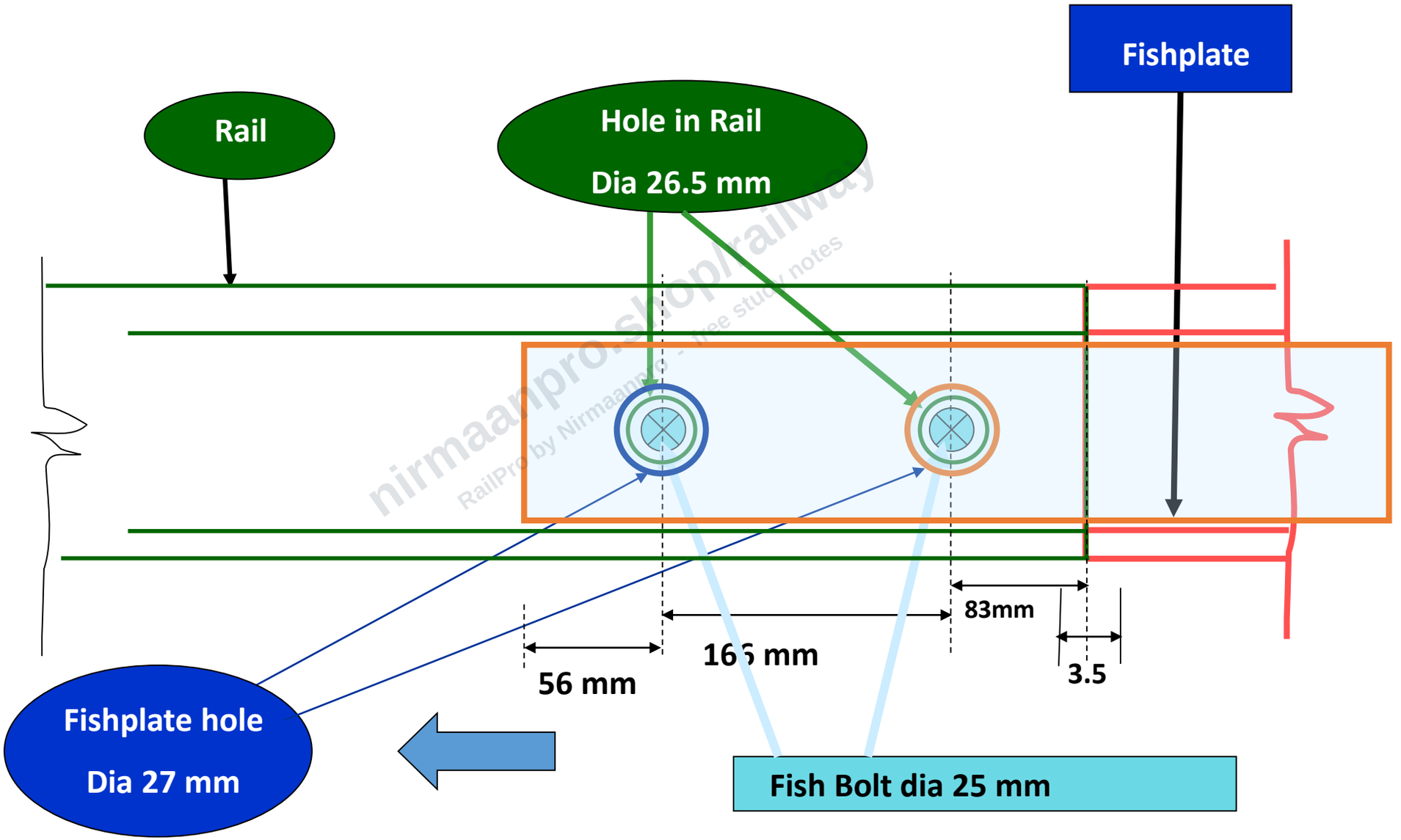
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Precautions during assembling

- **Machined/gapless joint**
- As per above arrangement maximum gap comes to 3.5 mm at temperature lower than at time of installation.
- This is literally not a gapless joint, it is rather joint with less gap.
- Advantages of Gapless joint
  - Reduce hammering action at the joint.
  - Reduction in wear of rail.
  - Reduction in battering of rail.
  - Reduction in loosening of bolts.
  - Reduce damage to sleepers thereby increasing life of CMS and its components.
  - Checking elongation of bolt hole provided greasing of fishplates carried out frequently and lateral and vertical misalignment during making of joint is ensured.
  - Enhancement in safety of running of trains due to reduction of impact load at joint

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Gapless Joint



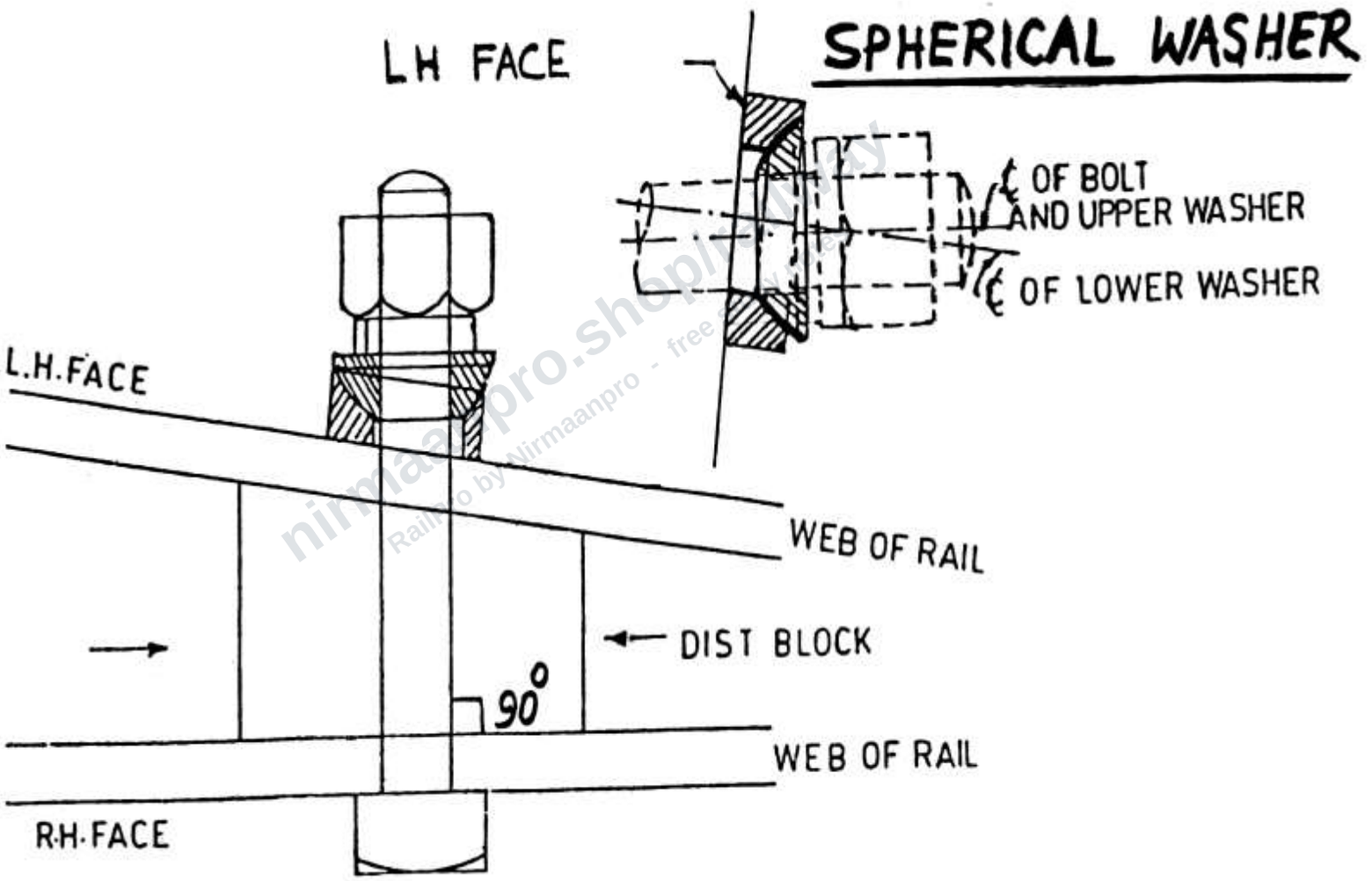
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Precautions during assembling

- **Gauge tie plate -** One gauge tie plate is used i.e. under ATS at sleeper number 3. for holding gauge at ATS in addition to take care of heavy thrust coming at ATS. This should be of insulated type.
- Spherical washers - Used to obtain flush fit of the head or the nut of bolt with the web of Rail.
- Required if axis (shank) of bolt is not at right angles to the axis of Rail (surface against which bolt will rest)

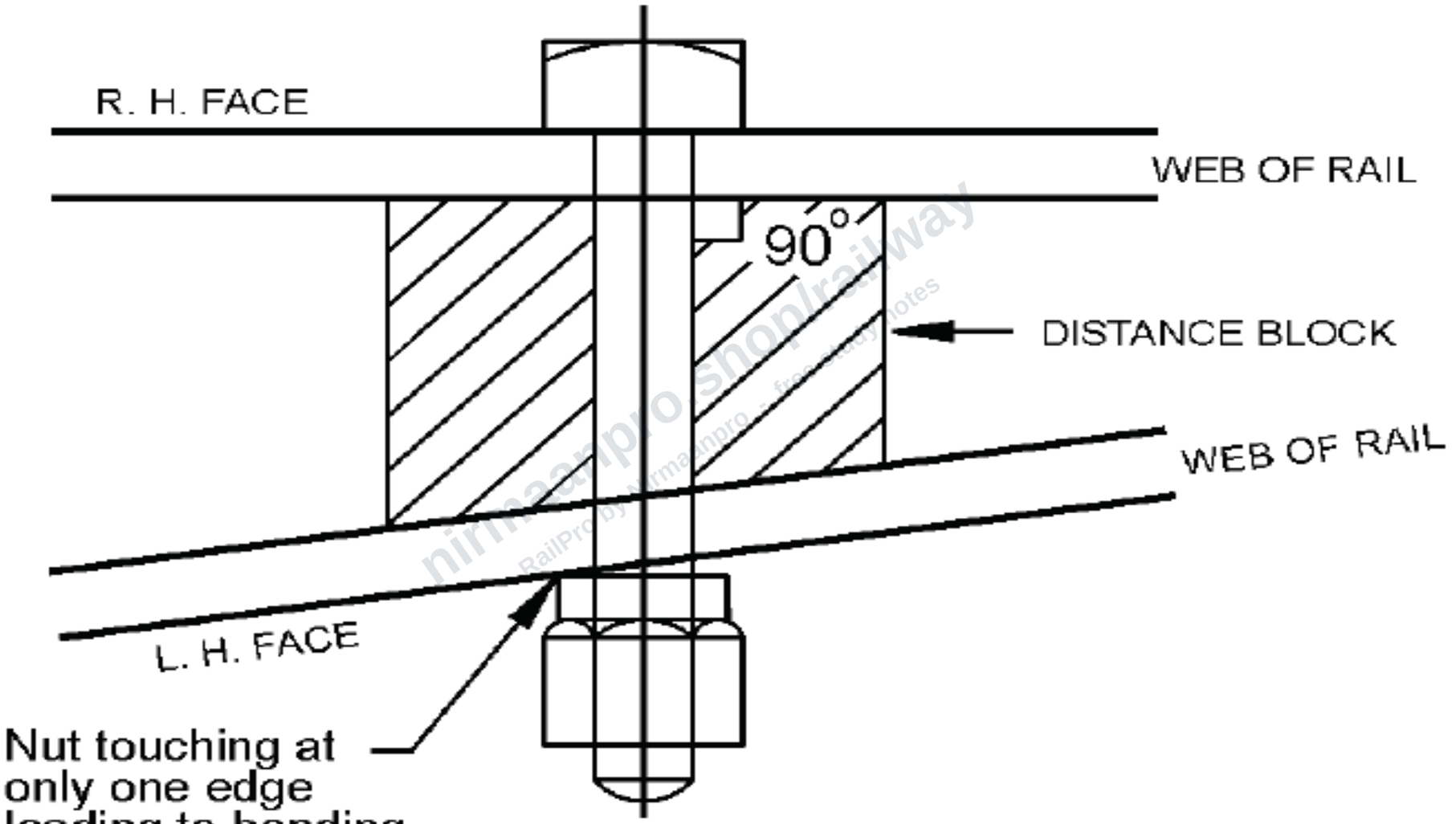
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Spherical Washers



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Effect of non provision of spherical washers

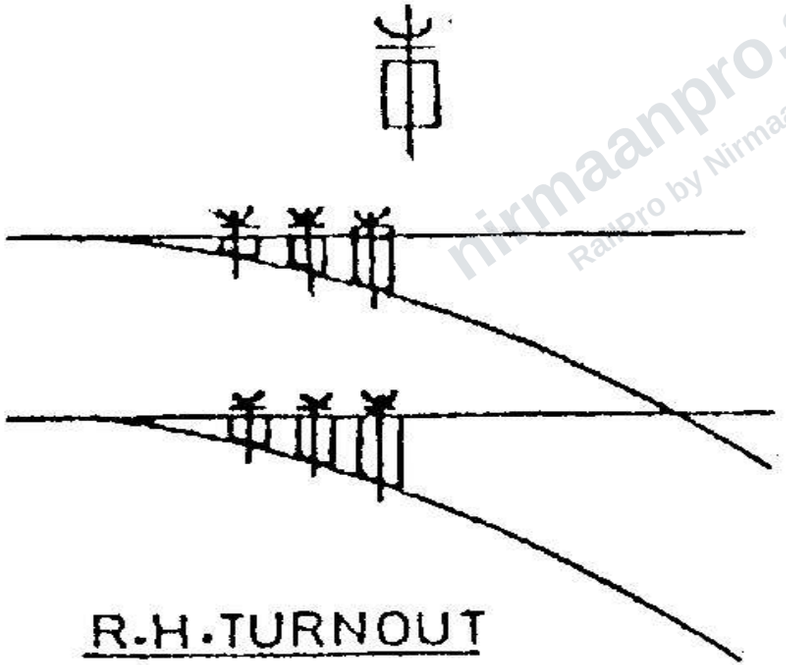


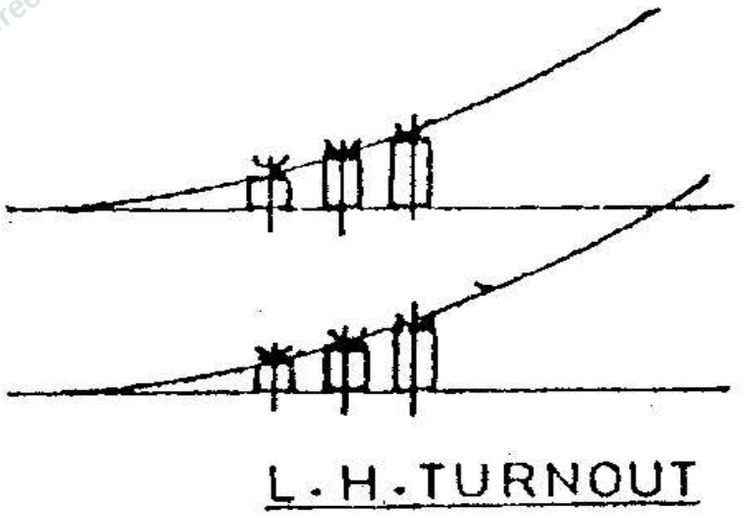
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Position of spherical washers at heel and distance blocks

- **At heel of switch and distance blocks behind heel, spherical washers are to be provided on the left hand side irrespective of whether it is a left hand turnout or right hand turnout.**

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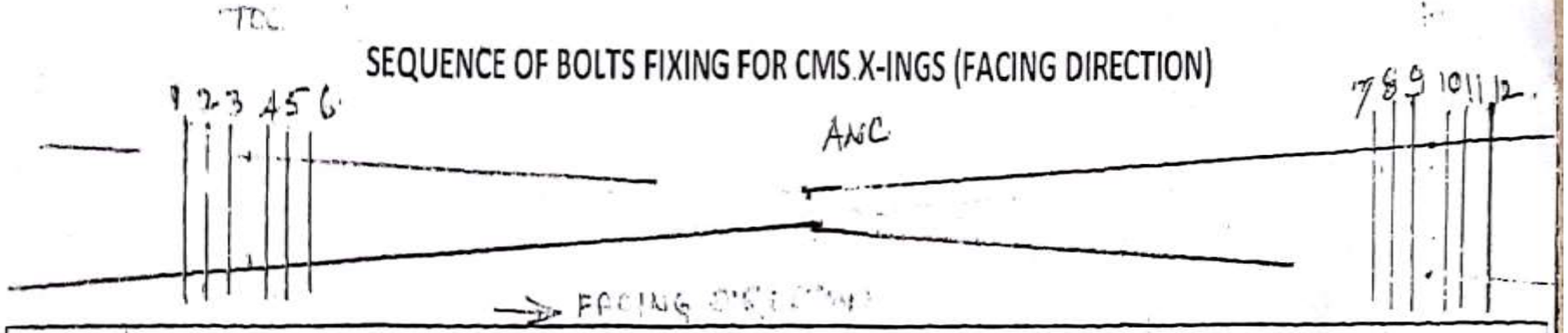
Spherical Washers

Training of keymen about proper fixing of spherical washers is very important.

If Keyman, is not properly trained, may fix washers on either wrong side or fix it wrongly. In such cases, only one side of head of bolt will come in contact with rail leading to eccentric forces. This will set a bending moment in the bolt. This bolt is likely to bend and break with in few days again.

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SEQUENCE OF BOLTS FIXING FOR CMS X-INGS (FACING DIRECTION)



ANGLE	TOC						HOC					
	1	2	3	4	5	6	7	8	9	10	11	12
1 in 8½ 52kg T4867	40 (T11535)	38 (T11533)	36 (T11531)	34 (T11529)	32 (T11527)	31 (T11526)	30 (T11525)	32 (T11527)	34 (T11529)	36 (T11531)	38 (T11533)	40 (T11535)
1 in 8½ 60kg T4967	41 (T11536)	39 (T11534)	37 (T11352)	35 (T11530)	33 (11528)	31 (T11526)	30 (T11525)	32 (T11527)	34 (T11529)	36 (T11531)	38 (T11533)	40 (T11535)
1 in 12 52kg T4734	40 (T11535)	38 (T11533)	36 (T11531)	34 (T11529)	32 (T11527)	31 (T11526)	31 (T11526)	32 (T11527)	34 (T11529)	36 (T11531)	38 (T11533)	40 (T11535)
1 in 12 60kg T4220	40 (T11535)	38 (T11533)	37 (T11532)	36 (T11531)	34 (T11529)	33 (T11528)	29 (T11524)	30 (T11525)	32 (T11527)	33 (T11528)	34 (T11529)	36 (T11531)
1 in 16 60kg T5693	--	--	36 (T11531)	35 (T11530)	34 (T11529)	33 (T11528)	32 (T11527)	33 (T11528)	34 (T11529)	35 (T11530)	--	--

Note 1: Fixing of bolts from 1 to 12 in facing direction of ANC.

2: T3930 Tapered washers to be provided on both sides, Tapered washers higher thickness to be placed towards ANC.

3: T10773 Spring washers tobe provided at Nut side only.

4: Pitch between two adjacent bolts is 166mm, dia of drill bit 27mm, half of the pitch is 83mm for gapless joints.

5: Relation between length of the bolt and Drg. No. is TO ADD 5 TO LAST TWO DIGITS OF DRG. NO. TO GET THE LENGTH OF THE BOLT IN CM.
(Ex: T11535 = 35+5 = 40CM LENGTH)

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Precautions during assembling

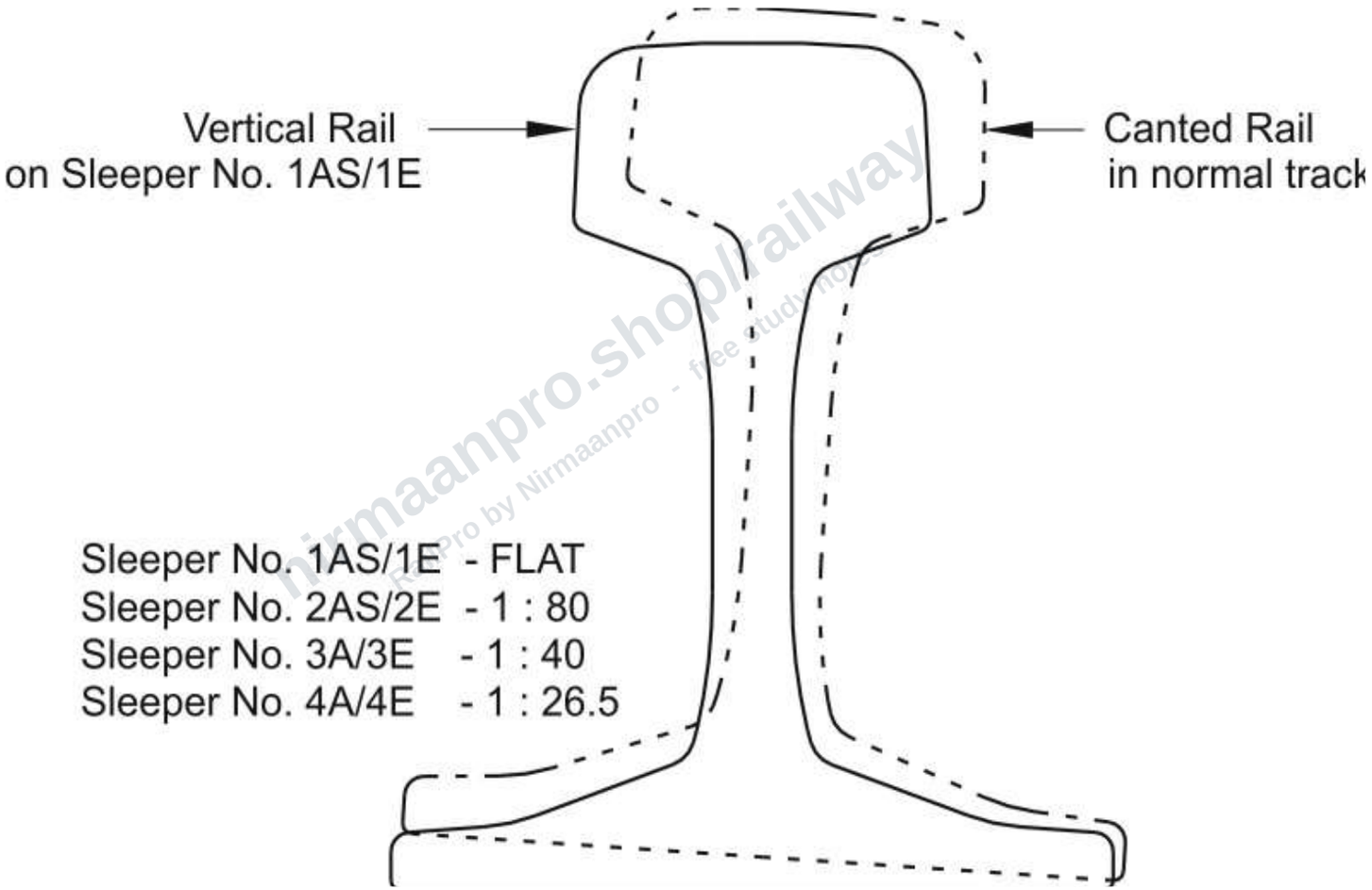
- Special approach and exit sleepers
- Points and Crossings are laid without Cant
  - Approach rails are Canted (1 in 20)
  - Running out Cant on Approaches

- Improper fishing at SRJ and Heel of Crossing
  - Reverse canting of sleepers in 4 sleepers
  - On all three sides
    - 1AS, 2AS, 3A, 4A, 60S (Before SRJ)
    - 1E, 2E, 3E, and 4E (Beyond Heel of Crossing)

    (on both Straight and Turnout side)

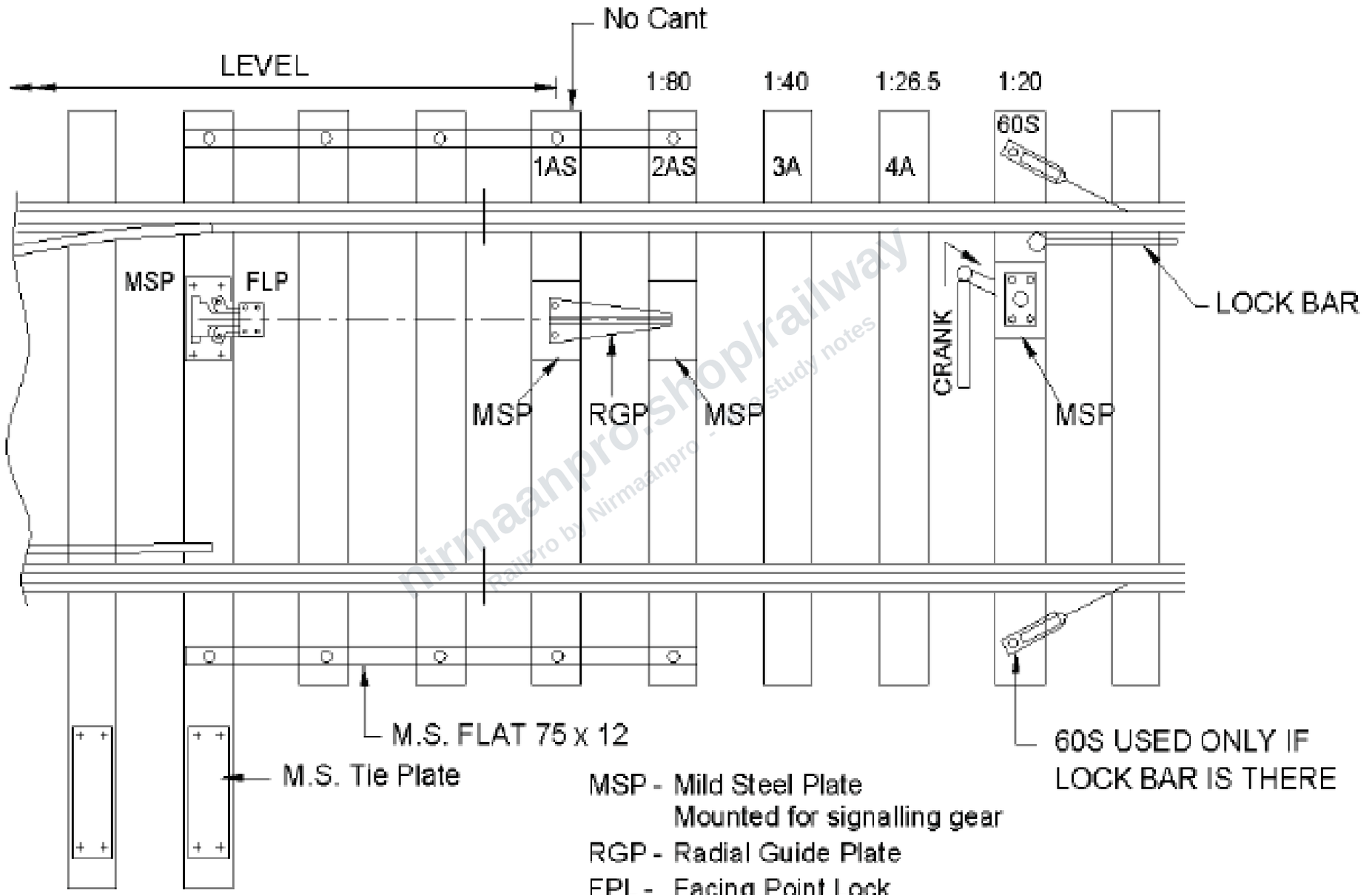
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Running out Cant on Approaches



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Running out Cant on Approaches



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Precautions during assembling

- **Provision of proper liners**

Location ↓	Turnout with 60 kg rail		Turnout with 52 kg rail	
	Inside	Outside	Inside	Outside
Crossing	3706	3706	3702	3702
Check rail	3706	3706	3708	3708
Special bearing plate Sl no . 21-27 (1 in 12) Sl no . 15-17 (1 in 8.5)	3706	3706	3702	3702
Rest of lead curve	3706	3706	3707	3708

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Precautions during assembling

- **Gauge at nose on crossing**
- **Where crossing is not exactly at centre, slack or tight gauge on one of the track will lead to tight or slack gauge on the other track. Tight gauge may lead to the possibility of wheel flange hitting the nose of crossing; Too slack gauge at ANC is likely to cause more wear to check rails. Hence gauge to a better accuracy should be maintained on crossing.**

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Permissible gauge in crossing portion.	
Crossing of turnout	New laying and Maintenance
PSC sleeper	1673 to 1677 (N to +4)
Other than PSC sleeper	1676 to1680 (N to +4)

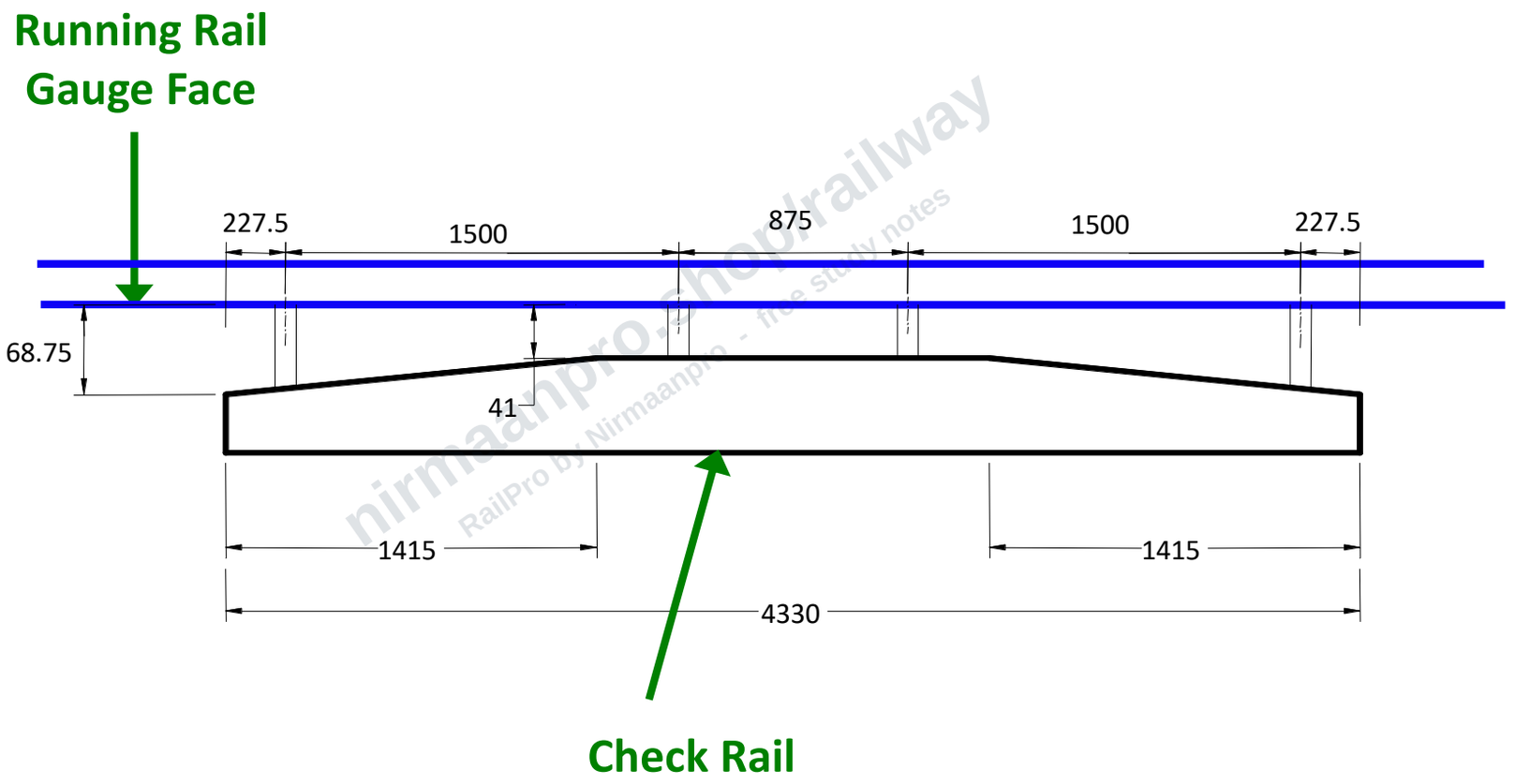
Precautions during assembling

- **Check rail clearance**
- **Check rail provides lateral guidance to the wheel in the unguided gap between throat of crossing to ANC in the crossing area.**
- **Opening of flared end is 68.75mm, this opening has been designed wide enough to trap any wheel without allowing any possibility for it to hit tip of check rail.**

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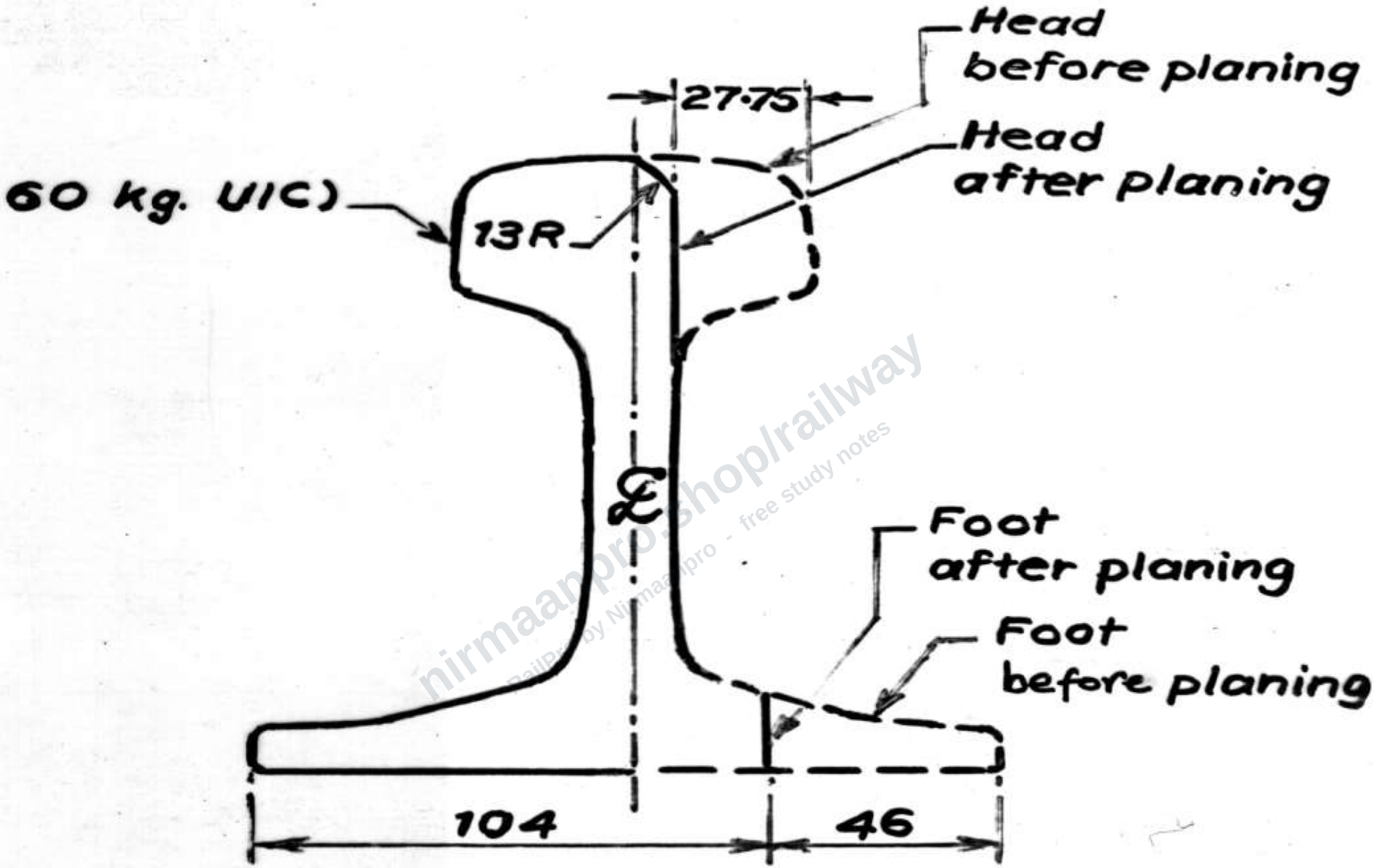
Permissible check rail clearance in mm opposite nose of crossing.	
PSC sleeper	41 to 45
Other than PSC sleeper	44 to 48

Machined Check Rail



Check Rail Flare 1 in 70

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MACHINED HEAD CHECK RAIL

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Precautions during assembling

- **Provision of spring washers**
- Due to heavy vibrations transmitted during passage of traffic, various plate screws and bolts provided in turnout are likely to get loosened.
- It is desirable to provide spring washers at all such locations to avoid loosening of screws and bolts. Vibrations are particularly heavy in crossing zone.
- In the switch area spring washers should be used with stud bolts and plate screws.

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Precautions during assembling

- **Rechecking of layout before replacement of turnout.**
- **Overall length calculated should be checked with SRJ points at both lines.**
- **If any false curve or other irregularities noticed it shall be removed.**
- **Overall length provided shall be close to theoretical overall length if not it will lead to kinky alignment either on the main line side or on the cross over side.**

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Precautions during assembling

- Display of date of laying of points & crossings
- The month and year of laying a new or second hand points and crossings should be painted in white block letters on the webs of switches about 500 mm from the heel joint and the webs of crossings about 500mm from the joint connected to the lead rails.
- When second hand points and crossings are laid at another site, the dates previously marked should not be obliterated; an indication of the total life will then be available.
- In the case of reconditioning of switches and crossings, the date of reconditioning should also be painted.

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Do’s for laying Turnout

- Check the availability of all components as per check list before laying in field.
- Arrange switch and crossing of required rail section and crossing angle.
- Decide on the method of laying depending upon land and T-28 machine availability.
- Lay approach and exit sleepers in proper sequence.
- Before marking the SRJ locations please check the overall length required.
- Pre curvature of tongue and stock rail to be checked before laying and corrected if required.

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Do’s for laying Turnout

- Ensure minimum throw of switch 115 ± 3 mm .
- Ensure full compliment of fittings.
- Ensure gapless joint at heel of switch and crossing.
- Ensure proper fixing of spherical/taper washer.
- In case of 52 kg. track on turnout, liners of proper design to be used.
- Ensure proper setting of spring setting device.
- Ensure sleepers spacing as per RDSO drawing for straight main line.

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Works required before interlocking

- Bring the rails to correct level and alignment.
- Fully pack and ballast the points to be interlocked.
- Provide creep indicators if required.
- Mark places where the rods and wires have to cross the lines.
- To avoid future adjustments of gear, see that the Permanent Way at points, is laid to correct gauge so that switches, fittings and locks may be correctly put together.
- Clear formation and bring it to the correct level and section where rods and wires have to be run.

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Works required before interlocking

- Make the road at level crossings, if any to correct level and section to allow casing pipes for wires to be put in their final position.
- Provide and fix special timbers as may be required.
- Provide sufficient anchors of an approved type ahead of switches.
- Fit gauge tie plates correctly to all switches.

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Various Types of Turnouts with Curved Switches and CMS Crossings on Fan shaped PSC Sleepers BG (60/52 Kg)

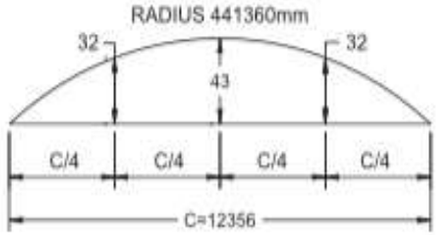
Rail Spec / Sleeper	Layout	T/O Drawing No	Switch Drawing No	Crossing Drawing no
52 KG /PSC	1 in 8.5	RT 4865 (Alt 6 21.7.17)	RT 4866 (Alt 6 21.7.17)	RT 4867 (Alt 8 21.7.17)
60 KG / PSC	1 in 8.5	RT 4865 (Alt 6 21.7.17)	RT 4966 (Alt 5 21.7.17)	RT 4967 (Alt 7 21.7.17)
52 KG /PSC	1 in 12	RT 4732 (Alt 4 27.2.17)	RT 4733 (Alt 5 27.2.17)	RT 4734 (Alt 5 27.2.17)
60 KG / PSC	1 in 12	RT 4218 (Alt 6 02.11.16)	RT 4219 (Alt 6 02.11.16)	RT 4220 (Alt 5 02.11.16)
60 KG /PSC	1 in 16	RT 5691 (Alt 3 05.2.18)	RT 5692 (Alt 3 05.2.18)	RT 5693 (Alt 1 05.6.03)
60 KG /PSC	1 in 20	RT 5858	RT 5859	RT 5860
52 KG /PSC	1 in 8.5 S/S	RT 5353 (Alt 2 21.4.98)	RT 5354 (Alt 3 01.5.10)	RT 4867 (Alt 8 21.7.17)
60 KG / PSC	1 in 8.5 S/S	RT 5353 (Alt 2 21.4.98)	RT 5354 (Alt 3 01.5.10)	RT 4967 (Alt 7 21.7.17)

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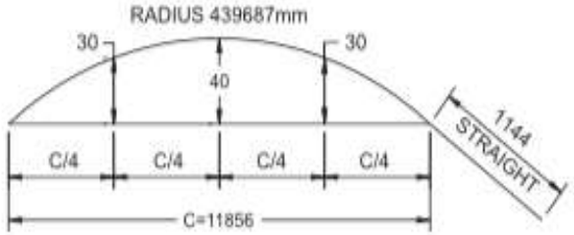
Various Types of Turnouts with Curved Switches and CMS Crossings on Fan shaped PSC Sleepers BG (60/52 Kg)

Rail Spec / Sleeper	Layout	T/O Drawing No	Switch Drawing No	Crossing Drawing no
52 KG /PSC	1 in 12 S/S	RT 5553	RT 5554	RT 4734 (Alt 5 27.2.17)
60 KG / PSC	1 in 12 S/S	RT 5553	RT 5554	RT 4220 (Alt 5 02.11.16)
60 KG / PSC TWS	1 in 8.5	RT 6279	RT 6280	RT 4967 (Alt 7 21.7.17)
52 KG / PSC TWS	1 in 12	RT 5268	RT 5269	RT 4734 (Alt 5 27.2.17)
60 KG / PSC TWS	1 in 12	RT 6154 (Alt 3 12.12.17)	RT 6155 (Alt 5 08.6.18)	RT 4220 (Alt 5 02.11.16)
60 KG / PSC TWS	1 in 16	RT 7075	RT 7076	RT 5693 (Alt 1 05.6.03)

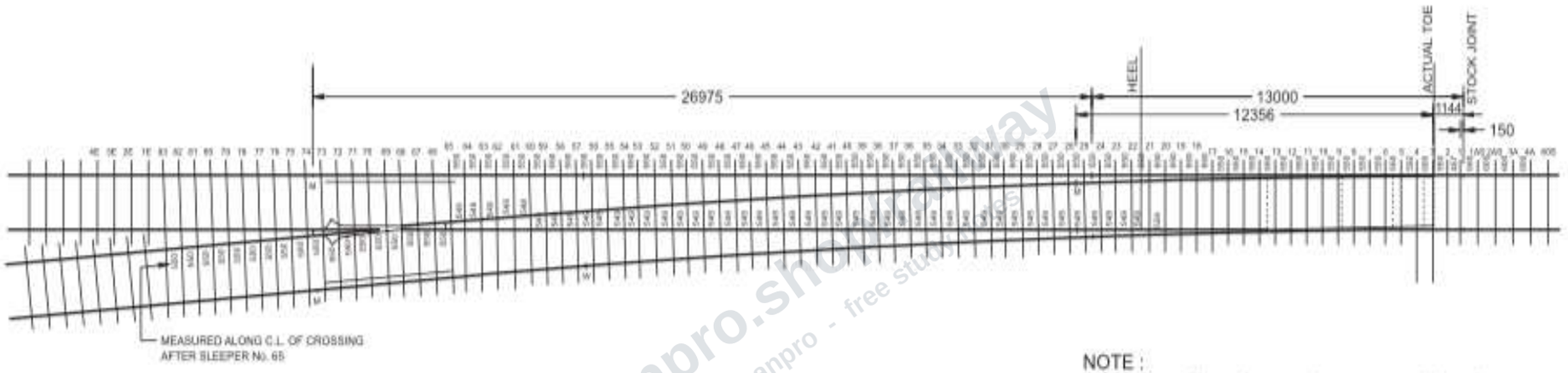
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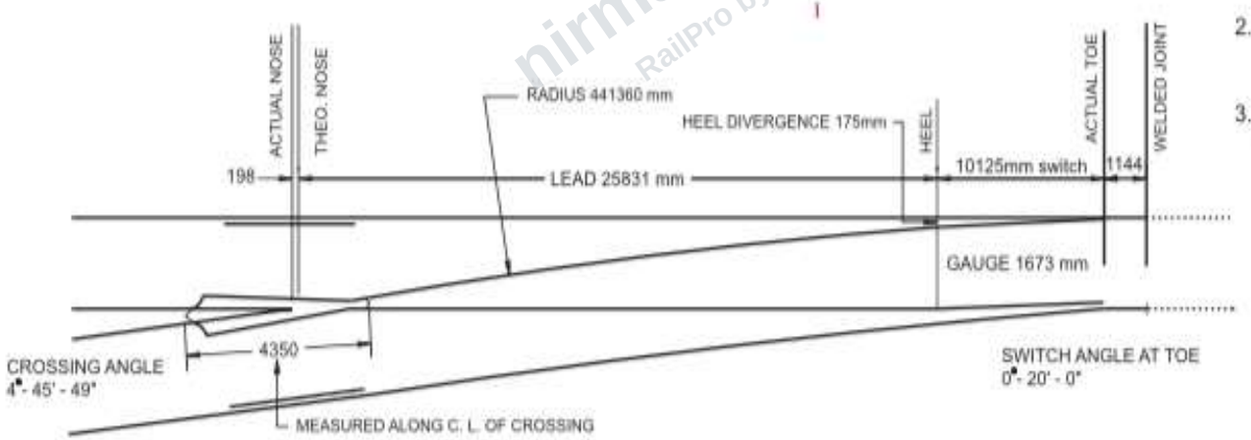


CURVED TONGUE RAIL



CURVED STOCK RAIL





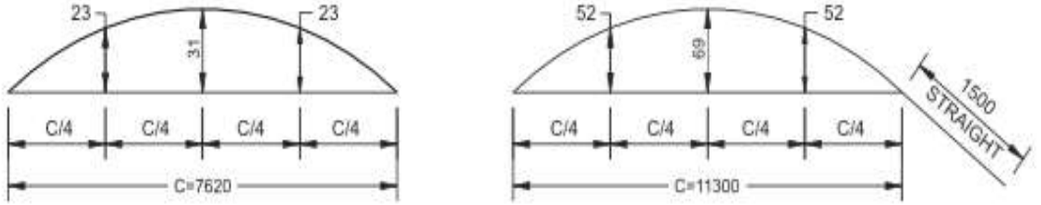
NOTE :

1. Spacing of the sleeper to be measured along the gauge face of Main Line up to sleeper No. 65.
2. From Sleeper No. 66 to 83 spacing given is to be measured along bisector of crossing.
3. ATS is 13mm towards SRJ from centre of sleeper No. 3.

KEY DIAGRAM OF THE LAYOUT

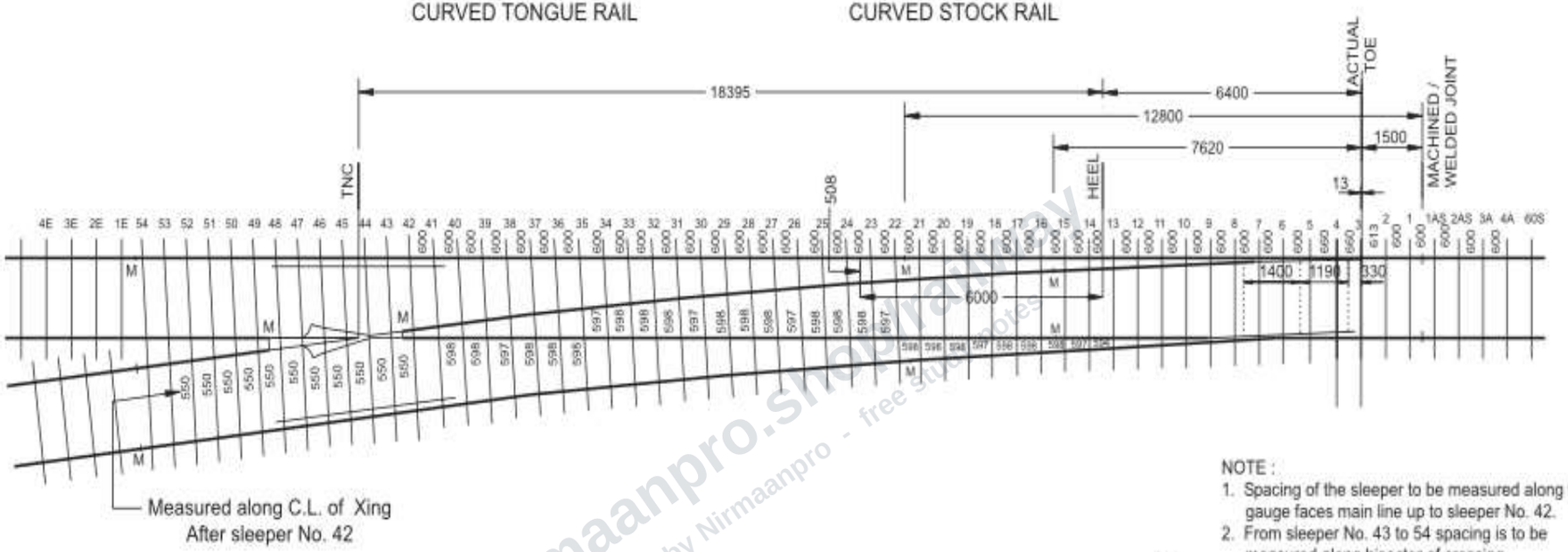
T-4218 for 1 in 12, 60kg

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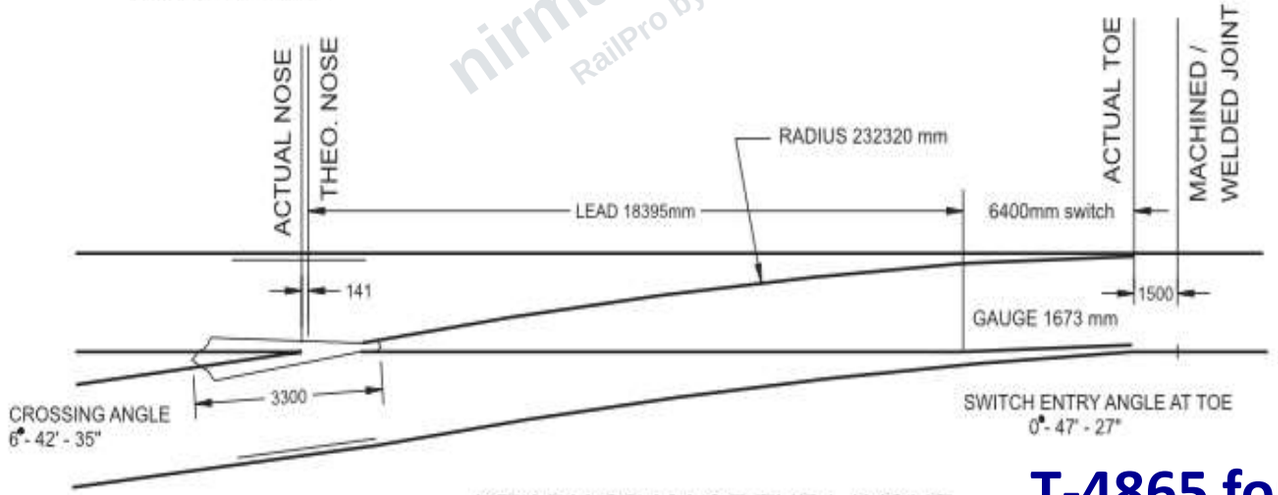
CURVED TONGUE RAIL

CURVED STOCK RAIL



NOTE :

1. Spacing of the sleeper to be measured along the gauge faces main line up to sleeper No. 42.
2. From sleeper No. 43 to 54 spacing is to be measured along bisector of crossing.
3. ATS is 13mm towards SRJ from centre of sleeper No. 3.



KEY DIAGRAM OF THE LAYOUT

T-4865 for 1 in 8.5, 60/52kg

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Maintenance of Turnouts in Curve

The turnouts are supposed to be laid on straight track as spacing are given according to ML as straight.

But it is required to be laid T/O on curve in field due to existing track geometry

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Following problems have been observed while laying fan shaped layout on curve

- Track circuiting may fail because of rail touching to insert.
- It may not be possible to insert liner at few sleepers.
- Breakage of pendrol clip.
- Incorrect gauge.
- . Inadequate toe load.
- Breakage of GFN liners.
- Inadequate holding of CMS Xing.
- At few places rail foot may even cut the inserts.

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Gap is too much causing poor toe load/breakage of GFN liner



In correct gap for liners



No space for liner setting at Xing



Rail cutting into insert

MODIFICATION REQUIRED IN THE EXISTING LAYOUT

- **Change in spacing of sleepers to suit curved track for main line track**

- **Pre-curving of stock and tongue rail to suit the curvature.**

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MODIFICATION REQUIRED

- **Based on the geometry two different solutions for Similar flexure as well as Contrary flexure are required.**

- **The solutions has been made for all the curves from 0.5^0 to 4^0 at a step of 0.5^0. (limits of curvature may be applied in field as per IRPWM.)**

- **Simple tables have been made to facilitate the work by SSE (P way). Cumulative spacing has also been given which should be preferably followed.**

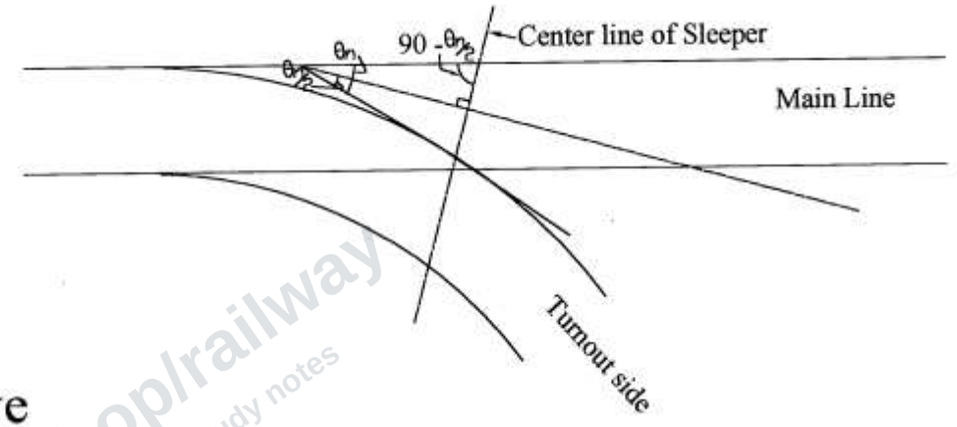
- **For Similar flexure laying of 1:8 ½ turnout is not permissible hence solution has not been made.**

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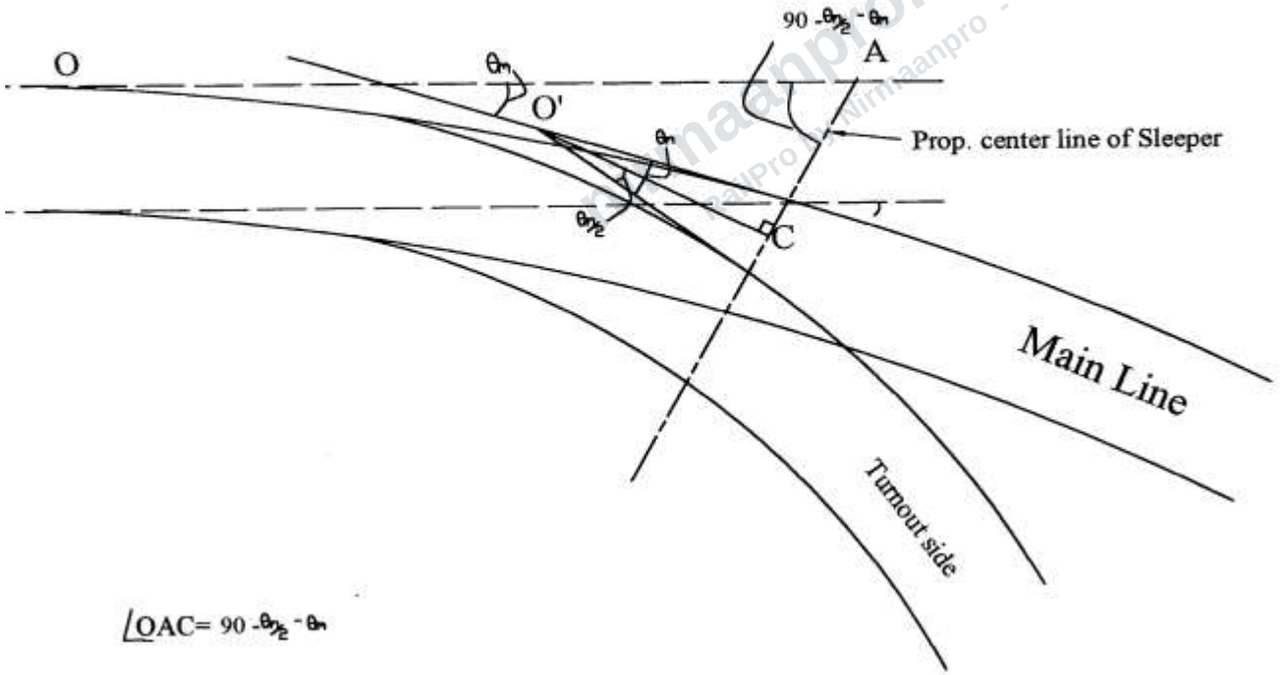
Re-spacing of sleeper

So the sleeper are to be rotated by an angle equal to the angle subtended by the ML curve at the center.

For straight track



While laying on curve



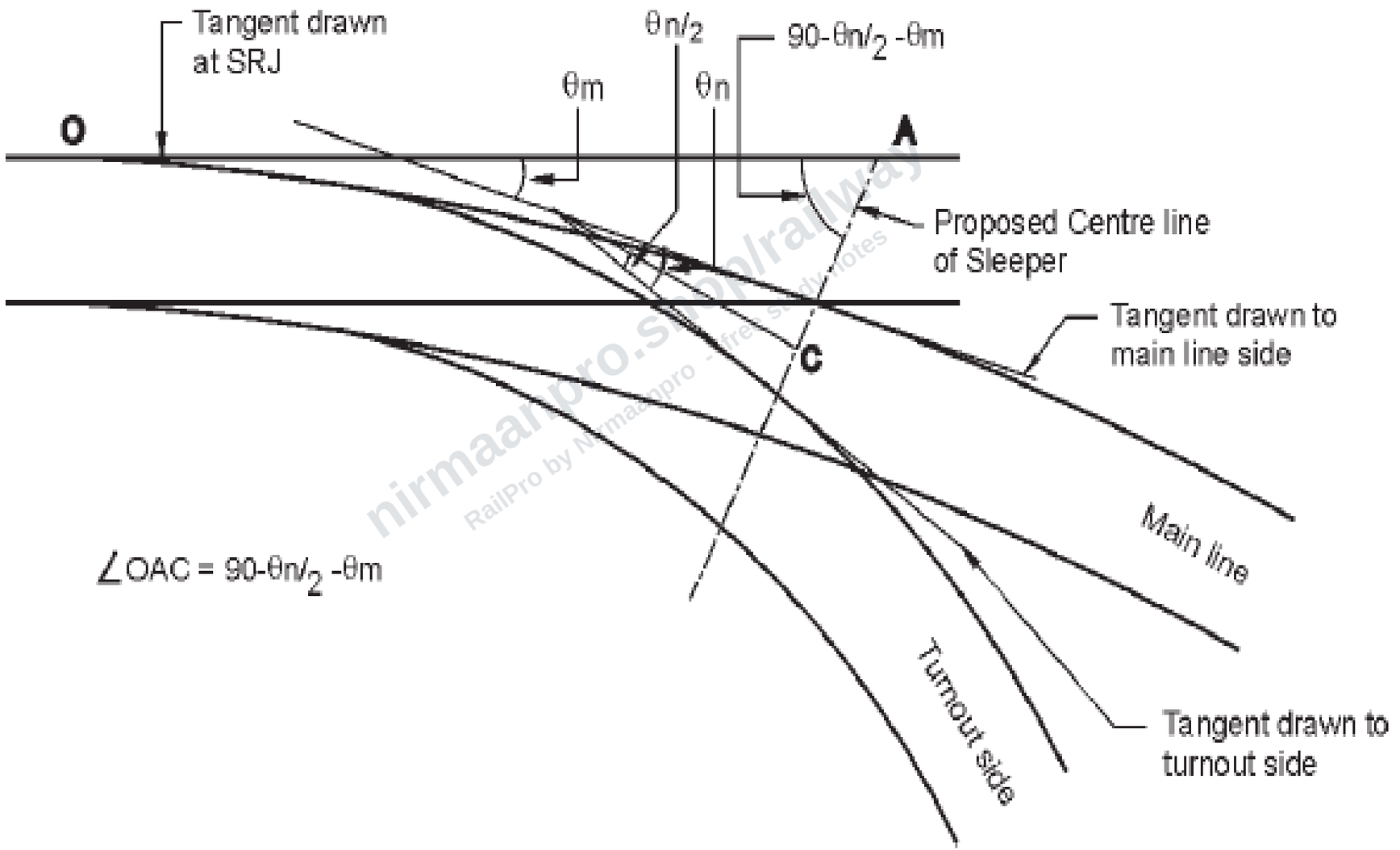
$\angle OAC = 90 - \theta_{/2} - \theta_n$

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Orientation of sleepers when turnouts laid in curves

- while laying the turnout on the curve, the tangent drawn to the main line is also changing direction along with the location.
- The tangent drawn to the main line of turnout at the location of sleeper makes an angle of θm with the tangent drawn to the SRJ.
- To maintain sleeper perpendicular to the bisector of the angle made by tangents drawn to main line and turnout side, the sleepers will also be required to be further rotated by an angle equal to the θm since it makes an angle of (90-θn/2-θm) with the tangent drawn to SRJ.

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Orientation of sleepers when turnouts laid in curves

- This additional rotation will reflect into change in the spacing of all the sleepers on the lead portion.
- Such changes will depend on
  - The type of turnout
  - Degree of main line curve
  - The turnout is similar flexure or contrary flexure.

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Orientation of sleepers when turnouts laid in curves

- The sleeper spacing can be increased or decreased on both the rails of main line track as compared to the spacing given in the standard drawing of RDSO.
- Since ERC can be fixed on CMS crossing at certain pre-decided locations it is better that the spacing is not changed on the rail of mainline on which crossing is likely to come i.e. the side on which train negotiates tongue rail while going towards main line.
- Hence the spacing of sleeper 21 to 65 is changed on the side on which crossing is not coming.

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Orientation of sleepers when turnouts laid in curves

- The change in spacing is also required between sleeper No. 1 to 20 by the same principle but since holes in the stock rails are received drilled from the factory spacing on the switch area cannot be changed
- But the total difference of spacing occrued between sleeper No. 1 to 20 is required to be adjusted between sleeper No. 20-21 on 1 in 12 turnout and between sleeper no. 13-14 in 1 in 8.5 turnout.
- In the crossing area sleepers are laid perpendicular to the bisector to the crossing legs. Same principle is applied while laying the turnout on the curve. Hence the sleepers are also required to be oriented along the direction perpendicular to the bisector of the crossing.

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TABLES FOR

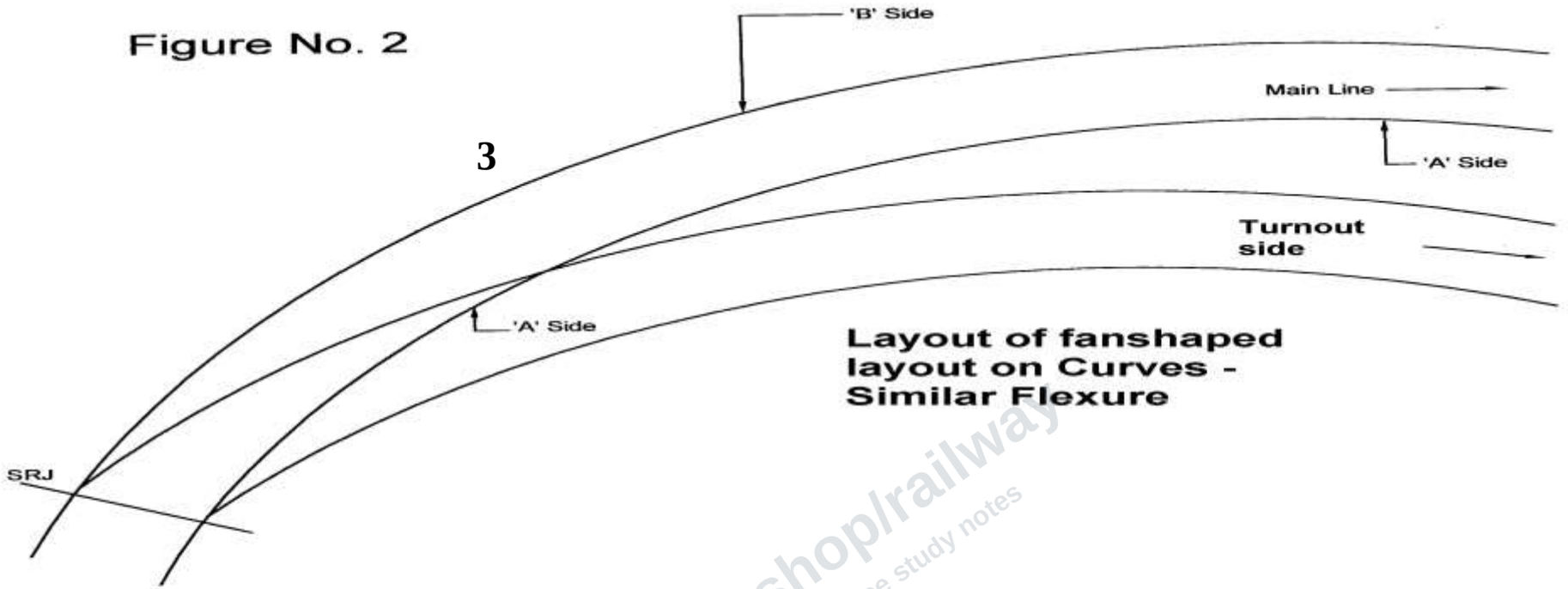
LAYING OF FANSHAPED

LAYOUT ON CURVE

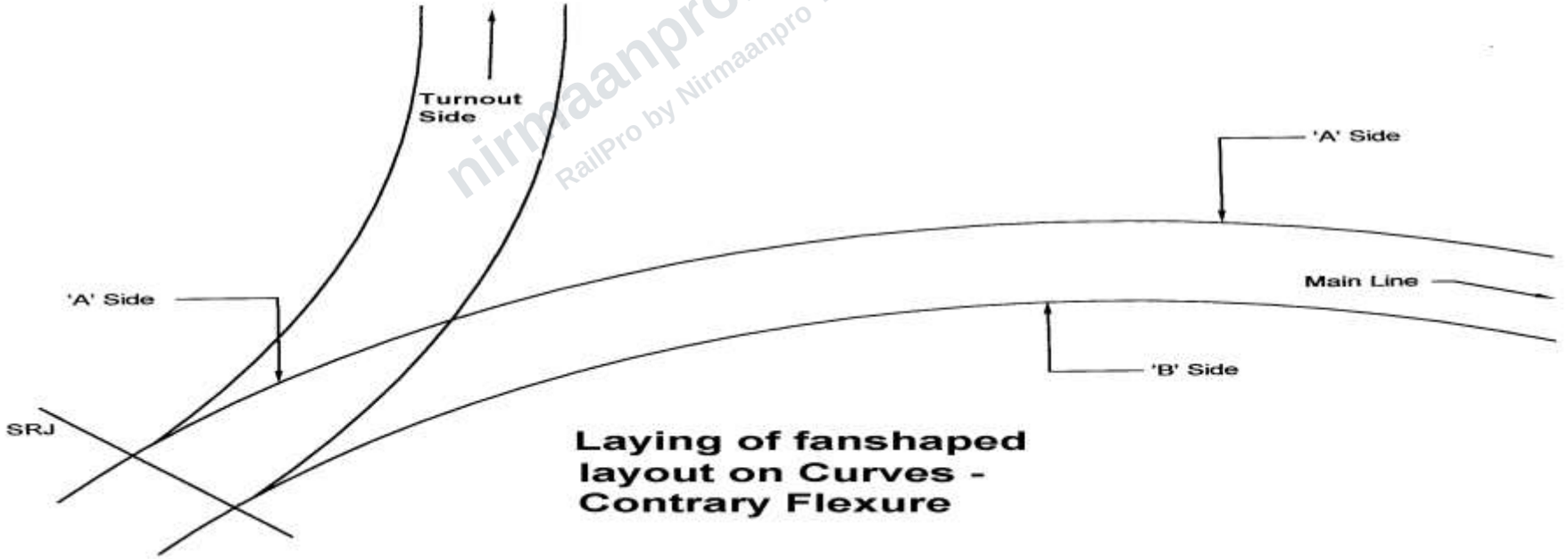
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Figure No. 2

3



Layout of fanshaped layout on Curves - Similar Flexure



Laying of fanshaped layout on Curves - Contrary Flexure

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TABLE FOR CONTRARY FLEXURE, 1:12 TURNOUT ON PSC

Sle. No.	Spacing on gauge face on tongue rail for ML side (A side)		Spacing on gauge face of stock rail for ML side (B side)									
	For All locations		Straight		1 degree		2 degree		3 degree		4 degree	
	Spacing	Cumul.	spacing	Cumul.	spacing	Cumul.	spacing	Cumul.	spacing	Cumul.	spacing	Cumul.
	150		150		150		150		150		150	
1		150		150		150		150		150		150
	457		457		457		457		457		457	
2		607		607		607		607		607		607
	505		505		505		505		505		505	
3		1112		1112		1112		1112		1112		1112
	685		685		685		685		685		685	
4		1797		1797		1797		1797		1797		1797
	552		552		552		552		552		552	
5		2349		2349		2349		2349		2349		2349
	550		550		550		550		550		550	
6		2899		2899		2899		2899		2899		2899
	550		550		550		550		550		550	
7		3449		3449		3449		3449		3449		3449
	550		550		550		550		550		550	
8		3999		3999		3999		3999		3999		3999
	550		550		550		550		550		550	
9		4549		4549		4549		4549		4549		4549
	550		550		550		550		550		550	
10		5099		5099		5099		5099		5099		5099
	550		550		550		550		550		550	
11		5649		5649		5649		5649		5649		5649

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Sle. No.	Spacing on A side		Spacing on gauge face of stock rail for ML side (B side)									
	For All locations		Straight		1 degree		2 degree		3 degree		4 degree	
	550		550		550		550		550		550	
12		6199		6199		6199		6199		6199		6199
	550		550		550		550		550		550	
13		6749		6749		6749		6749		6749		6749
	550		550		550		550		550		550	
14		7299		7299		7299		7299		7299		7299
	550		550		550		550		550		550	
15		7849		7849		7849		7849		7849		7849
	550		550		550		550		550		550	
16		8399		8399		8399		8399		8399		8399
	550		550		550		550		550		550	
17		8949		8949		8949		8949		8949		8949
	550		550		550		550		550		550	
18		9499		9499		9499		9499		9499		9499
	550		550		550		550		550		550	
19		10049		10049		10049		10049		10049		10049
	550		550		550		550		550		550	
20		10599		10599		10599		10599		10599		10599
	526		550		539.36		528.72		518.08		507.44	
21		11125		11149		11138		11128		11117		11106
	549		550		549.48		548.95		548.42		547.9	
22		11674		11699		11688		11677		11666		11654
	549		550		549.48		548.95		548.42		547.9	
23		12223		12249		12237		12226		12214		12202

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Sle. No.	Spacing on A side		Spacing on gauge face of stock rail for ML side (B side)									
	For All locations		Straight		1 degree		2 degree		3 degree		4 degree	
	549		550		549.48		548.95		548.42		547.9	
24		12772		12799		12787		12775		12762		12750
	549		550		549.48		548.95		548.42		547.9	
25		13321		13349		13336		13324		13311		13298
	549		550		549.48		548.95		548.42		547.9	
26		13870		13899		13886		13872		13859		13846
	549		550		549.48		548.95		548.42		547.9	
27		14419		14449		14435		14421		14408		14394
	549		550		549.48		548.95		548.42		547.9	
28		14968		14999		14985		14970		14956		14942
	549		550		549.48		548.95		548.42		547.9	
29		15517		15549		15534		15519		15504		15490
	549		550		549.48		548.95		548.42		547.9	
30		16066		16099		16084		16068		16053		16038
	549		550		549.48		548.95		548.42		547.9	
31		16615		16649		16633		16617		16601		16585
	549		550		549.48		548.95		548.42		547.9	
32		17164		17199		17183		17166		17150		17133
	549		550		549.48		548.95		548.42		547.9	
33		17713		17749		17732		17715		17698		17681
	549		550		549.48		548.95		548.42		547.9	
34		18262		18299		18282		18264		18247		18229
	549		550		549.48		548.95		548.42		547.9	
35		18811		18849		18831		18813		18795		18777

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Sle. No.	Spacing on A side		Spacing on gauge face of stock rail for ML side (B side)									
	For All locations		Straight		1 degree		2 degree		3 degree		4 degree	
	549		550		549.48		548.95		548.42		547.9	
36		**19360**		**19399**		**19380**		**19362**		**19343**		**19325**
	549		550		549.48		548.95		548.42		547.9	
37		**19909**		**19949**		**19930**		**19911**		**19892**		**19873**
	549		550		549.48		548.95		548.42		547.9	
38		**20458**		**20499**		**20479**		**20460**		**20440**		**20421**
	549		550		549.48		548.95		548.42		547.9	
39		**21007**		**21049**		**21029**		**21009**		**20989**		**20969**
	549		550		549.48		548.95		548.42		547.9	
40		**21556**		**21599**		**21578**		**21558**		**21537**		**21517**
	549		550		549.48		548.95		548.42		547.9	
41		**22105**		**22149**		**22128**		**22107**		**22085**		**22064**
	549		550		549.48		548.95		548.42		547.9	
42		**22654**		**22699**		**22677**		**22656**		**22634**		**22612**
	549		550		549.48		548.95		548.42		547.9	
43		**23203**		**23249**		**23227**		**23205**		**23182**		**23160**
	549		550		549.48		548.95		548.42		547.9	
44		**23752**		**23799**		**23776**		**23754**		**23731**		**23708**
	549		550		549.48		548.95		548.42		547.9	
45		**24301**		**24349**		**24326**		**24303**		**24279**		**24256**
	549		550		549.48		548.95		548.42		547.9	
46		**24850**		**24899**		**24875**		**24851**		**24828**		**24804**
	549		550		549.48		548.95		548.42		547.9	
47		**25399**		**25449**		**25425**		**25400**		**25376**		**25352**

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Sle. No.	Spacing on A side		Spacing on gauge face of stock rail for ML side (B side)									
	For All locations		Straight		1 degree		2 degree		3 degree		4 degree	
	549		550		549.48		548.95		548.42		547.9	
48		**25948**		**25999**		**25974**		**25949**		**25924**		**25900**
	549		550		549.48		548.95		548.42		547.9	
49		**26497**		**26549**		**26524**		**26498**		**26473**		**26448**
	549		550		549.48		548.95		548.42		547.9	
50		**27046**		**27099**		**27073**		**27047**		**27021**		**26996**
	549		550		549.48		548.95		548.42		547.9	
51		**27595**		**27649**		**27623**		**27596**		**27570**		**27543**
	549		550		549.48		548.95		548.42		547.9	
52		**28144**		**28199**		**28172**		**28145**		**28118**		**28091**
	549		550		549.48		548.95		548.42		547.9	
53		**28693**		**28749**		**28722**		**28694**		**28667**		**28639**
	549		550		549.48		548.95		548.42		547.9	
54		**29242**		**29299**		**29271**		**29243**		**29215**		**29187**
	549		550		549.48		548.95		548.42		547.9	
55		**29791**		**29849**		**29821**		**29792**		**29763**		**29735**
	549		550		549.48		548.95		548.42		547.9	
56		**30340**		**30399**		**30370**		**30341**		**30312**		**30283**
	549		550		549.48		548.95		548.42		547.9	
57		**30889**		**30949**		**30919**		**30890**		**30860**		**30831**
	549		550		549.48		548.95		548.42		547.9	
58		**31438**		**31499**		**31469**		**31439**		**31409**		**31379**
	549		550		549.48		548.95		548.42		547.9	
59		**31987**		**32049**		**32018**		**31988**		**31957**		**31927**

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Sle. No.	Spacing on A side		Spacing on gauge face of stock rail for ML side (B side)									
	For All locations		Straight		1 degree		2 degree		3 degree		4 degree	
	549		550		549.48		548.95		548.42		547.9	
60		**32536**		**32599**		**32568**		**32537**		**32505**		**32475**
	548		550		549.48		548.95		548.42		547.9	
61		**33084**		**33149**		**33117**		**33086**		**33054**		**33022**
	549		550		549.48		548.95		548.42		547.9	
62		**33633**		**33699**		**33667**		**33635**		**33602**		**33570**
	549		550		549.48		548.95		548.42		547.9	
63		**34182**		**34249**		**34216**		**34184**		**34151**		**34118**
	549		550		549.48		548.95		548.42		547.9	
64		**34731**		**34799**		**34766**		**34733**		**34699**		**34666**
	549		550		549.48		548.95		548.42		547.9	
65		**35280**		**35349**		**35315**		**35282**		**35248**		**35214**
	550		550		549.73		549.45		548.92		548.39	
66		**35830**		**35899**		**35865**		**35831**		**35796**		**35762**
	550		550		549.73		549.45		548.92		548.39	
67		**36380**		**36449**		**36415**		**36380**		**36345**		**36311**
	550		550		549.73		549.45		548.92		548.39	
68		**36930**		**36999**		**36964**		**36930**		**36894**		**36859**
	550		550		549.73		549.45		548.92		548.39	
69		**37480**		**37549**		**37514**		**37479**		**37443**		**37408**
	550		550		549.73		549.45		548.92		548.39	
70		**38030**		**38099**		**38064**		**38029**		**37992**		**37956**
	550		550		549.73		549.45		548.92		548.39	
71		**38580**		**38649**		**38614**		**38578**		**38541**		**38504**

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Sle. No.	Spacing on A side		Spacing on gauge face of stock rail for ML side (B side)									
	For All locations		Straight		1 degree		2 degree		3 degree		4 degree	
	550		550		549.73		549.45		548.92		548.39	
72		39130		39199		39163		39128		39090		39053
	550		550		549.73		549.45		548.92		548.39	
73		39680		39749		39713		39677		39639		39601
	550		550		549.73		549.45		548.92		548.39	
74		40230		40299		40263		40227		40188		40150
	550		550		549.73		549.45		548.92		548.39	
75		40780		40849		40813		40776		40737		40698
	550		550		549.73		549.45		548.92		548.39	
76		41330		41399		41362		41325		41286		41246
	550		550		549.73		549.45		548.92		548.39	
77		41880		41949		41912		41875		41835		41795
	550		550		549.73		549.45		548.92		548.39	
78		42430		42499		42462		42424		42384		42343
	550		550		549.73		549.45		548.92		548.39	
79		42980		43049		43011		42974		42932		42892
	550		550		549.73		549.45		548.92		548.39	
80		43530		43599		43561		43523		43481		43440
	550		550		549.73		549.45		548.92		548.39	
81		44080		44149		44111		44073		44030		43988
	550		550		549.73		549.45		548.92		548.39	
82		44630		44699		44661		44622		44579		44537
	550		550		549.73		549.45		548.92		548.39	
83		45180		45249		45210		45172		45128		45085

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TABLE FOR SIMILAR FLEXURE, 1:12 TURNOUT ON PSC												
Sle. No.	Spacing on gauge face on tongue rail for ML side(A side)		spacing on gauge face of stock rail for ML side (B side)									
	For all locations		Straight		1 degree		2 degree		3 degree		4 degree	
	Spac.	cumul.	Spac.	cumul.	Spac.	cumul.	Spac.	cumul.	Spac.	cumul.	Spac.	cumul.
	150		150		150		150		150		150	
1		150		150		150		150		150		150
	457		457		457		457		457		457	
2		607		607		607		607		607		607
	505		505		505		505		505		505	
3		1112		1112		1112		1112		1112		1112
	685		685		685		685		685		685	
4		1797		1797		1797		1797		1797		1797
	552		552		552		552		552		552	
5		2349		2349		2349		2349		2349		2349
	550		550		550		550		550		550	
6		2899		2899		2899		2899		2899		2899
	550		550		550		550		550		550	
7		3449		3449		3449		3449		3449		3449
	550		550		550		550		550		550	
8		3999		3999		3999		3999		3999		3999
	550		550		550		550		550		550	
9		4549		4549		4549		4549		4549		4549
	550		550		550		550		550		550	
10		5099		5099		5099		5099		5099		5099
	550		550		550		550		550		550	
11		5649		5649		5649		5649		5649		5649

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TABLE FOR SIMILAR FLEXURE, 1:12 TURNOUT ON PSC

Sle. No.	Spacing on gauge face on tongue rail for ML side(A side)		spacing on gauge face of stock rail for ML side (B side)									
	For all locations		Straight		1 degree		2 degree		3 degree		4 degree	
	Spac.	cumul.	Spac.	cumul.	Spac.	cumul.	Spac.	cumul.	Spac.	cumul.	Spac.	cumul.
	150		150		150		150		150		150	
1		150		150		150		150		150		150
	457		457		457		457		457		457	
2		607		607		607		607		607		607
	505		505		505		505		505		505	
3		1112		1112		1112		1112		1112		1112
	685		685		685		685		685		685	
4		1797		1797		1797		1797		1797		1797
	552		552		552		552		552		552	
5		2349		2349		2349		2349		2349		2349
	550		550		550		550		550		550	
6		2899		2899		2899		2899		2899		2899
	550		550		550		550		550		550	
7		3449		3449		3449		3449		3449		3449
	550		550		550		550		550		550	
8		3999		3999		3999		3999		3999		3999
	550		550		550		550		550		550	
9		4549		4549		4549		4549		4549		4549
	550		550		550		550		550		550	
10		5099		5099		5099		5099		5099		5099
	550		550		550		550		550		550	
11		5649		5649		5649		5649		5649		5649

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TABLE FOR SIMILAR FLEXURE, 1:12 TURNOUT ON PSC

Sle. No.	Spacing on gauge face on tongue rail for ML side(A side)	spacing on gauge face of stock rail for ML side (B side)									
	For all locations	Straight		1 degree		2 degree		3 degree		4 degree	
	550	550		550		550		550		550	
12	6199		6199		6199		6199		6199		6199
	550	550		550		550		550		550	
13	6749		6749		6749		6749		6749		6749
	550	550		550		550		550		550	
14	7299		7299		7299		7299		7299		7299
	550	550		550		550		550		550	
15	7849		7849		7849		7849		7849		7849
	550	550		550		550		550		550	
16	8399		8399		8399		8399		8399		8399
	550	550		550		550		550		550	
17	8949		8949		8949		8949		8949		8949
	550	550		550		550		550		550	
18	9499		9499		9499		9499		9499		9499
	550	550		550		550		550		550	
19	10049		10049		10049		10049		10049		10049
	550	550		550		550		550		550	
20	10599		10599		10599		10599		10599		10599
	526	550		562.6		571.3		581.9		592.6	
21	11125		11149		11162		11170		11181		11192
	548	550		550.5		551.1		551.6		552.1	
22	11673		11699		11712		11721		11732		11744

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TABLE FOR SIMILAR FLEXURE, 1:12 TURNOUT ON PSC

Sle. No.	Spacing on gauge face on tongue rail for ML side(A side)	spacing on gauge face of stock rail for ML side (B side)									
	For all locations	Straight		1 degree		2 degree		3 degree		4 degree	
	549		550		550.5		551.1		551.6		552.1	
23		12222		12249		12263		12272		12284		12296
	549		550		550.5		551.1		551.6		552.1	
24		12771		12799		12813		12823		12836		12848
	549		550		550.5		551.1		551.6		552.1	
25		13320		13349		13364		13374		13387		13400
	549		550		550.5		551.1		551.6		552.1	
26		13869		13899		13914		13926		13939		13952
	549		550		550.5		551.1		551.6		552.1	
27		14418		14449		14465		14477		14490		14504
	548		550		550.5		551.1		551.6		552.1	
28		14966		14999		15015		15028		15042		15056
	549		550		550.5		551.1		551.6		552.1	
29		15515		15549		15566		15579		15594		15608
	549		550		550.5		551.1		551.6		552.1	
30		16064		16099		16116		16130		16145		16160
	549		550		550.5		551.1		551.6		552.1	
31		16613		16649		16667		16681		16697		16713
	549		550		550.5		551.1		551.6		552.1	
32		17162		17199		17217		17232		17248		17265
	549		550		550.5		551.1		551.6		552.1	
33		17711		17749		17768		17783		17800		17817
	549		550		550.5		551.1		551.6		552.1	

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TABLE FOR SIMILAR FLEXURE, 1:12 TURNOUT ON PSC

Sle. No.	Spacing on gauge face on tongue rail for ML side(A side)	spacing on gauge face of stock rail for ML side (B side)									
	For all locations	Straight		1 degree		2 degree		3 degree		4 degree	
34		18260		18299		18318		18334		18351		18369
	549		550		550.5		551.1		551.6		552.1	
35		18809		18849		18869		18885		18903		18921
	549		550		550.5		551.1		551.6		552.1	
36		19358		19399		19420		19436		19455		19473
	548		550		550.5		551.1		551.6		552.1	
37		19906		19949		19970		19987		20006		20025
	548		550		550.5		551.1		551.6		552.1	
38		20454		20499		20521		20538		20558		20577
	549		550		550.5		551.1		551.6		552.1	
39		21003		21049		21071		21089		21109		21129
	549		550		550.5		551.1		551.6		552.1	
40		21552		21599		21622		21640		21661		21682
	549		550		550.5		551.1		551.6		552.1	
41		22101		22149		22172		22191		22212		22234
	549		550		550.5		551.1		551.6		552.1	
42		22650		22699		22723		22742		22764		22786
	549		550		550.5		551.1		551.6		552.1	
43		23199		23249		23273		23293		23316		23338
	549		550		550.5		551.1		551.6		552.1	
44		23748		23799		23824		23844		23867		23890

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TABLE FOR SIMILAR FLEXURE, 1:12 TURNOUT ON PSC

Sle. No.	Spacing on gauge face on tongue rail for ML side(A side)	spacing on gauge face of stock rail for ML side (B side)									
	For all locations	Straight		1 degree		2 degree		3 degree		4 degree	
	549		550		550.5		551.1		551.6		552.1	
45		24297		24349		24374		24396		24419		24442
	549		550		550.5		551.1		551.6		552.1	
46		24846		24899		24925		24947		24970		24994
	549		550		550.5		551.1		551.6		552.1	
47		25395		25449		25475		25498		25522		25546
	549		550		550.5		551.1		551.6		552.1	
48		25944		25999		26026		26049		26073		26098
	549		550		550.5		551.1		551.6		552.1	
49		26493		26549		26576		26600		26625		26650
	549		550		550.5		551.1		551.6		552.1	
50		27042		27099		27127		27151		27177		27203
	549		550		550.5		551.1		551.6		552.1	
51		27591		27649		27677		27702		27728		27755
	549		550		550.5		551.1		551.6		552.1	
52		28140		28199		28228		28253		28280		28307
	549		550		550.5		551.1		551.6		552.1	
53		28689		28749		28778		28804		28831		28859
	549		550		550.5		551.1		551.6		552.1	
54		29238		29299		29329		29355		29383		29411
	549		550		550.5		551.1		551.6		552.1	
55		29787		29849		29880		29906		29935		29963

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TABLE FOR SIMILAR FLEXURE, 1:12 TURNOUT ON PSC

Sle. No.	Spacing on gauge face on tongue rail for ML side(A side)	spacing on gauge face of stock rail for ML side (B side)									
	For all locations	Straight		1 degree		2 degree		3 degree		4 degree	
	549		550		550.5		551.1		551.6		552.1	
56		**30336**		**30399**		**30430**		**30457**		**30486**		**30515**
	549		550		550.5		551.1		551.6		552.1	
57		**30885**		**30949**		**30981**		**31008**		**31038**		**31067**
	549		550		550.5		551.1		551.6		552.1	
58		**31434**		**31499**		**31531**		**31559**		**31589**		**31619**
	549		550		550.5		551.1		551.6		552.1	
59		**31983**		**32049**		**32082**		**32110**		**32141**		**32171**
	549		550		550.5		551.1		551.6		552.1	
60		**32532**		**32599**		**32632**		**32661**		**32692**		**32724**
	548		550		550.5		551.1		551.6		552.1	
61		**33080**		**33149**		**33183**		**33212**		**33244**		**33276**
	549		550		550.5		551.1		551.6		552.1	
62		**33629**		**33699**		**33733**		**33763**		**33796**		**33828**
	549		550		550.5		551.1		551.6		552.1	
63		**34178**		**34249**		**34284**		**34314**		**34347**		**34380**
	549		550		550.5		551.1		551.6		552.1	
64		**34727**		**34799**		**34834**		**34866**		**34899**		**34932**
	549		550		550.5		551.1		551.6		552.1	
65		**35276**		**35349**		**35385**		**35417**		**35450**		**35484**
	550		550		550.5		551.1		551.6		552.1	
66		**35826**		**35899**		**35935**		**35968**		**36002**		**36036**

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TABLE FOR SIMILAR FLEXURE, 1:12 TURNOUT ON PSC

Sle. No.	Spacing on gauge face on tongue rail for ML side(A side)	spacing on gauge face of stock rail for ML side (B side)									
	For all locations	Straight		1 degree		2 degree		3 degree		4 degree	
	550		550		550.5		551.1		551.6		552.1	
67		36376		36449		36486		36519		36553		36588
	550		550		550.5		551.1		551.6		552.1	
68		36926		36999		37036		37070		37105		37140
	550		550		550.5		551.1		551.6		552.1	
69		37476		37549		37587		37621		37657		37693
	550		550		550.5		551.1		551.6		552.1	
70		38026		38099		38137		38172		38208		38245
	550		550		550.5		551.1		551.6		552.1	
71		38576		38649		38688		38723		38760		38797
	550		550		550.5		551.1		551.6		552.1	
72		39126		39199		39238		39274		39311		39349
	550		550		550.5		551.1		551.6		552.1	
73		39676		39749		39789		39825		39863		39901
	550		550		550.5		551.1		551.6		552.1	
74		40226		40299		40340		40376		40414		40453
	550		550		550.5		551.1		551.6		552.1	
75		40776		40849		40890		40927		40966		41005
	550		550		550.5		551.1		551.6		552.1	
76		41326		41399		41441		41478		41518		41557
	550		550		550.5		551.1		551.6		552.1	
77		41876		41949		41991		42029		42069		42109

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TABLE FOR SIMILAR FLEXURE, 1:12 TURNOUT ON PSC												
Sle. No.	Spacing on gauge face on tongue rail for ML side(A side)		spacing on gauge face of stock rail for ML side (B side)									
	For all locations		Straight		1 degree		2 degree		3 degree		4 degree	
	550		550		550.5		551.1		551.6		552.1	
78		42426		42499		42542		42580		42621		42661
	550		550		550.5		551.1		551.6		552.1	
79		42976		43049		43092		43131		43172		43214
	550		550		550.5		551.1		551.6		552.1	
80		43526		43599		43643		43682		43724		43766
	550		550		550.5		551.1		551.6		552.1	
81		44076		44149		44193		44233		44276		44318
	550		550		550.5		551.1		551.6		552.1	
82		44626		44699		44744		44784		44827		44870
	550		550		550.5		551.1		551.6		552.1	
83		45176		45249		45294		45336		45379		45422

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1 in 8.5 turnout contrary flexure turnout

Slee per No.	Spacing on gauge faceon tongue rail for ML side (A side)		Spacing on gauge face on stock rail for ML side (B side)									
			Straight		1 degree		2 degree		3 degree		4 degree	
	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.
	300		300		300		300		300		300	
1		300		300		300		300		300		300
	600		600		600		600		600		600	
2		900		900		900		900		900		900
	613		613		613		613		613		613	
3		1513		1513		1513		1513		1513		1513
	600		600		600		600		600		600	
4		2173		2173		2173		2173		2173		2173
	660		660		660		660		660		660	
5		2773		2773		2773		2773		2773		2773
	600		600		600		600		600		600	
6		3373		3373		3373		3373		3373		3373
	600		600		600		600		600		600	
7		3973		3973		3973		3973		3973		3973
	600		600		600		600		600		600	
8		4573		4573		4573		4573		4573		4573
	600		600		600		600		600		600	
9		5173		5173		5173		5173		5173		5173
	600		600		600		600		600		600	
10		5773		5773		5773		5773		5773		5773
	600		600		600		600		600		600	
11		6373		6373		6373		6373		6373		6373

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Sl.No.	Spacing on A side		Spacing on gauge face on stock rail for ML side (B side)									
			Straight		1 degree		2 degree		3 degree		4 degree	
	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.
	600		600		600		600		600		600	
12		6973		6973		6973		6973		6973		6973
	600		600		600		600		600		600	
13		7573		7573		7573		7573		7573		7573
	564		600		592.22		584.44		576.66		568.88	
14		8137		8173		8165		8157		8150		8142
	597		600		599.43		598.86		598.29		597.72	
15		8734		8773		8765		8756		8748		8740
	597		600		599.43		598.86		598.29		597.72	
16		9331		9373		9364		9355		9346		9337
	598		600		599.43		598.86		598.28		597.71	
17		9929		9973		9964		9954		9945		9935
	598		600		599.43		598.86		598.28		597.71	
18		10527		10573		10563		10553		10543		10533
	597		600		599.43		598.86		598.29		597.72	
19		11124		11173		11162		11152		11141		11130
	598		600		599.43		598.86		598.28		597.71	
20		11722		11773		11762		11751		11739		11728
	598		600		599.43		598.86		598.28		597.71	
21		12320		12373		12361		12349		12338		12326
	598		600		599.43		598.86		598.28		597.71	
22		12918		12973		12961		12948		12936		12924

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Sl.No.	Spacing on A side		Spacing on gauge face on stock rail for ML side (B side)									
			Straight		1 degree		2 degree		3 degree		4 degree	
	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.
	597		600		599.43		598.86		598.29		597.72	
23		13515		13573		13560		13547		13534		13521
	598		600		599.43		598.86		598.28		597.71	
24		14113		14173		14160		14146		14133		14119
	598		600		599.43		598.86		598.28		597.71	
25		14711		14773		14759		14745		14731		14717
	598		600		599.43		598.86		598.28		597.71	
26		15309		15373		15358		15344		15329		15314
	597		600		599.43		598.86		598.29		597.72	
27		15906		15973		15958		15943		15927		15912
	598		600		599.43		598.86		598.28		597.71	
28		16504		16573		16557		16541		16526		16510
	598		600		599.43		598.86		598.28		597.71	
29		17102		17173		17157		17140		17124		17108
	598		600		599.43		598.86		598.28		597.71	
30		17700		17773		17756		17739		17722		17705
	597		600		599.43		598.86		598.29		597.72	
31		18297		18373		18356		18338		18321		18303
	598		600		599.43		598.86		598.28		597.71	
32		18895		18973		18955		18937		18919		18901
	598		600		599.43		598.86		598.28		597.71	
33		19493		19573		19554		19536		19517		19498

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Sl.No.	Spacing on A side		Spacing on gauge face on stock rail for ML side (B side)									
			Straight		1 degree		2 degree		3 degree		4 degree	
	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.
	598		600		599.43		598.86		598.28		597.71	
34		20091		20173		20154		20135		20115		20096
	597		600		599.43		598.86		598.29		597.72	
35		20688		20773		20753		20733		20714		20694
	598		600		599.43		598.86		598.28		597.71	
36		21286		21373		21353		21332		21312		21292
	598		600		599.43		598.86		598.28		597.71	
37		21884		21973		21952		21931		21910		21889
	598		600		599.43		598.86		598.28		597.71	
38		22482		22573		22552		22530		22509		22487
	597		600		599.43		598.86		598.29		597.72	
39		23079		23173		23151		23129		23107		23085
	598		600		599.43		598.86		598.28		597.71	
40		23677		23773		23750		23728		23705		23682
	598		600		599.43		598.86		598.28		597.71	
41		24275		24373		24350		24327		24303		24280
	598		600		599.43		598.86		598.28		597.71	
42		24873		24973		24949		24925		24902		24878
	550		550.5		549.97		549.97		549.97		548.39	
43		25423		25524		25499		25475		25452		25426
	550		550.5		549.97		549.45		548.92		548.39	
44		25973		26074		26049		26025		26001		25975

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Sl.No.	Spacing on A side		Spacing on gauge face on stock rail for ML side (B side)									
			Straight		1 degree		2 degree		3 degree		4 degree	
	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.	Spacing	cumul.
	550		550.5		549.97		549.45		548.92		548.39	
45		26523		26625		26599		26574		26549		26523
	550		550.5		549.97		549.45		548.92		548.39	
46		27073		27175		27149		27124		27098		27071
	550		550.5		549.97		549.45		548.92		548.39	
47		27623		27726		27699		27673		27647		27620
	550		550.5		549.97		549.45		548.92		548.39	
48		28173		28276		28249		28223		28196		28168
	550		550.5		549.97		549.45		548.92		548.39	
49		28723		28827		28799		28772		28745		28717
	550		550.5		549.97		549.45		548.92		548.39	
50		29273		29377		29349		29322		29294		29265
	550		550.5		549.97		549.45		548.92		548.39	
51		29823		29928		29899		29871		29843		29813
	550		550.5		549.97		549.45		548.92		548.39	
52		30373		30478		30449		30420		30392		30362
	550		550.5		549.97		549.45		548.92		548.39	
53		30923		31029		30999		30970		30941		30910
	550		550.5		549.97		549.45		548.92		548.39	
54		31473		31579		31549		31519		31490		31459

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Precurvature of tongue and stock rail

- It is a known fact that the curved switch manufactured for LH turnout can not be used for RH turnout because of difference in the pattern of machining of both the tongue rails.
- In every curved switch, gauge face of pair of tongue rail and stock rail leading to turnout side is made curved with some curvature.
- Curved tongue rail is machined straight up to JOH, as this is supposed to bear against straight stock rail.
- Curved stock railand tongue rail are given certain predefined pre-curvature at the time of manufacturing.

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Precurvature of tongue and stock rail

- While laying fan shaped turnout on straight track, stock rail and tongue rail for turnout side is required to be checked for pre-curvature (by checking mid and quarter ordinate).
- Versines at mid and quarter ordinates readings to be as per relevant drawings
- Improper curvature of stock and tongue rail lead to
  - Improper housing of switch.
  - Variation in gauge and versine readings..
  - Improper seating of tongue rail.

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Precurvature of tongue and stock rail in curved track

- While laying fan shaped turnout on straight track, stock rail and tongue rail for turnout side is required to be checked for pre-curvature (by checking mid and quarter ordinate).
- Versines at mid and quarter ordinates readings to be as per relevant drawings which are true only for staright track.
- Laying of fan shaped turnouts on curved track both the stock and tongue rails become curved and the pre-curvature requirements change according to the degree of curve and whether it is similar flexure or contrary flexure.
- To ensure proper bearing of both the tongue rails proper pre-curvature is required.

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Precurvature of tongue and stock rail in curved track

- Pre-curvature requirements change according to the degree of main line curve and flexure of turnout (similar or contrary).
- Stock as well as tongue rail are to be given required pre-curving for good setting of point.
- A table for checking and providing pre-curving for Similar flexure as well as Contrary flexure turnout on curves of various degrees have been prepared.
- The different method to be followed for checking of pre-curving for Similar as well as Contrary flexure turnout has also been given by schematic diagram.
- It may not be possible to measure positive versine of one of the tongue rail of similar flexure (i.e. tongue rail for mainline side); hence the measurements of mid and quarter point should be done as per diagram

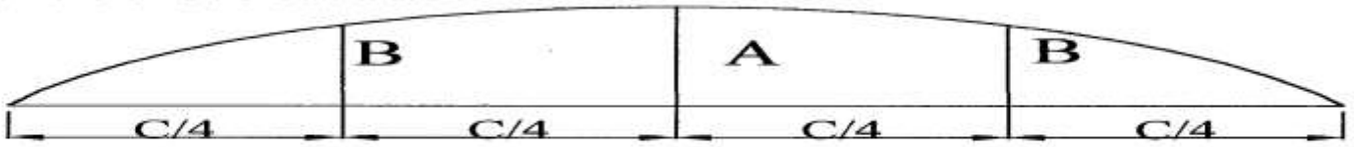
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Table for pre-curving versine of stock and tongue rails when lain in curves in similar and contrary flexure

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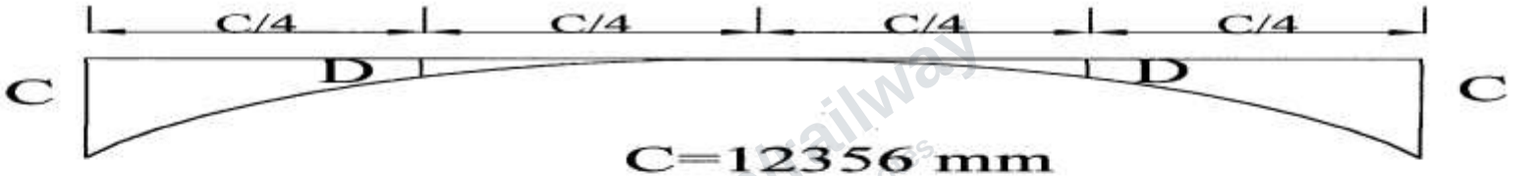
For 1:12 Turnout Similar flexure

(I) Curved stock rail for ML



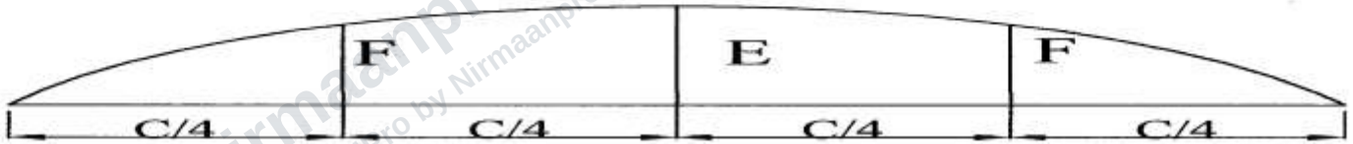
C=11856 mm

(II) Curved tongue rail for ML



C=12356 mm

(III) Curved stock rail for turnout side



C=11856 mm

(IV) Curved tongue rail for turnout side

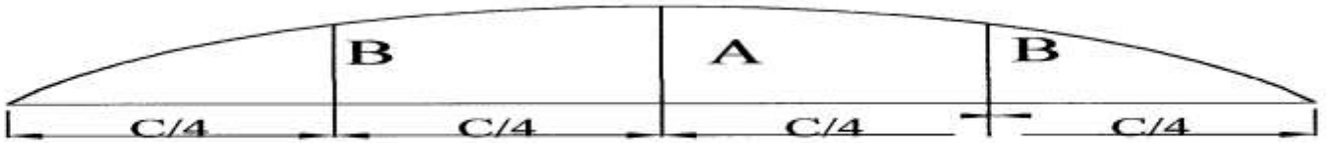


C=12356 mm

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Turnout with contrary flexure

(I) Curved stock rail for ML



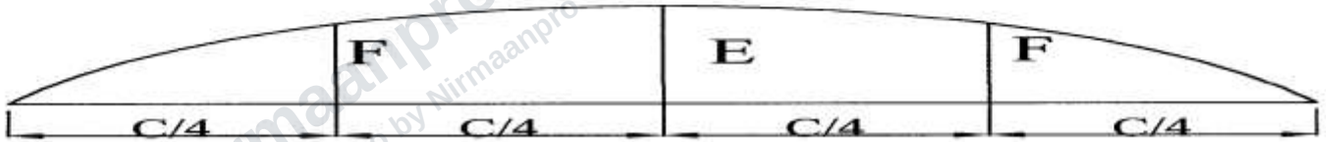
C=11856 mm for 1:12 and 11300 for 1:8.5

(II) Curved tongue rail for ML



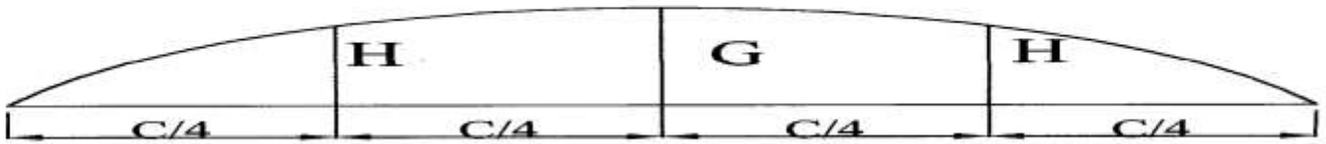
C=12356 mm for 1:12 and 7620 for 1:8.5

(III) Curved stock rail for turnout side



C=11856 mm for 1:12 and 11300 for 1:8.5

(IV) Curved tongue rail for turnout side



C=11356 mm for 1:12 and 7620 for 1:8.5

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Table 1 - For 1 in 12 Turnout with similar flexure

Degree of Mainline Curve	A	B	C	D	E	F	G	H
0	0	0	0	0	40	30	43	32
.5	5	4	5	1	45	34	48	36
1	10	7	11	3	50	37	54	40
1.5	15	11	16	4	55	41	59	44
2	20	15	22	6	60	45	64	48
2.5	25	19	27	7	65	49	70	52
3	30	22	33	8	70	52	75	56
3.5	35	26	38	9	75	56	81	60
4	40	30	44	11	80	60	86	64

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Table 2 - For Contrary flexure 1 in 12

Degree of Mainline curve	A	B	C	D	E	F	G	H
0	0	0	0	0	40	30	43	32
.5	5	4	5	4	35	26	37	28
1	10	7	11	8	30	22	32	24
1.5	15	11	16	12	25	19	26	19
2	20	15	22	16	20	15	21	15
2.5	25	19	27	20	15	11	15	11
3	30	22	33	25	10	7	10	7
3.5	35	26	38	29	5	4	4	3
4	40	30	44	33	0	0	0	0

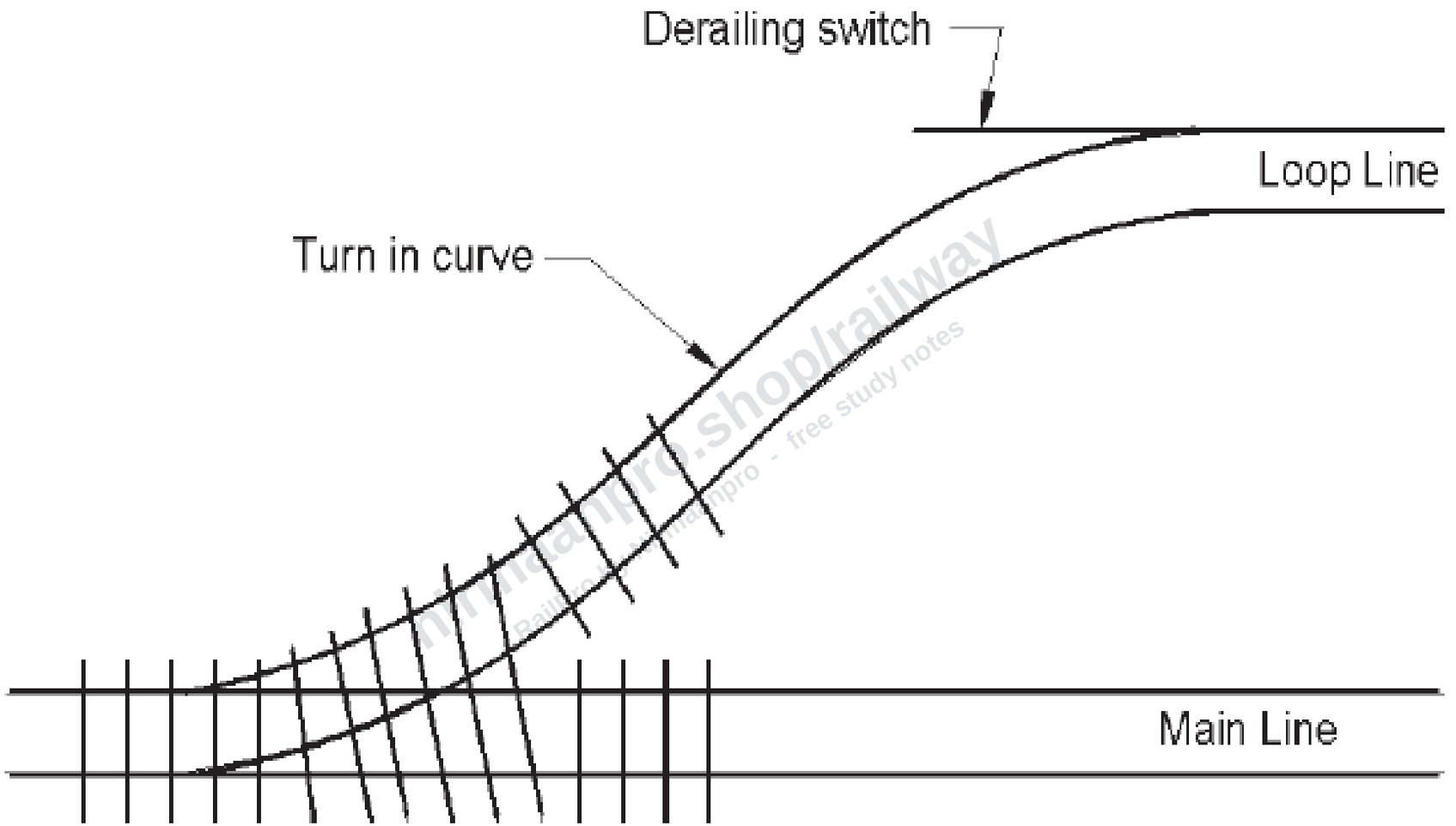
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Table 3 - For Contrary flexure 1 in 8.5

Degree of Mainline curve	A	B	C	D	E	F	G	H
0	0	0	0	0	69	52	31	23
.5	5	3	2	1	65	48	29	21
1	9	7	4	3	61	44	27	20
1.5	14	10	6	5	55	41	25	18
2	18	14	8	6	51	38	23	17
2.5	23	17	10	8	46	35	21	15
3	27	21	12	9	42	32	19	14
3.5	32	24	15	11	37	23	17	12
4	36	27	17	12	33	24	15	10

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Turn in curve



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Turn in curve

- Turnouts are always provided to connect 2 tracks, hence on divergent side after heel of crossing (or last long sleeper in case of PSC sleepers) track is laid to connect it to adjoining track.
- This part of track may be straight or curving in any direction.
- If it is curved in same direction, it is called connecting curve.
- If this curve is in the direction opposite to the direction of lead curve, it is called turn in curve. (i.e.) track portion between the heel of crossing to the fouling mark

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Laying & Maintenance of Spring Setting Device

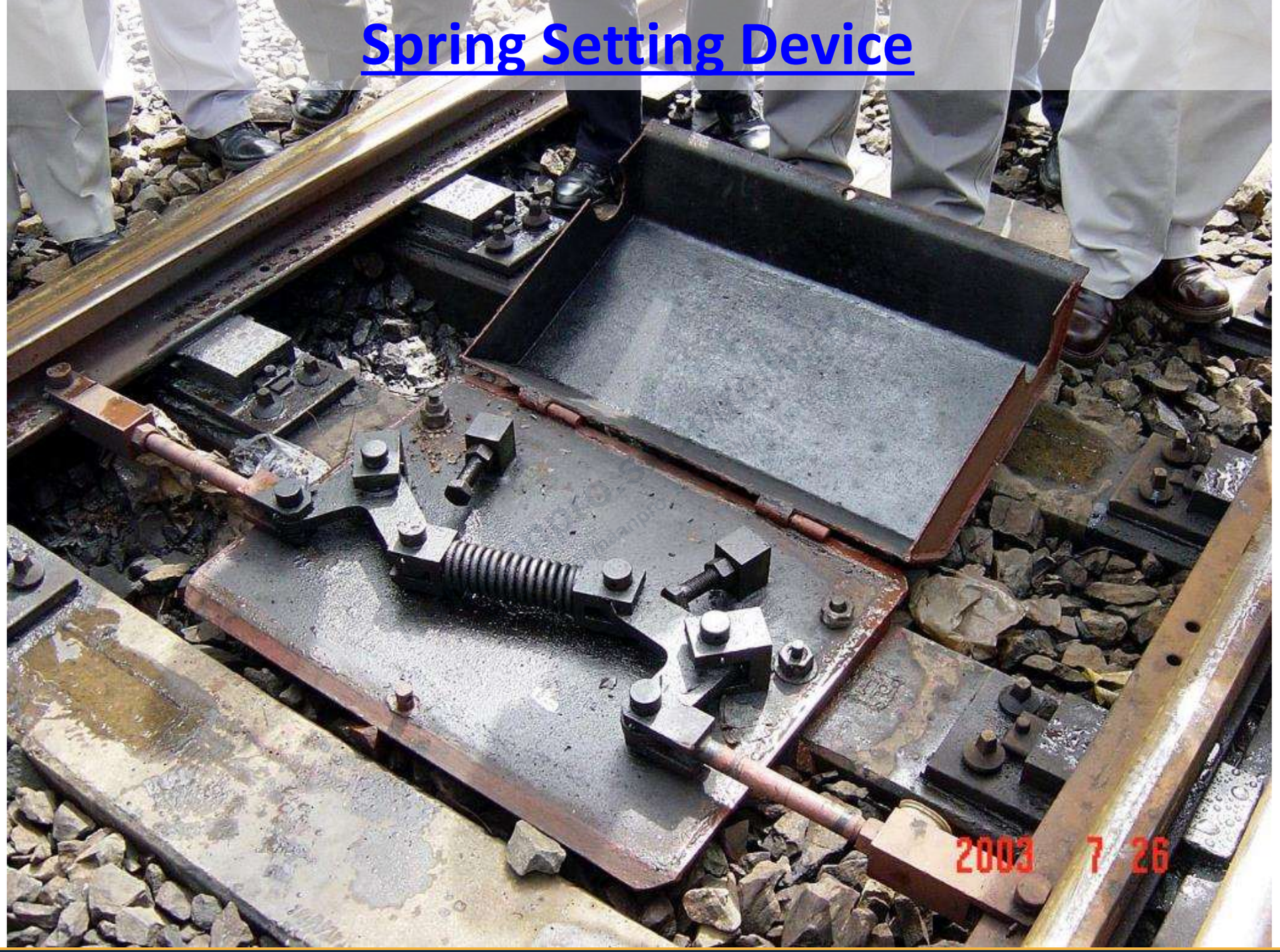
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Spring Setting Device

- It is a **reversible mechanical spring device** connected to the foot of two tongue rails **at or near JOH**
- The device **actuates** after the movement of TRs initiated by the point motor reaches **about half way**
- At this stage, **one** connecting rod of the **SSD pulls** the open TR away from SR and simultaneously the **other** connecting rod **pushes** the closed TR firmly against the SR

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Spring Setting Device



Spring Setting Device

- This **prevents the rattling of TRs** between TOE and HEEL under moving wheels and ensures **adequate clearance** between TR and SR.
- Hence, **enhanced life** of switches and better riding comfort can be achieved.
  - RDSO Drg No. RT-6216 (60 kg)

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Speed Potential on Turnouts

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Permissible Speeds on Points & Crossings

- **Criteria For Permissible Speed On Main Line**
  - Standard of Interlocking

- **Speeds on Main Line**
  - Standard I Interlocking - 50 kmph
  - Standard II Interlocking - 75 kmph
  - Standard III Interlocking - Unrestricted
  - Irrespective of interlocking, speed shall be restricted to 50 kmph in case of a point taking off in the block section

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Permissible Speeds on Points & Crossings

- **Criteria For Permissible Speed On Main Line**
  - Curvature of Main Line
- **Speeds on Main Line**
  - No restriction in case of straight Main Line
  - Main line & Turnout having curvature in opposite direction
    - CANT given to mainline acts as negative CANT for turnout.
    - This restricts permissible speed on main line.
  - Main line & Turnout having curvature in same direction
    - CANT given to Main line is also given to Loop Lines. This puts restriction on permissible speed on Main Line.

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Speed Potential on Turnouts

- Factors which restricts speed potential on Turnout:
  - Abrupt change in direction at Toe of Switch quantified by Switch Entry Angle
  - Absence of Transition
  - Deficiency of Super elevation in lead
  - Discontinuity at Crossing
  - Un-transitioned entry from curved lead to straight crossing
  - Straight or un-flexed crossing.

- However out of above only SEA has significant bearing on speed potential of T/O at low speeds.

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Speeds on Points and Crossings

Effect of SEA

- Following feature of TO affect running over it **ABRUPT CHANGE IN DIRECTION** –resulting in lateral jerk on bogie and corresponding heavy lateral force on tongue rail.
- The magnitude of the force primarily depends on Switch Entry Angle.
- The SEA has therefore direct bearing on speed potential of Turnouts.
- In fact this is the most important factor affecting the speed potential .

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The D-72 Report of ORE (now, ERRI) has Recommended following SEAs for different speeds

SPEED (kmph)	SEA (d-m-s)
40	0-40-30
60	0-25-00
100	0-15-00
160	0-08-00

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ORE — Office Of Reseasrch and Experimentation

ERRI — Europian Rail Research Institute (A body of UIC)

Absence of Transition

- Absence of transition on entry from straight switch to curved lead or straight approach to curved switch causes lurch (lateral force) and primarily affects comfort.

- The effect of absence of transition has been studied by ORE and the results indicate that at slow speeds this effect is not pronounced.

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Deficiency of Super-elevation

- Absence of super-elevation over Turnout causes **UNBALANCED LATERAL ACCELERATION** and affects **SAFETY** and **COMFORT.**
- In European Railways, Switch Entry Angles are small and the permissible cant deficiency on the TO curves becomes main criteria for evaluating the permissible speed.
- On IR this is a minor consideration as compared to SEA.
- WHY?

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Discontinuity at Crossing

- Due to the gap, vertical impact forces are exerted on the nose of crossing.
- Studies conducted by ORE have indicated that for speeds upto 200 kmph on the straight and 160 on turnout, it is not necessary to avoid this gap.
- However, it can be avoided, with the objective of improving safety, with the comfort and maintainability.
- SOLUTION :

Movable nose crossing for speed beyond 160 Kmph.

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Un-transitioned entry from curved lead to straight crossing

Straight or un-flexed crossing

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- SOLUTION :

Use of Curved Crossings

Theoretical Evaluation of Speed Potential on Turnout

- The permissible speed over the turnout is the minimum of the following three speeds

a) Permissible speed due to non transitioning of the lead curve

b) Permissible speed due to non-canting of lead curve

c) Permissible speed to obtain desirable values of lateral forces and acceleration at entry

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Permissible speeds for various criteria

Turnout	SEA	Speed due to non-transition-ing (KMPH)	Speed due to non-provision of super elevation (KMPH)
1 in 8.5 (Straight Switch)	1°34’ 37”	43.6	35.8
1 in 8.5 (Curved Switch)	0°47’ 27”	45.0	36.0
1 in 12 (Straight Switch)	1°8’ 0”	68.0	50.0
1 in 12 (Curved Switch)	0°27’ 35”	69.4	51.0
1 in 16	0°24’ 27”	95.4	68.8
1 in 16 (Symmetrical split)	0°12’ 13”	138.0	97.0
1 in 20	0°24’ 27”	122.0	86.4

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Flange forces depend to a greater extent on the angle of attack than on speed

Angle of Attack	Maximum Value of lateral forces (Tonnes)		
	Speed 30 KMPH	Speed 45 KMPH	Speed 60 KMPH
0° 12’ 0”	2.4	3.0	4.0
0° 24’ 0”	4.9	5.10	6.50
0° 34.4’ 0”	7.0	7.50	10.0
1° 41.5’0”	10.0	11.50	14.9

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Instrumented trials have revealed the following permissible speeds based on lateral forces exerted by vehicles while negotiating the switches -

Type of Turnout	SEA	Speed Potential
1 in 8.5 (straight)	1°34’ 27”	10 kmph
1 in 8.5 (curved)	0°47’ 27”	25 kmph
1 in 12 (straight)	1° 08 ‘00”	15 kmph
1 in 12 (curved)	0°27’ 35”	42 kmph
1 in 16 and 1 in 20	0°24’ 27”	55 kmph
1 in 16 (high speed)	0°17’ 11”	80kmph

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Based on the Field Trial results and Limiting values of Parameters, the Speed Potential for different Turnouts has been prescribed by RDSO

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Speed Potential on BG

Description	Speed (kmph)
1 in 8 ½ - Straight Switch	10
1 in 8 ½ - Curved Switch	25
1 in 12 - Straight Switch	15
1 in 12 Conventional Curved Switch (SEA : 0^0 27’ 35”)	40
1 in 12 - Improved Curved Switch	50
1 in 12 - Thick Web Switch	50
1 in 16 - Conventional Curved Switch	50
1 in 16 - Improved Curved Switch	65
1 in 20 - Improved Curved Switch	85

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Speed Potential on BG

Description	Speed (kmph)
1 in 8 ½ - Symmetrical Split with Curved Switch	40
1 in 12 - Symmetrical Split with Improved Curved Switch	70
1 in 16 - Symmetrical split with Curved Switch	75

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Speed on PSC Turnouts

Type of Turnout (BG)	Permissible Speed (Kmph)
1 in 8.5 - 52 Kg/60 Kg with Curved Switch	15
1 in 8.5 - 52 Kg/60 Kg Symmetrical Split with Curved Switch	30
1 in 12 - 52 Kg/60 Kg with Curved Switch	30

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PART II - TRACK STRUCTURE

3 Crossovers – Layout Calculations

3.1 Calculation for laying cross over, Cross over between straight parallel tracks with same & different no. of crossings.

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(Periods – 1)

General: methods of Layout Calculations:

- **Centre line method**
  - Turnout is represented by centre lines of straight and turnout side.
  - Used for locating SRJ and OL.
  - Suitable for turnouts taking off from straight tracks.
  - It is simple in calculation
- **Outer rail method**
  - Turnout is represented by LH and RH rails of turnout.
  - Used for locating TNC.
  - Suitable for turnouts taking off from the curved tracks and can be used for straight tracks also.
  - It is cumbersome in calculation.
- **Graphical method**.
  - Turnout is represented in computer by AUTOCAD.
  - Yard calculation is powerful feature

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Why Layout Calculations?

- To fix correct position of T/out w.r.t. existing track in case of yard remodeling.
- To avoid kinks & sharp curvatures.
- To design new layouts in case of new construction.
- To ensure safety
- For space economization.

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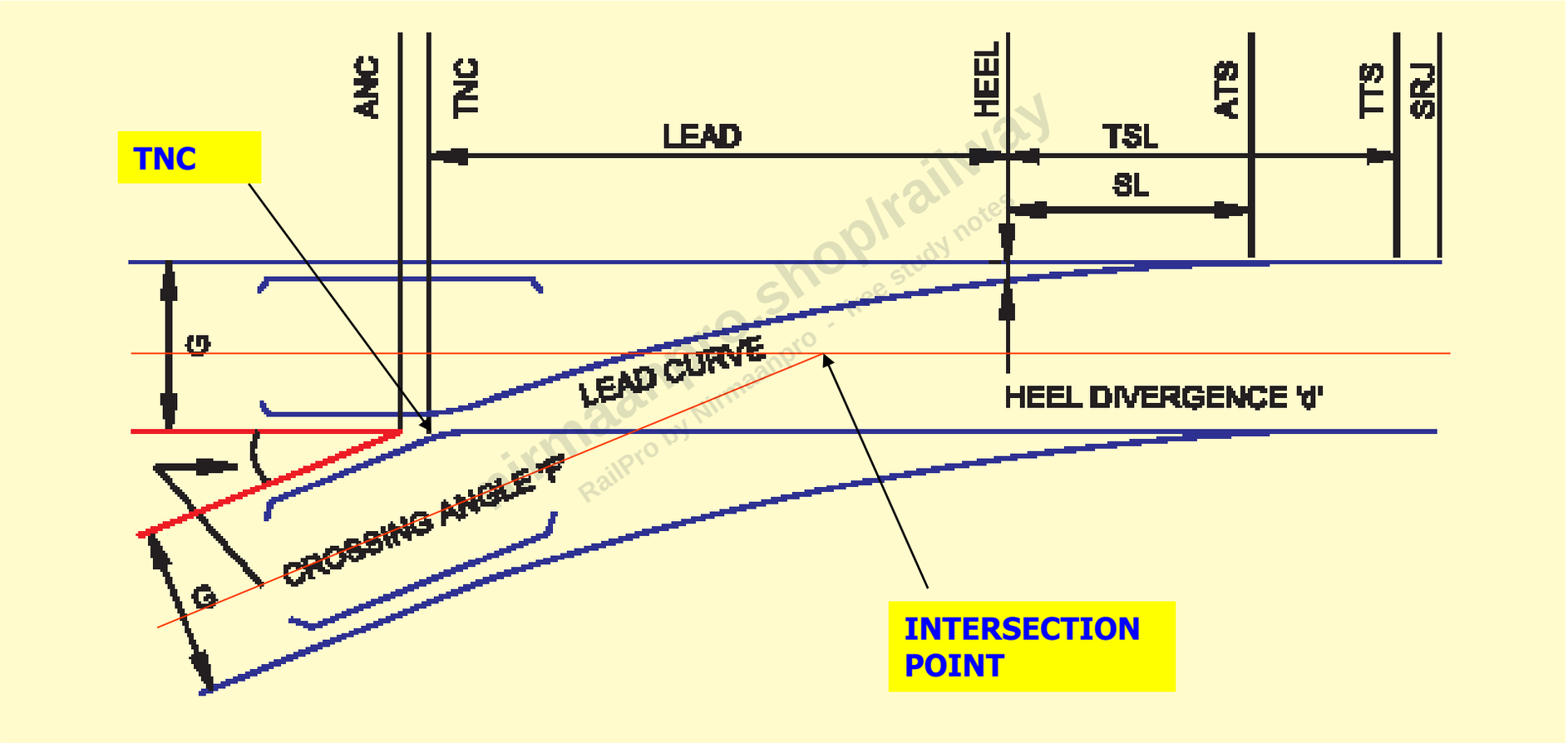
When needed ?

- *Open Line engineers*
  - To rectify defective layouts
  - For yard remodeling works

- *Construction Engineers*
  - For Gauge conversion works
  - For doubling works
  - For yard remodeling works

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TURNOUT


ANC
TNC
HEEL
ATS
TTS
SRJ
LEAD
TSL
SL
TNC
G
LEAD CURVE
HEEL DIVERGENCE 'd'
CROSSING ANGLE 'F'
G
INTERSECTION POINT

TYPES OF LAYOUT

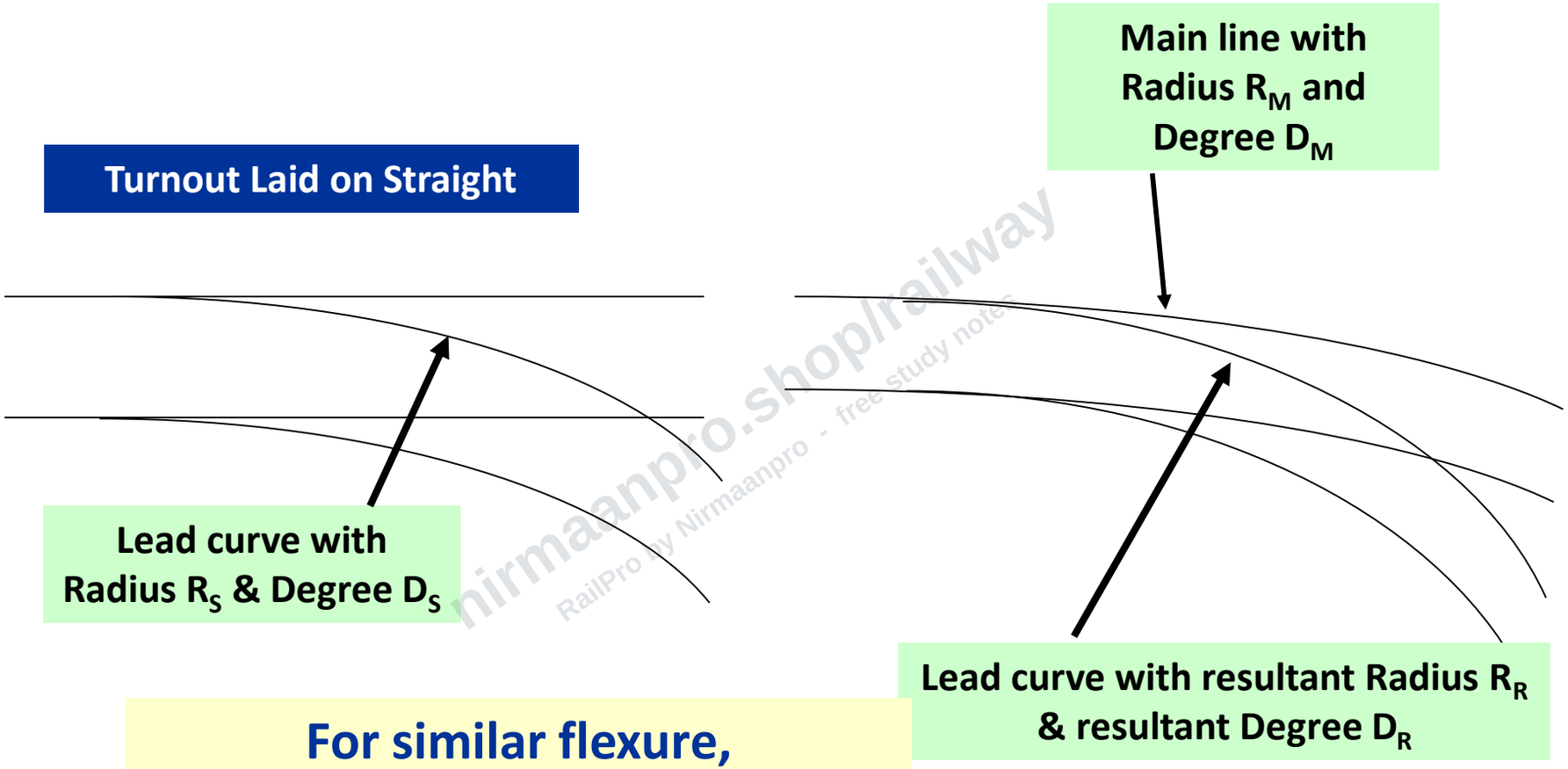
-T/Os taking off from *straight* track

-T/Os taking off from *curved* tracks

- D_S is the degree of T/O curve (lead curve) taking off from *straight*
- D_M is the degree of main line curve
- D_R is the resultant degree of T/O curve (lead curve) when taking off from *curved main line*

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Resultant Lead Radius in Similar Flexure Turnouts



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For similar flexure,

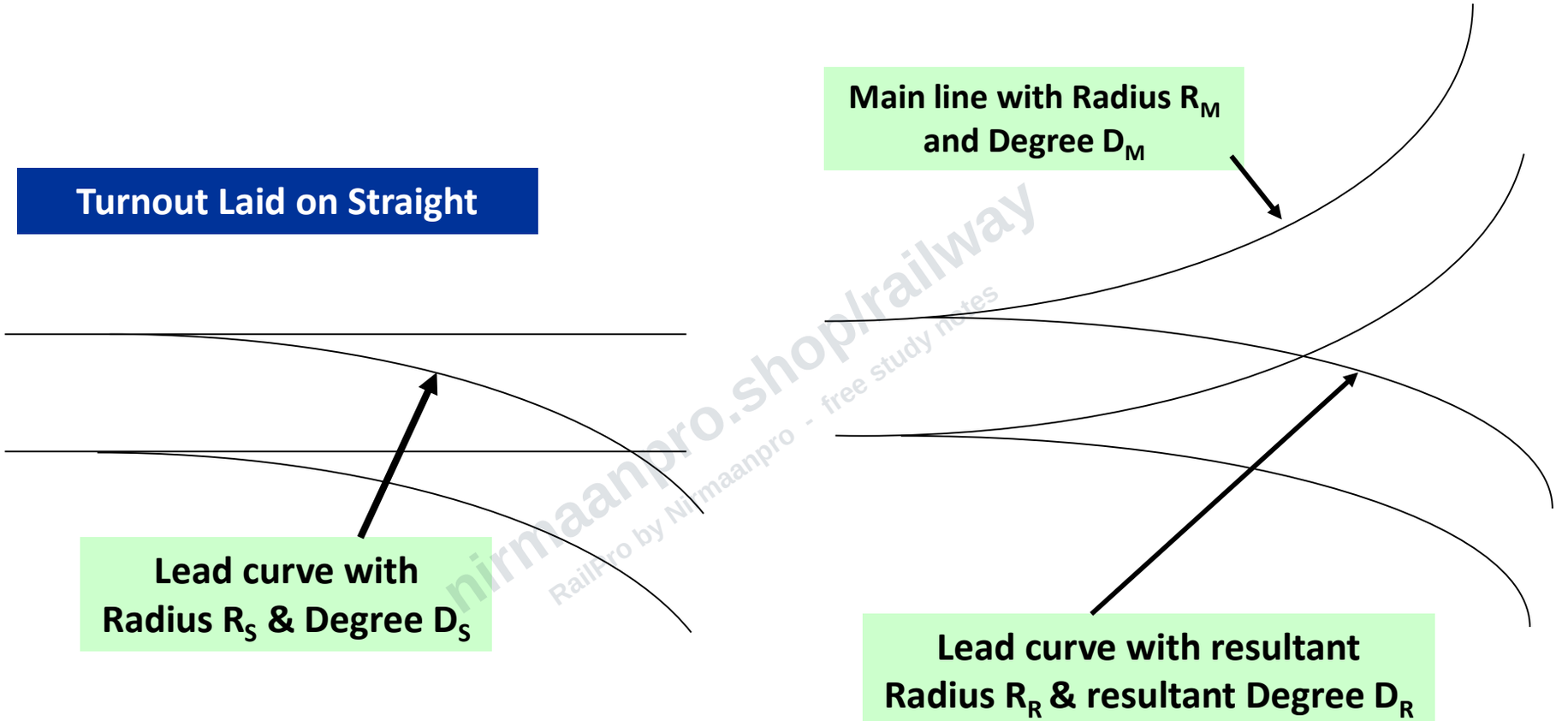
$$D_R = D_M + D_S$$

$$1750/ R_R = 1750/ R_M + 1750/ R_S$$

$$1/ R_R = 1/ R_M + 1/ R_S$$

Resultant Lead Radius in Contrary Flexure Turnouts

Turnout Laid on Straight



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For contrary flexure,

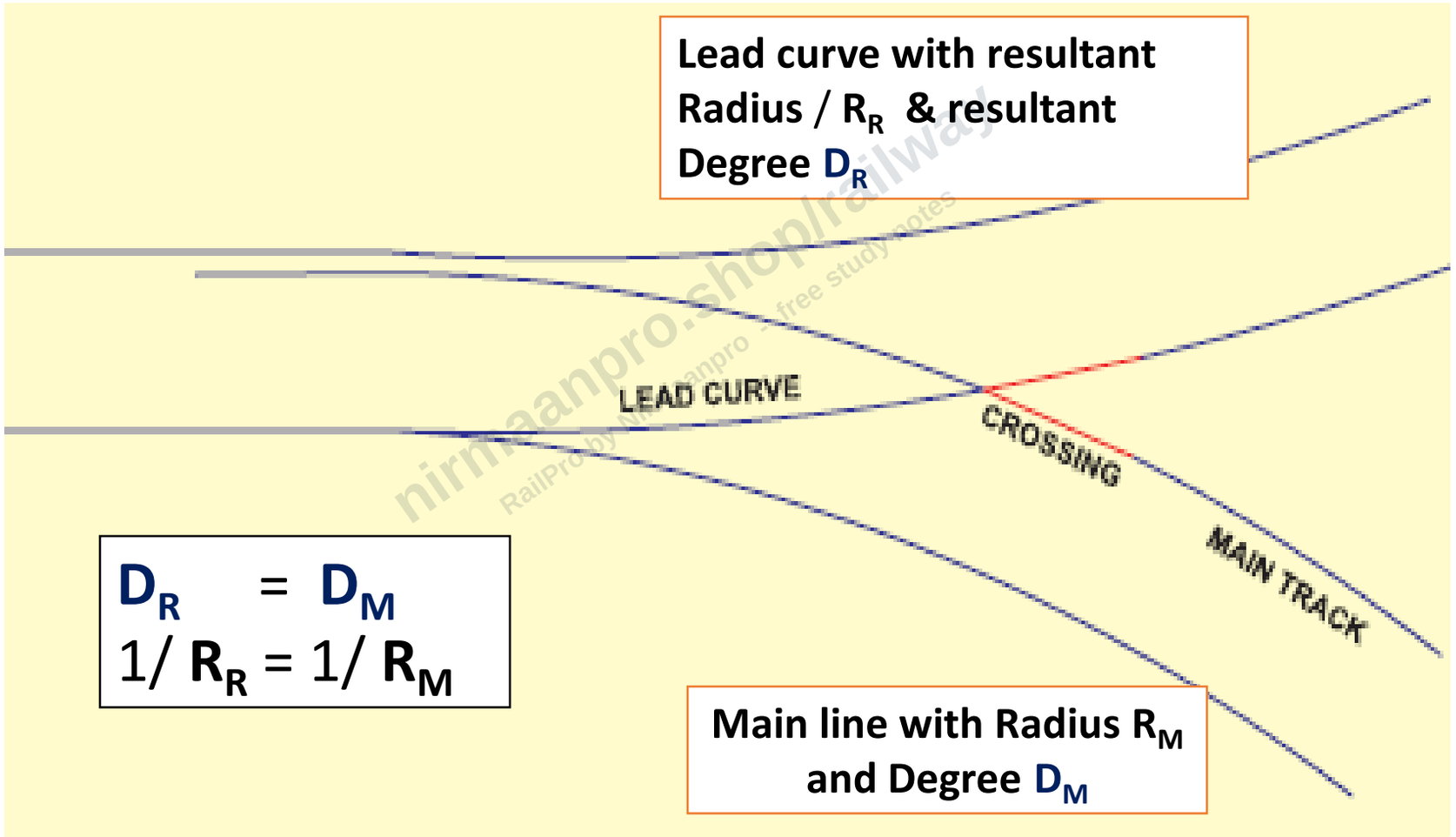
$$D_R = D_M - D_S$$

$$1750/ R_R = 1750/ R_M - 1750/ R_S$$

$$1/ R_R = 1/ R_M - 1/ R_S$$

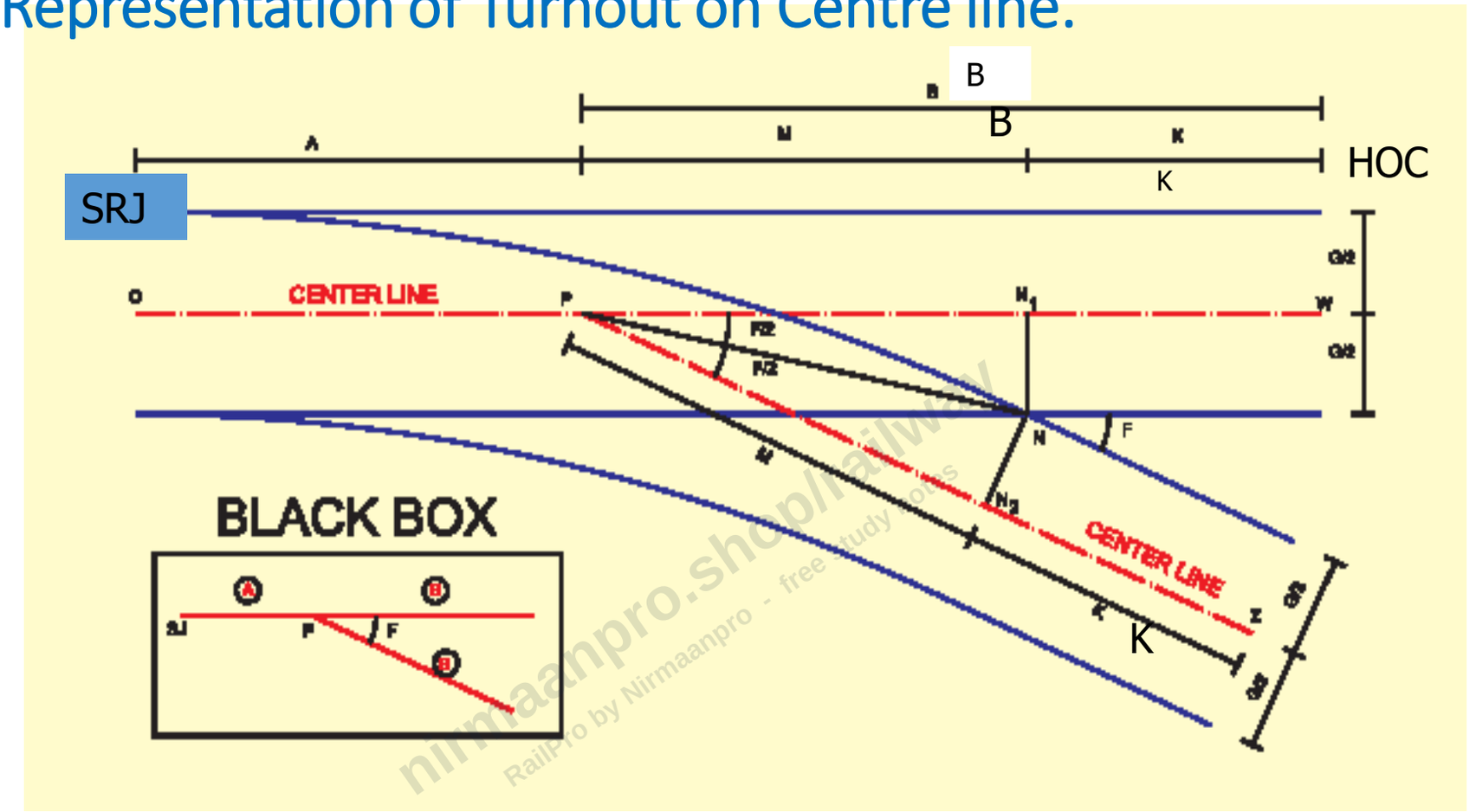
Resultant Lead Radius in

Symmetrical split



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Representation of Turnout on Centre line.



A = SRJ to P distance, is dependent upon angle of crossing 'F' and not on type of switches, i.e. straight or curved or else whole yard will have to be redesigned in case of adopting new design of a switch.

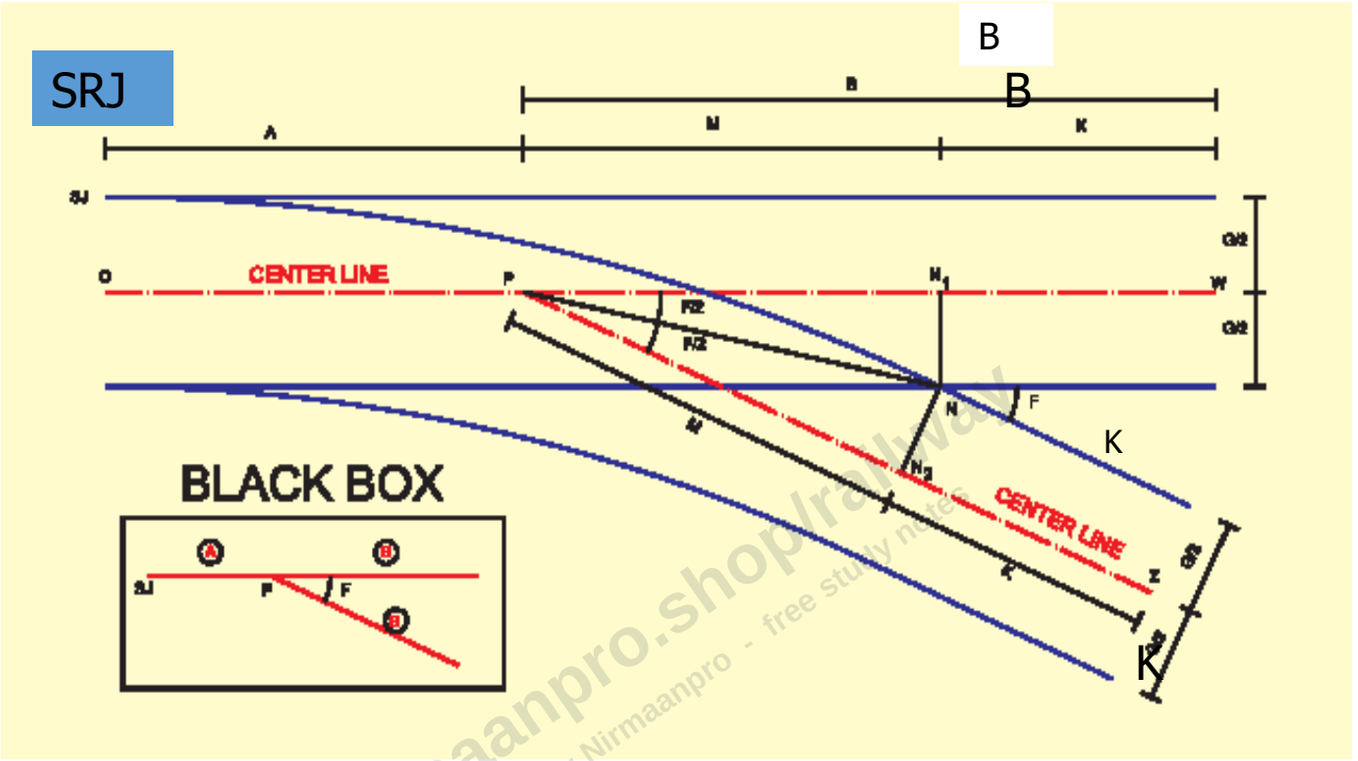
M = Distance from P to TNC. Calculated as

$$M = \frac{G}{2} Cot \frac{F}{2}$$

M is fixed for a particular gauge **'G'** & angle of crossing **'F'**

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Representation of Turnout on Centre line.



- K = Length of back leg of crossing i.e. Distance from TNC to HOC.
- K is dependent upon type of crossing i.e. BU or CMS crossing. For a particular type of crossing chosen for a yard, value of 'K' will be fixed. 'K' is large for Built-up and less for CMS xing. Therefore B = M + K is also fixed.
- 'F'= (Angle of crossing) is same for straight or curved switch.
- Overall length = A + B

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A TURNOUT

- A,M and K are known as turnout parameters
- For a particular gauge and angle of crossing , M is fixed
- K is the length of back leg of Xing and will depend on type of Xing, built up or CMS
- A is also dependent on angle of xing and not on type of switch
- Therefore for a given gauge, crossing angle and crossing type (BU or CMS), value of these turnout parameters i.e. ‘A’, ‘M’ & ‘K’ are fixed.

  i.e. The T/O are fixed.

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CENTRE LINE LAYING (FOR BG WITH CMS CROSSING)

Section	Gauge	Crossing No	Type	Dimensions (mm)					Assembly Drg No
				A	B	C	M	K	
52 KG	BG	1 IN 8 1/2	S, LH	12000	17418	840	14295	3123	TA-20122, TA-20804
52 KG	BG	1 IN 8 1/2	C, FH	12000	17418	1500	14295	3123	TA-20196, TA-20835
90R	BG	1 IN 8 1/2	S, LH	12000	17404	840	14295	3109	TA20110, TA-20198,etc
90R	BG	1 IN 8 1/2	C, FH	12000	17404	1500	14295	3109	TA-20148, TA-20822
52 KG	BG	1 IN 12	S, FH	16953	23981	1500	14295	3834	TA-5268(M), TA-20222, TA-20801
52 KG	BG	1 IN 12	C, FH	16953	23981	1500	20147	3834	TA-20171, TA-20831
90R	BG	1 IN 12	S, FH	16953	23962	1500	20147	3815	TA-5044(M), TA-20184, etc
90 R	BG	1 IN 12	C, FH	16953	23962	1500	20147	3815	TA-20125, TA-20839
52 KG	BG	1 IN 16	C, FH	20922	31447	844	20147	4605	TA-20141, TA-20828
52 KG	BG	1 IN 16 (HS)	C, FH	22693	31447	850	26842	4605	RDST/T-403
90 R	BG	1 IN 16	C, FH	20922	31421	844	26842	4579	TA-20138, TA-20813
90 R	BG	1 IN 20	C, FH	24664	39470	844	26842	5930	TA-20122, TA-20804
60 KG	BG (PSC)	1 IN 8 1/2	C, FH	12025	16486	1500	14270	2216	RT-4865
52 KG	BG (PSC)	1 IN 8 1/2	C, FH	12025	16486	1500	14270	2216	RT-4865
60 KG	BG (PSC)	1 IN 12	C, FH	16989	22912	1141	20111	2803	RT-4218
52 KG	BG (PSC)	1 IN 12	C, FH	16989	22914	1141	20111	2801	RT-4218
60 KG	BG(PSC)	1 IN 16	C,FH	20970	30558	844	26794	3764	RDSO/T-5691
60 KG	BG(PSC)	I IN 20	C, FH	25850	38031	844	33480	4550	RDSO/T-5858

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BROAD GAUGE (1673 MM) ON PSC SLEEPERS

CROSSING NO.	***SECTION***	***TYPE***	***ANGLE OF CROSSING (F)***	***RADIUS (R)***
1 IN 8 ½	60 kg	C, FH	6° 42’ 35’’	232260
1 IN 8 ½	52 kg	C, FH	6° 42’ 35’’	232260
1 in 12	60 kg	C, FH	4° 45’ 49’’	441360
1 IN 12	52 kg	C, FH	4° 45’ 49’’	441360
1 IN 16	60 kg	C, FH	3° 34’ 35’’	784993
1 IN 20	60 kg	C, FH	2° 51’ 45’’	1283100

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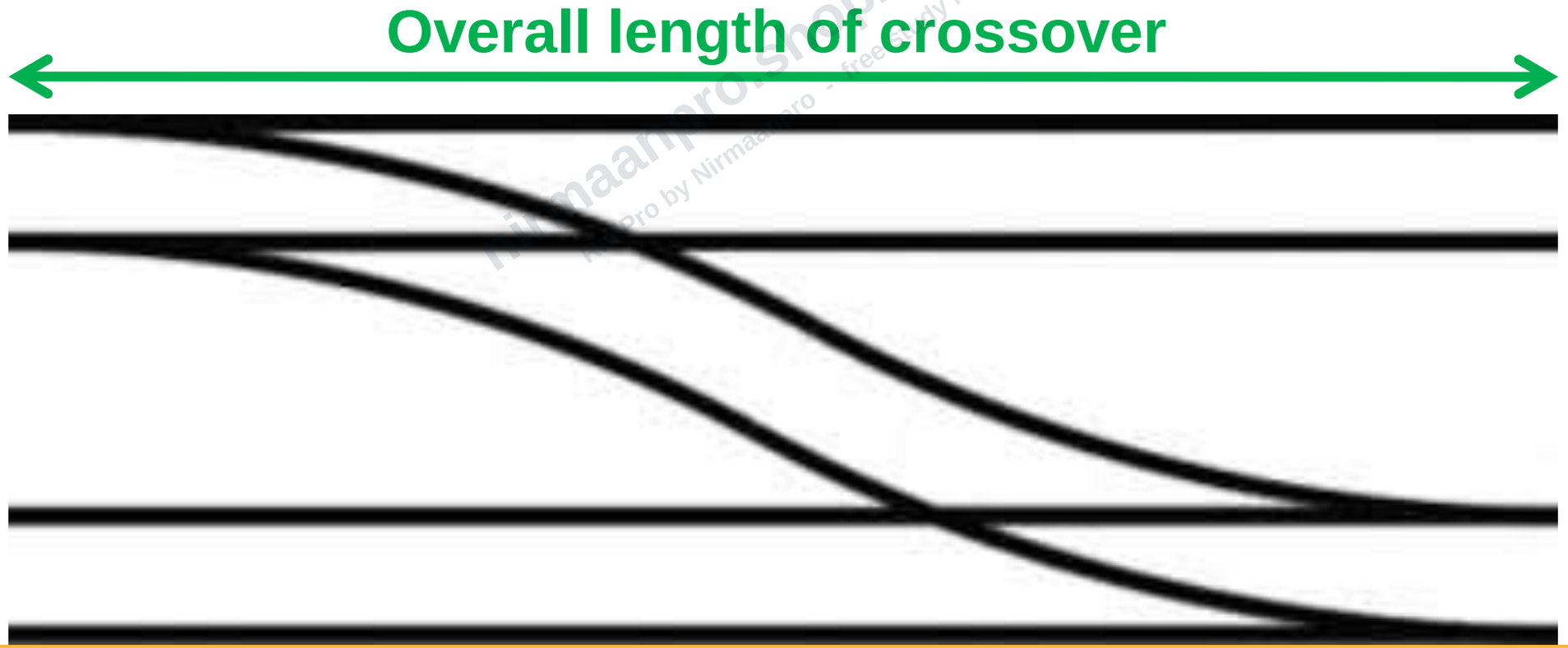
CROSSOVER



• Crossover

A crossover is a pair of switches that connects two parallel rail tracks, allowing a train on one track to cross over to the other.

Overall length of crossover: It is length measured in straight from SRJ of one point to another.



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Crossover Between Straight Parallel Track

With normal spacing between the tracks and with the same angle of crossing.

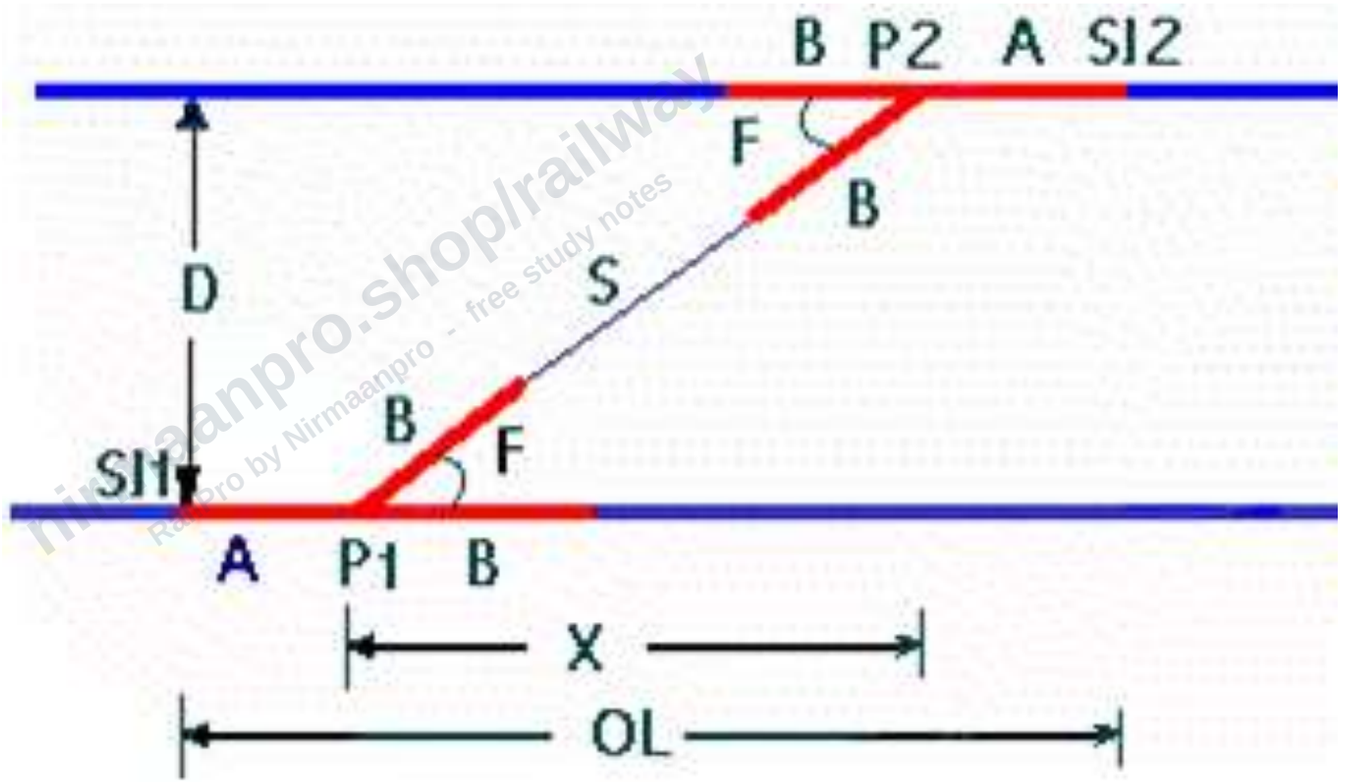
X = D CotF

OL = X + 2A

2B + S = D/SinF .

Hence,

$$S = \frac{D}{SinF} - 2B$$



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Crossover Between Straight Parallel Track

With **large** spacing between tracks and **same** angle of crossing and *no* straight

$$\theta = Cos^{-1}\frac{RCosF + BSinF - D/2}{R}$$

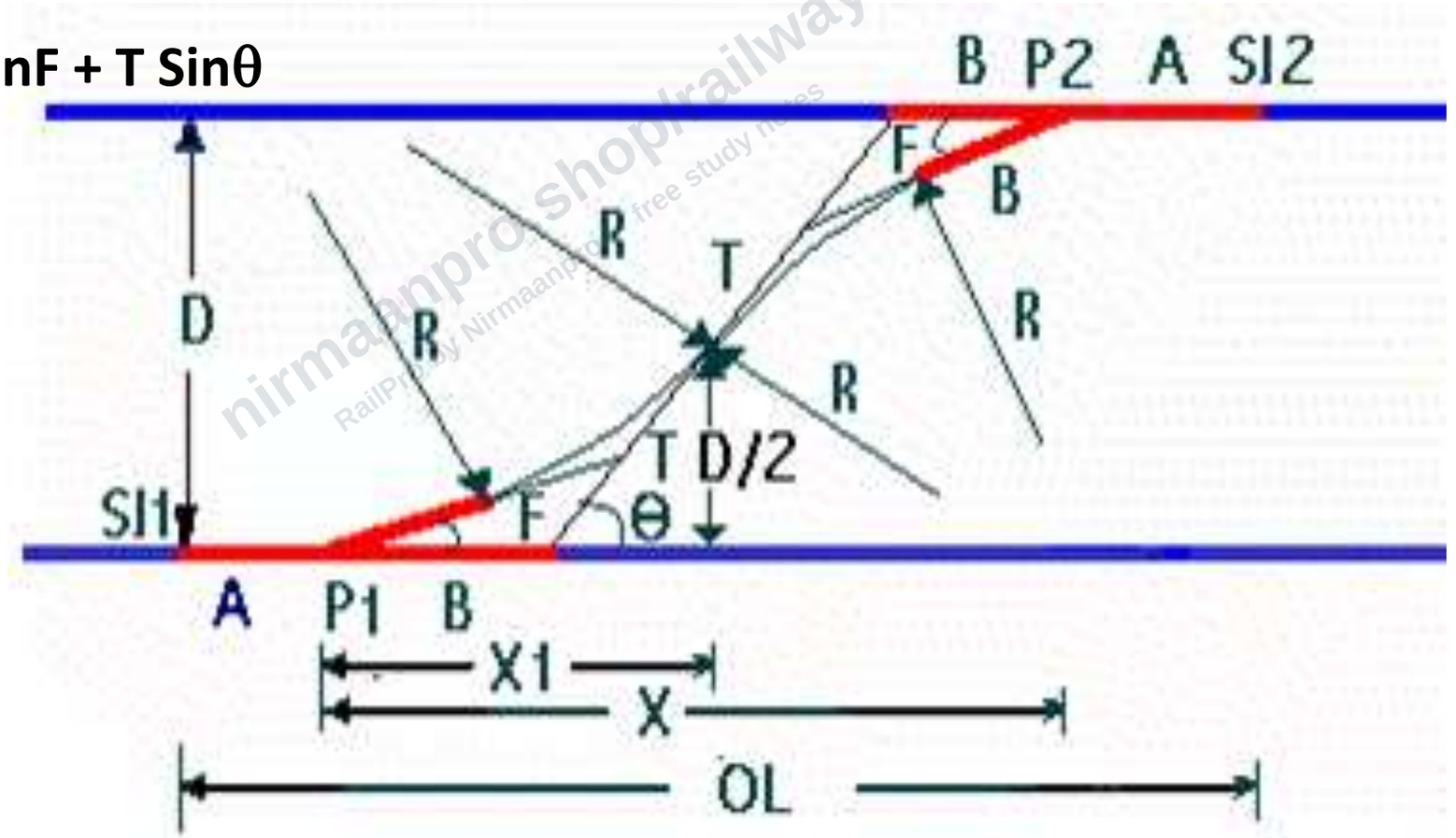
T = RTan (θ -F)/2

X1 = (B+T) cos F + T Cosθ

Y1 = (B+T) SinF + T Sinθ

X = 2X1

OL = X + 2A



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Crossover Between Straight Parallel Track

With **large** spacing between tracks and **same** angle of crossing and *no* straight

- 'R' is assumed same as that lead curve radius of T/out.
- D' is known from actual field measurement.
- Type of T/out is decided. Accordingly value of T/out parameters A,B will be known.
- θ, T, X1, Y1 is calculated from expressions.
- One of the point P1 or P2 is to be fixed on field considering obligatory points if any.
- other points can be fixed w.r.t. P1 or P2.

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Crossover Between Straight Parallel Track

With **large** spacing between tracks and **same** angle of crossing and *with* **a** straight

$$\mu = Tan^{-1}\frac{S}{2R}$$

$$\theta = Cos^{-1}\left(\frac{\{2(RCosF + BSinF) - D\}Sin\mu}{S}\right) - \mu$$

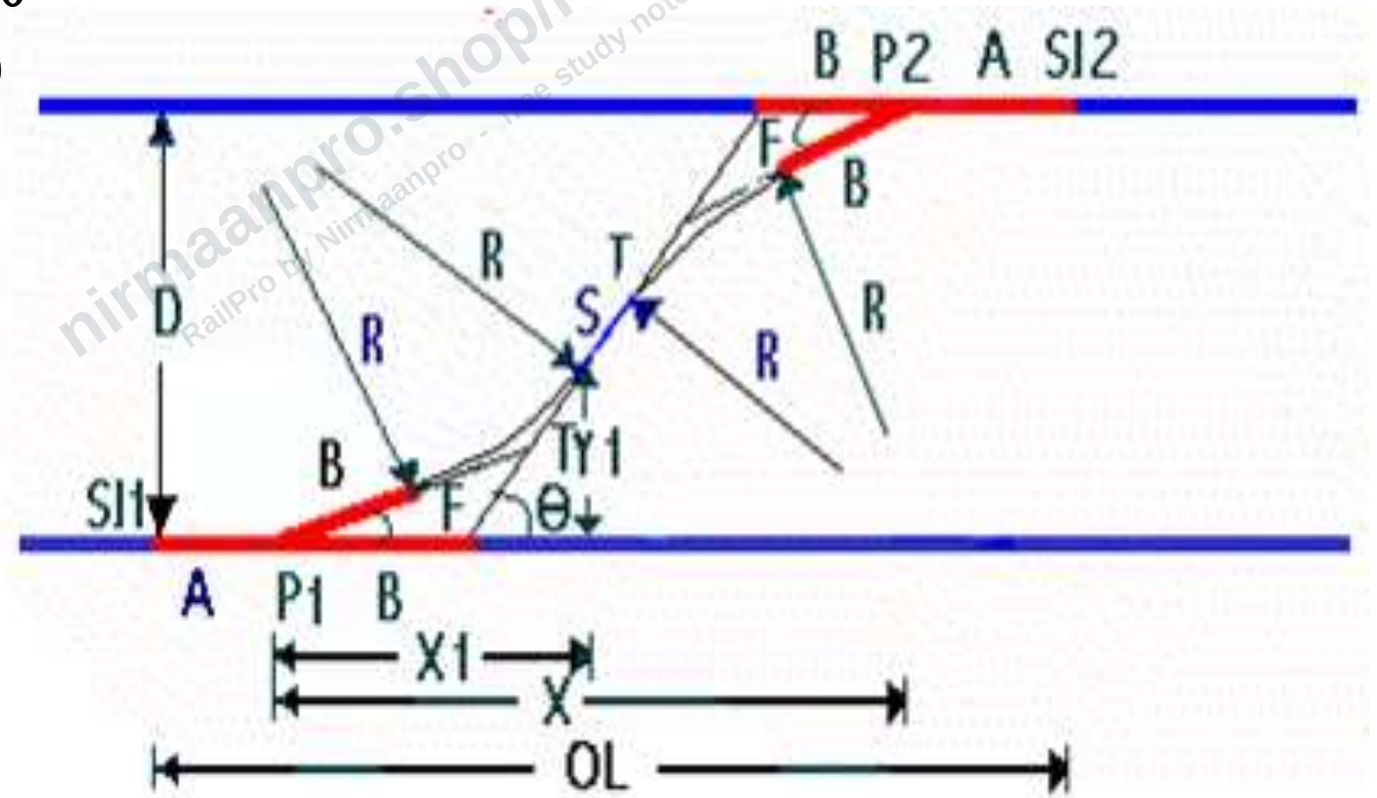
T = R Tan(θ-F)/2

X1 = (B+T) CosF + T Cosθ

Y1 = (B+T) SinF + T Sinθ

X = 2(B+T)CosF+
(2T+S)Cosθ

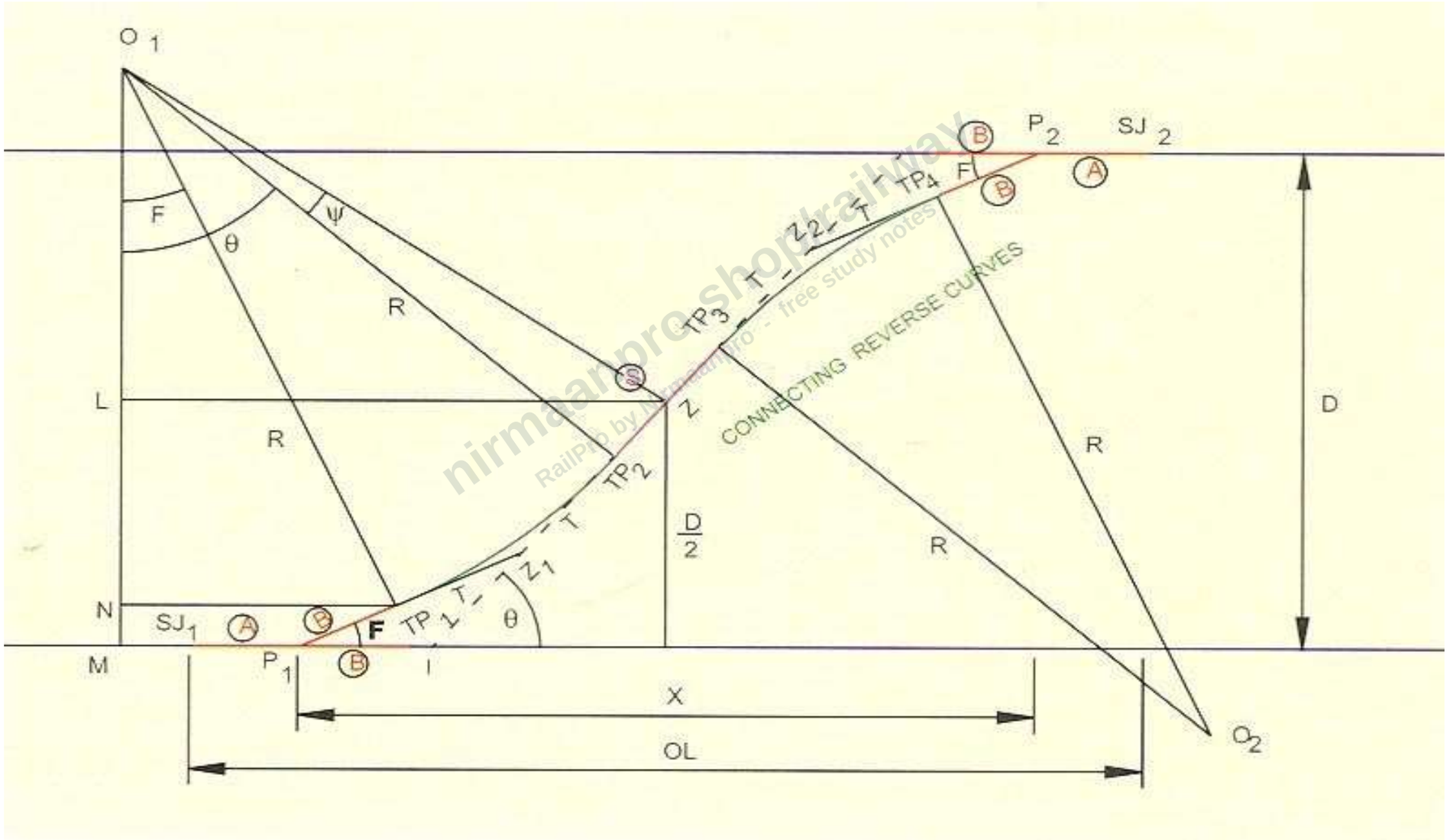
OL=X+2A



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Crossover Between Straight Parallel Track

With **large** spacing between tracks and **same** angle of crossing and ***with*** **a** straight



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Crossover Between Straight Parallel Track With different angles of crossings

D = (B1 + T) SinF1 + (B2 + T) SinF2

Hence,

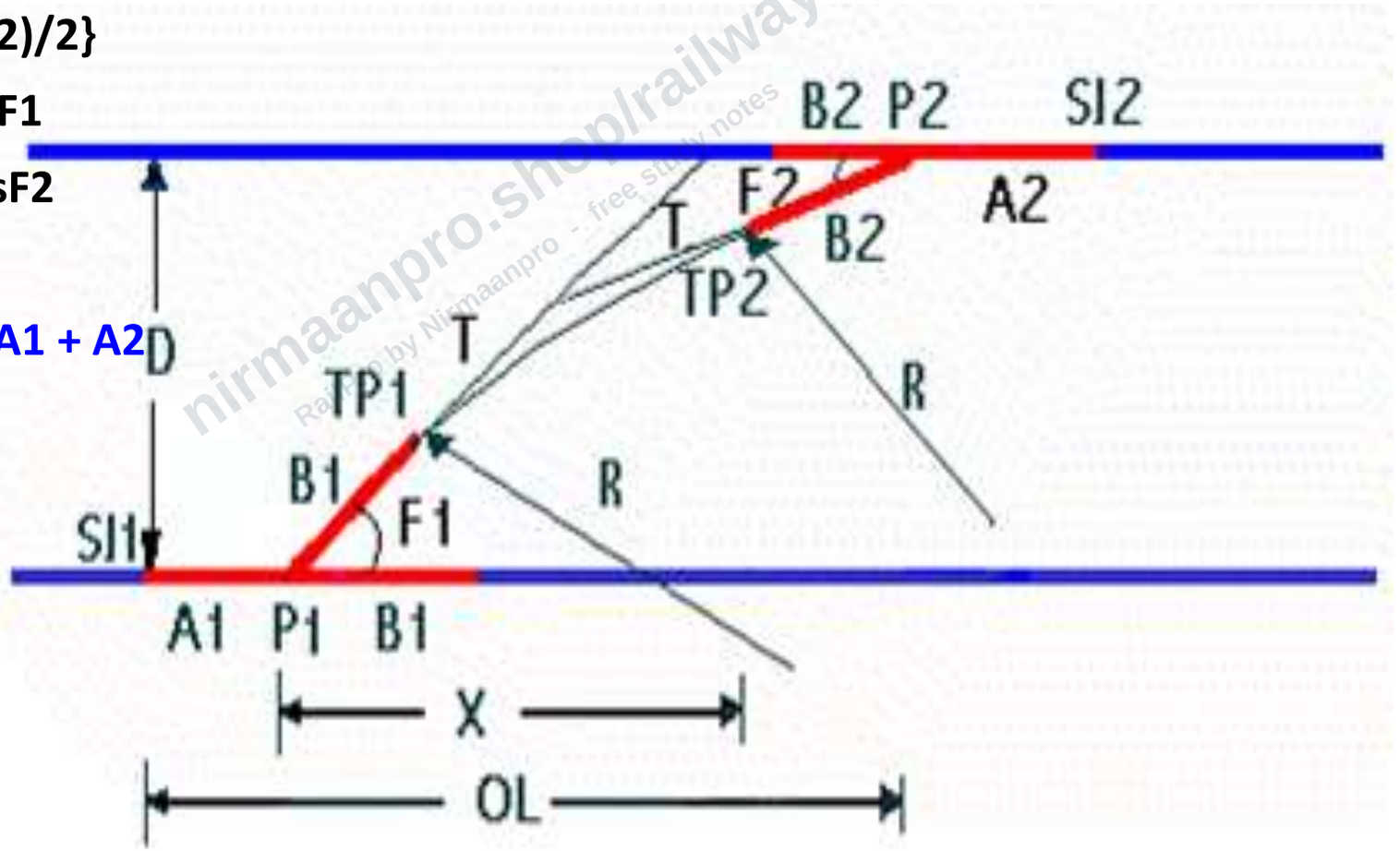
$$T = \frac{D - (B_1 SinF_1 + B_2 SinF_2)}{SinF_1 + SinF_2}$$

R = T/tan{(F1-F2)/2}

X1 = (B1+T)CosF1

X2 = (B2+T) CosF2

OL = X1 + X2 + A1 + A2



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One turnout being Symmetrical Split.

T = R Tan{(F1- F2/2)/2}

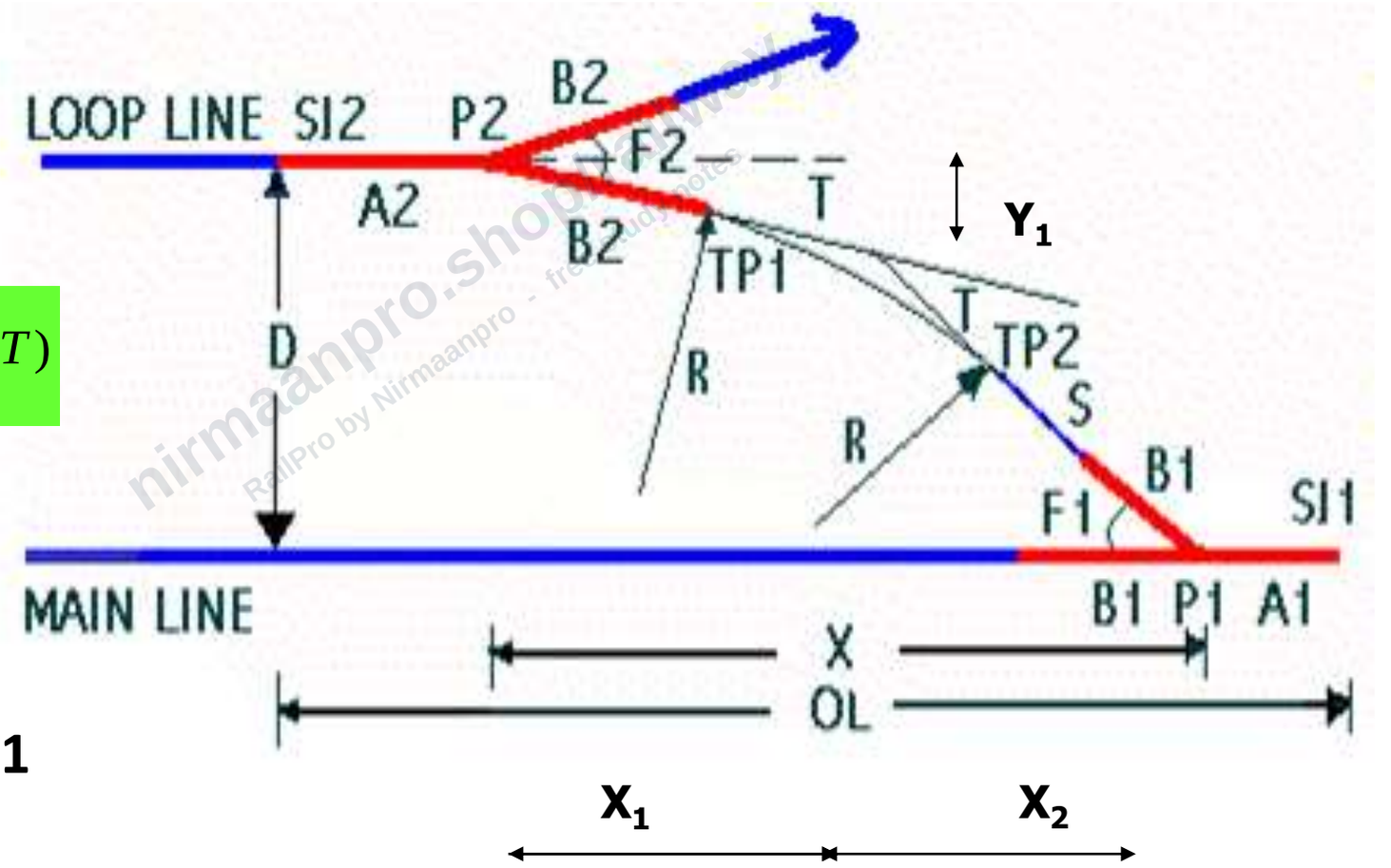
X1 = (B2 +T) CosF2/2

Y1 = (B2 + T) SinF2/2

$$SinF_1 = \frac{D - Y_1}{T + S + B_1}$$

$$S = \frac{D - Y_1}{SinF_1} - (B_1 + T)$$

X=X1+X2



X2 = (D-Y1) CotF1

OL = X+A1+A2

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Examples

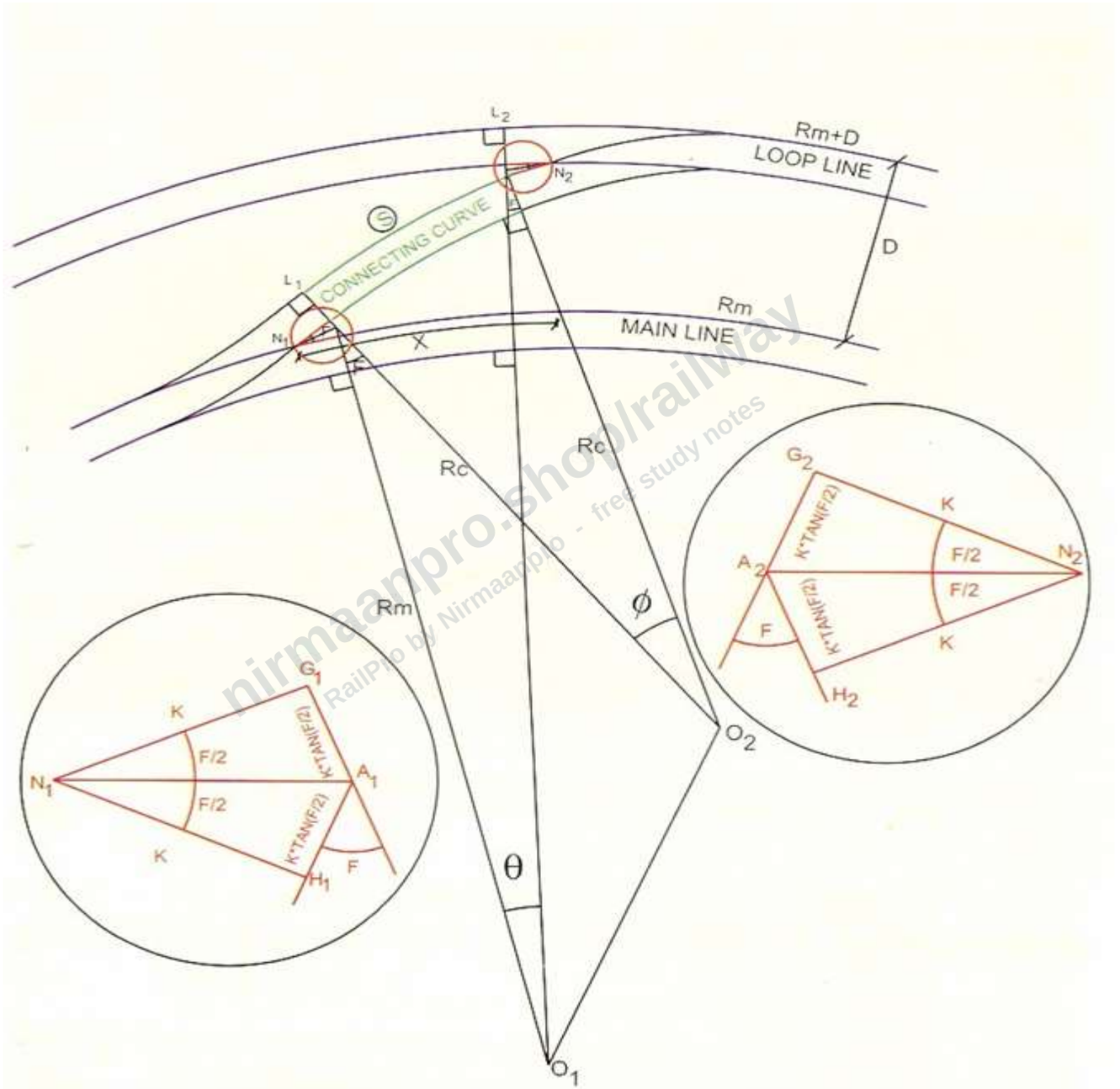
- Instructor to give few examples to trainee to workout in class itself .
- (2 periods)

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3.2 Cross over between curved parallel tracks, Cross over between inclined tracks. (1 period)

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Cross-over between curved parallel tracks



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Cross-over between curved parallel tracks

- In ΔO_1O_2A, $O_1A = Rm + K \text{ Tan } F/2$
- $O_2A = Rc - G - K \text{ Tan } F/2$
- $(O_1O_2)^2 = (O_1A)^2 + (O_2A)^2 - 2\, O_1A \times O_2A \text{ Cos } F$
- $= (Rm+KTanF/2)^2 + (Rc-G-KtanF/2)^2 - 2(Rm+KTanF/2)(Rc-G-KtanF/2)CosF$ .....(1)
- In ΔO_1O_2B, $O_1B = Rc + K \text{ Tan } F/2$
- $O_2B = Rm - D - G - K \text{ Tan } F/2$
- $(O_1O_2)^2 = O_1B^2 + O_2B^2 - 2\, O_1B \times O_2B \text{ Cos } F$
- $= (Rc+KTanF/2)^2 + (Rm-D-G-KtanF/2)^2 - 2(Rc+KTanF/2)(Rm-D-G-KtanF/2)CosF$ .....(2)
- Equating equations (1) & (2), We can have,

$$R_c = \frac{[\{2R_m + D - G\}\{D - G - 2KTan(F/2)\} - G\{G + 2KTan(F/2)\} - 2CosF(2R_m + D)\{KTan(F/2) + R_mG\}]}{2[DCosF - \{G + 2KTan(F/2)\}(1 + CosF)]}$$

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In ΔO_1O_2B, $O_1B = R_c + K \tan F/2$ $O_2B = R_m - D-G - K \tan F/2$
$(O_1O_2)^2 = OB_1^2 + OB_2^2 - 2\ O_1B \times O_2B \cos \angle O_1BO_2$

$$Cos\angle\left(\frac{BO_2O_1}{2}\right) = \sqrt{\frac{S_B(S_B - O_2B)}{O_1B * O_1O_2}}$$

Where, $S_B = (O_1B + O_2B + O_1O_2)/2$
$\angle BO_2O_1 = 180^o - (\angle BO_1O_2 + F)$.(3)
In ΔO_1O_2A, $O_1A = R_m + K \tan F/2$
$O_2A = R_c - G - K \tan F/2$
$(O_1O_2)^2 = OA_1^2 + OA_2^2 - 2\ O_1A \times O_2A \cos \angle O_1AO_2$

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Where, SA = (O1A + O2A + O1O2)/2

$\angle$AO1O2 = 180° – ($\angle$AO2O1 + F) …(4)

From equations (3) and (4),

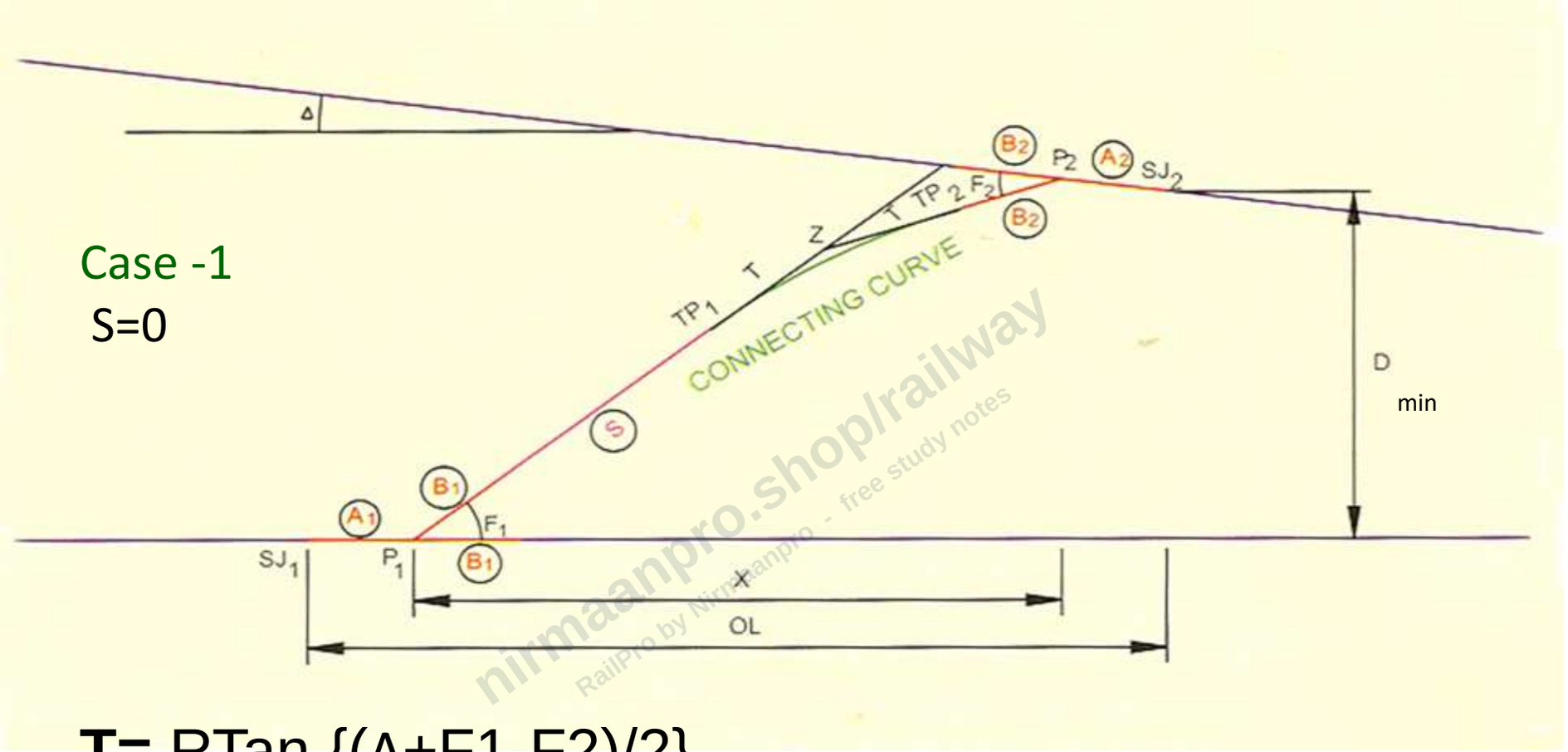
α = $\angle$BO2O1 - $\angle$AO1O2 & Δ =$\angle$BO2O1 -$\angle$AO1O2

$$S = \frac{R_c * \phi}{180/\pi}$$

$$X = \frac{R_m * \theta}{180/\pi} + 2K - \frac{KD}{R_m}$$

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Cross-over between non parallel straight tracks



Case -1

S=0

T= RTan {(Δ+F1-F2)/2}

D_{min} = (B1 +T) SinF1 + (B2 +T) Sin(F2 - Δ) – A2 SinΔ

X = (B1 +T) Cos F1 + (B2 +T) Cos(F2 - Δ)

OL = X + A1 + A2 CosΔ

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Cross-over between non parallel straight tracks

(I) **Given** - R, Δ, T/o parameters

Find – T - (from eq.1)

Dmin (Location of SJ2) - (from eq. 2),

X - (from eq.3),

OL - (from eq.4)

(II) **Given** – D, Δ, T/o parameters

Find – T - (from eq. 2),

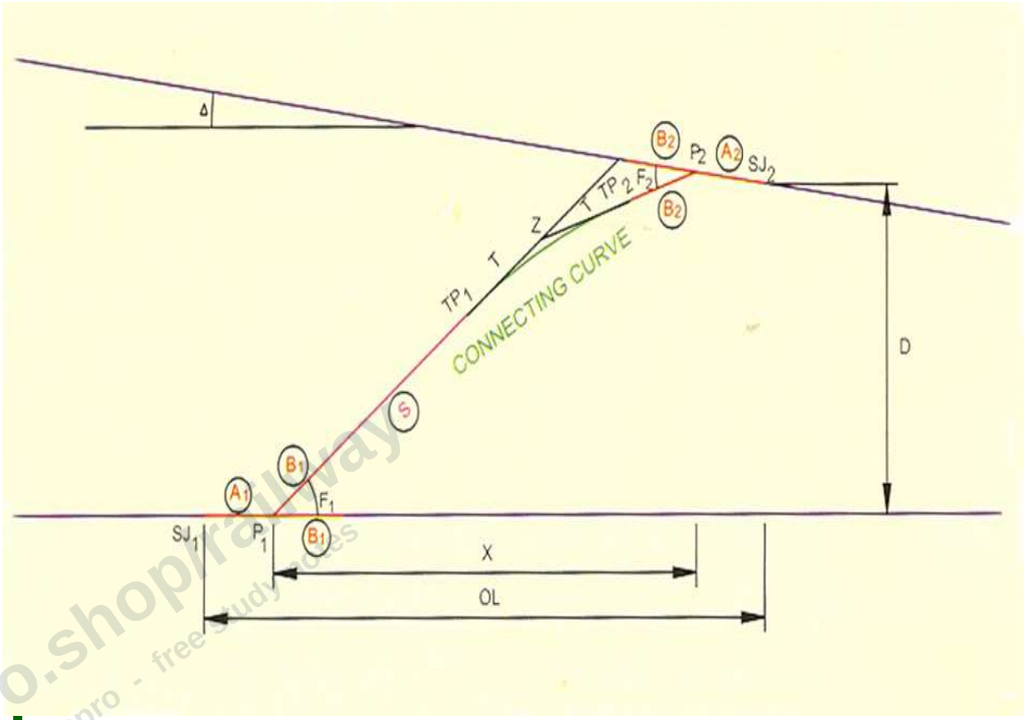
R - (from eq.1)

X - (from eq.3),

OL - (from eq.4)

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Case-2, S≠0



- In case D>Dmin
- **T= RTan {(Δ+F1-F2)/2}**

D = (B1 +T+ S) SinF1 +

(B2 +T) Sin(F2 - Δ) –

A2 SinΔ--------- 'S' will be calculated or alternatively

S = (D-Dmin) CosecF1

X = (B1 +T + S) Cos F1 + (B2 +T) Cos(F2 - Δ)

OL = X + A1 + A2 CosΔ

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- **Problem** :
- Calculate the overall length between parallel straight tracks 60 kg 1 in 12 PSC turnouts at both ends with c/c is 4755 mm and also find out TNC to TNC?
- Ans : C/C distance between tracks (D) = 4755 mm
- 60 KG 1 in 12 point
- Number of crossing (N) = 12
- Crossing angle (F) = 4° 45’ 49’’ = 4 + (45/60) + (49/3600)
- F = 4.7636 Sin F = 0.083 A = 16989 mm B = 28412 mm
- Overall length (OL) = DN +2A = (4755 x 12) + (2 x 16989)
- OL = 91038 mm
- TNC to TNC = D Cot F – G Cot F/2
- TNC to TNC = (4755 x 12) – (1673 x 24.038)
- TNC to TNC = 16844.42 say 16844mm

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Cross over 1 in 12 60kg/52kg on PSC sleepers laid on straight for normal spacing

Track centre in mm	Overall length in mm
4755	91038
4800	91578
4900	92778
5000	93978
Track centre less than 4755 mm	Not possible to lay turnout, if required to be laid at track centres less than 4755 mm few long sleepers at end not to be inserted
Note: For every 100 mm increase in track centre increase overall length by 1200 mm.	

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Cross over 1 in 8.5 60kg/52kg on PSC sleepers laid on straight for normal spacing

Track centre in mm	Overall length in mm
4625	63363
4700	64000
4800	64850
4900	65700
Track centre less than 4625 mm	Not possible to lay turnout, if required to be laid at track centres less than 4625 mm few long sleepers at end not to be inserted
Note: For every 100 mm increase in track centre increase overall length by 850mm.	

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3.3 Special layouts: Scissors crossover, Definitions and description of components.

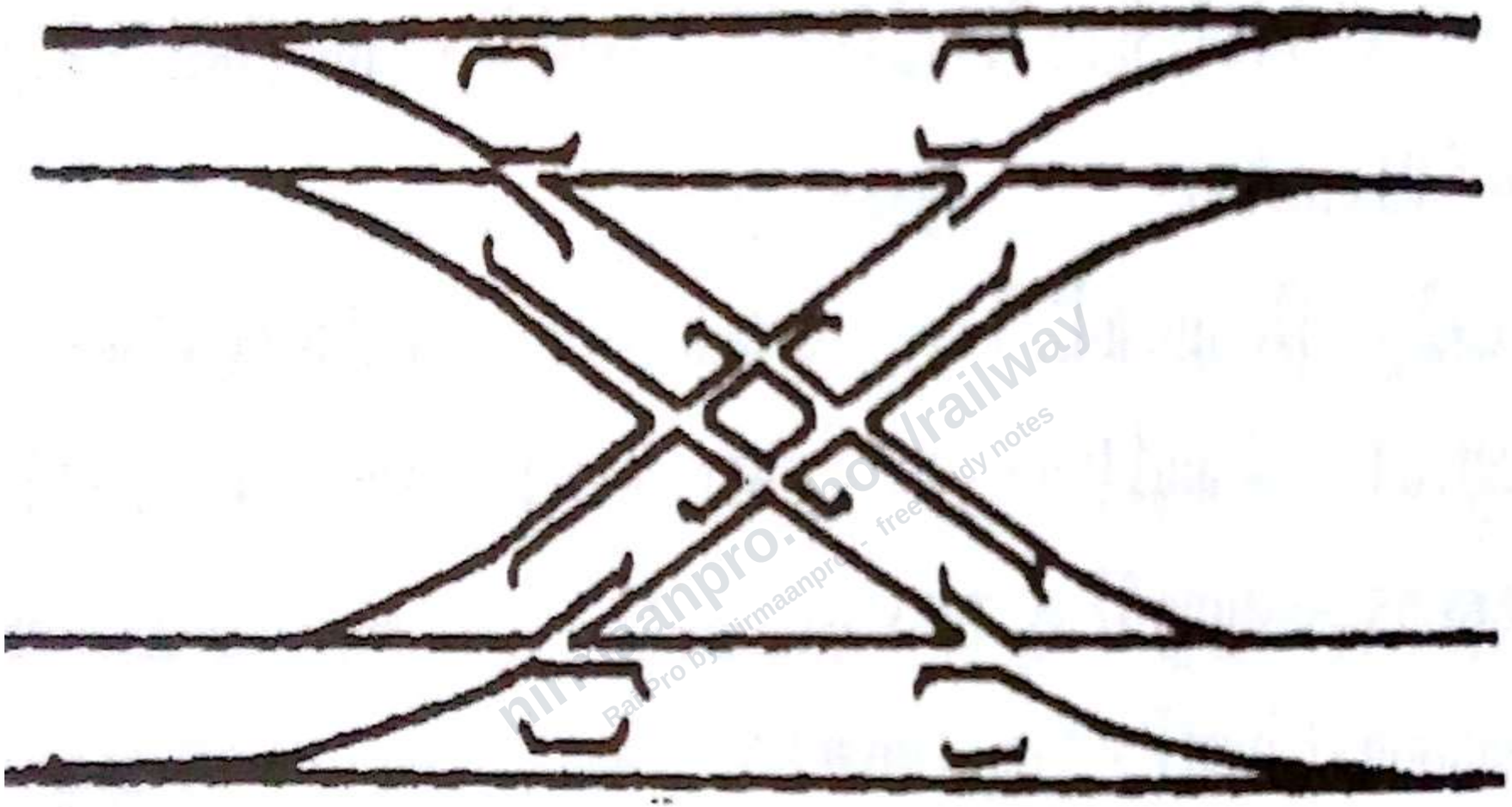
Periods 1

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SCISSORS CROSSOVER

- When two x-over cross each other a scissors crossover is formed.
- A diamond is formed in addition to four turnouts or it may be said as six acute crossing and two obtuse crossing is formed.
- Advantage of scissors crossover is the saving of space in congested yard.
- Since two crossovers are placed exactly to each other the TNC of acute crossing also fall opposite to each other.

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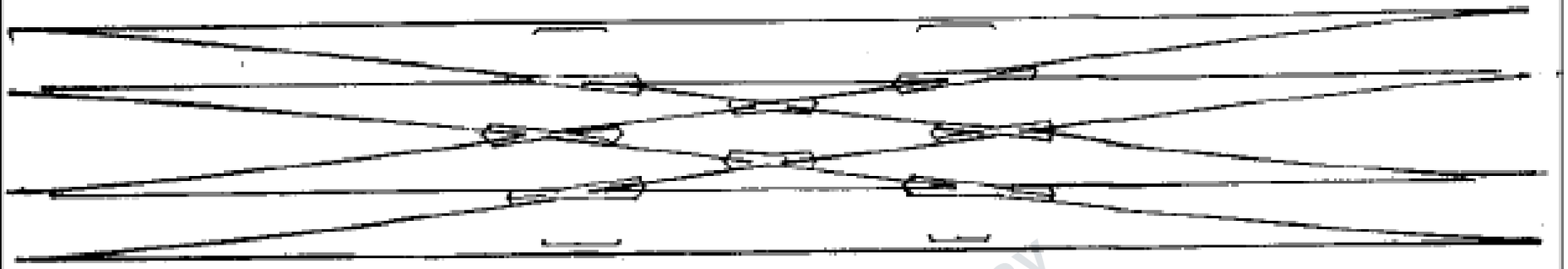


Scissors Cross Over

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SCISSORS CROSS-OVER ON PSC SLEEPERS



GAUGE	(BG –1673 mm)	Gauge	(B.G.- 1673 mm)
Angle Rail section	1 IN 8.5 60 Kg (UIC)	Angle Rail section	1 in 12 60 Kg.(UIC)
Types of laying	Perpendicular	Types of laying	Perpendicular
Crossing assembly	RDSO/T-6092	Crossing assembly	RDSO/T-8109
Crossing sub assembly Acute LH 1 in 8.5	RDSO/T-6093	Crossing sub-assembly Acute L.H. 1 IN 12	RDSO/T-8113
Detail of acute crossing LH 1 in 8.5	RDSO/T-6093/1	Detail of Acute Crossing L.H. 1 IN 12	RDSO/T-8113/1
Crossing sub assembly Acute RH 1 in 8.5	RDSO/T-6096	Crossing sub-assembly Acute R.H. 1 IN 12	RDSO/T-8110
Detail of acute crossing RH 1 in 8.5	RDSO/T-6096/1	Detail of Acute Crossing R.H. 1 IN 12	RDSO/T-8110/1
Crossing sub assembly Acute 1 in 4.25	RDSO/T-6099	Crossing sub-assembly Acute 1 IN 6	RDSO/T-8116
Detail of acute crossing 1 in 4.25	RDSO/T-6099/1	Detail of Acute Crossing 1 IN 6	RDSO/T-8116/1
Crossing sub assembly obtuse 1 in 4.25	RDSO/T-6102	Crossing sub-assembly Obtuse 1 IN 6	RDSO/T-8119
Detail of obtuse crossing 1 in 4.25	RDSO/T-6102/1	Detail of Obtuse Crossing 1 IN 6	RDSO/T-8119/1

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4.1 Track Structure in Yards: Simple Station layouts, loop lines, gathering neck, stabling lines, overrun line, shunting neck, hot axle/fuel lines, machine siding etc.

Periods 3

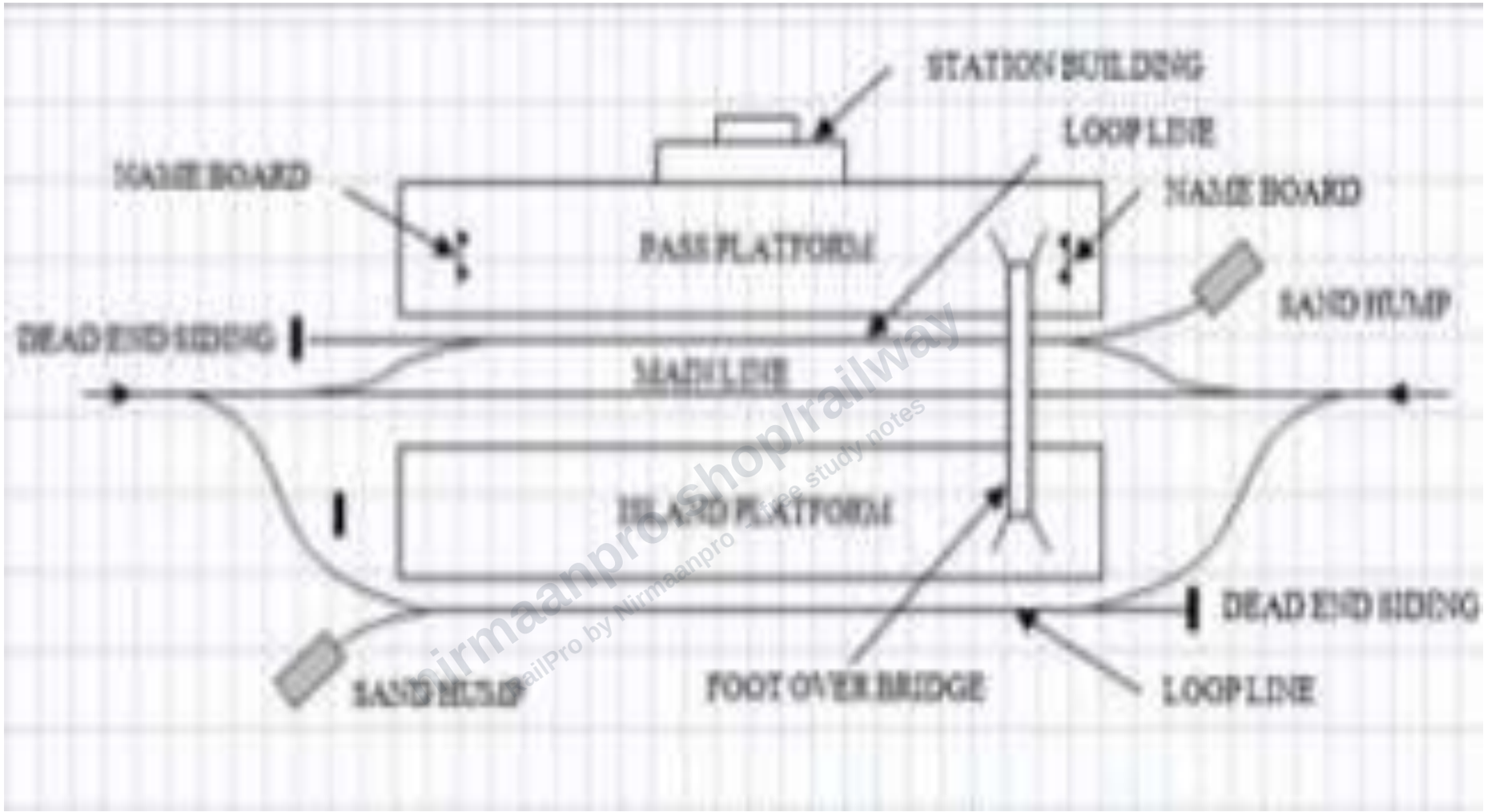
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Simple Station Layout

- Definition of Railway Station - A Railway Station or a Railroad Station and often shortened to Just Station, is a Railway facility where trains regularly stop to load or unload passengers and/or freight/goods.
- To enable the trains on a single line track to cross from opposite directions.
- To enable the following express trains to overtake
- For taking diesel or coal and water for locomotives
- For detaching engines and running staff
- For detaching or attaching of compartments and wagons
- For sorting of bogies to form new trains, housing of locomotive in loco sheds.

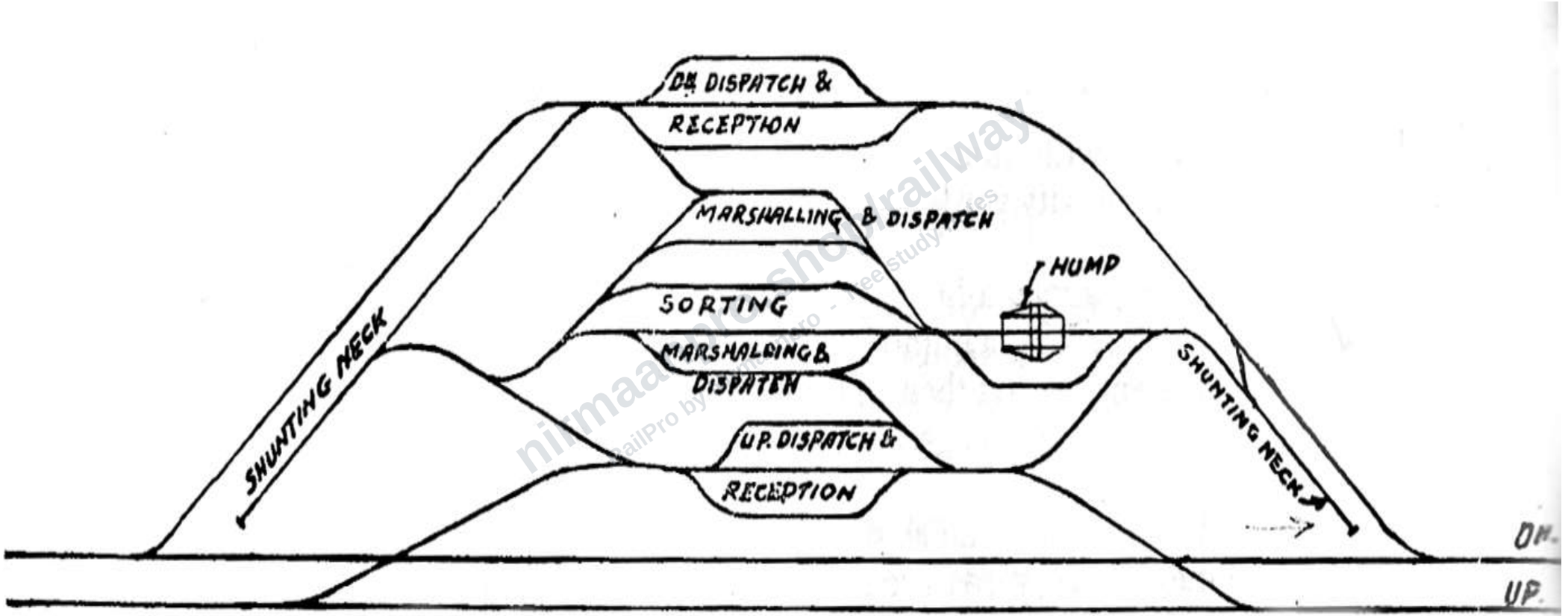
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Layout of a Simple Station

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Reception and Sorting yards



Typical arrangement of Reception and Sorting lines.

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- Loop Line : These are provided to facilitate passengers to board or alight from a train. These are provided with Platforms. Generally 2 separate Loop lines are provided at a station for UP & DOWN directions.

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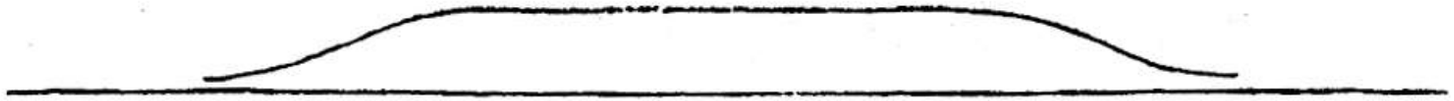


Figure 8—Ordinary Crossing Station.

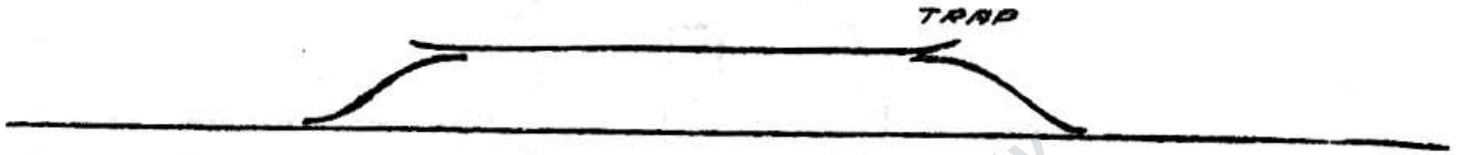
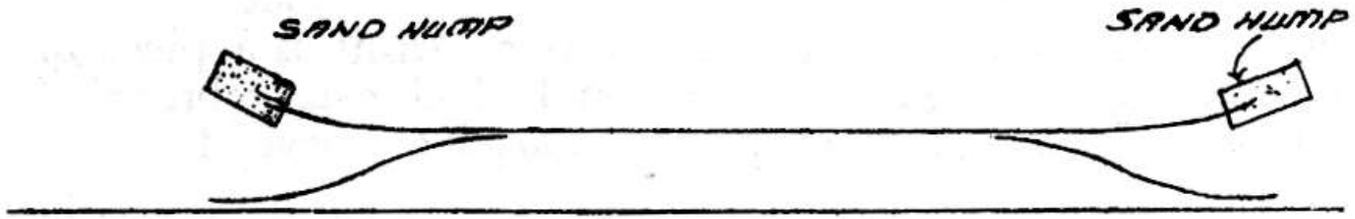


Figure 9—Crossing Station with traps on the Loop.



Figure 10—Crossing Station with snag dead-ends on the Loop.



Crossing Station with sand humps on the Loop.

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Catch Sidings –

Normally all catch sidings except those which are sanded shall be kept alive. On sanded catch siding, the rails shall be kept clear of sand for a length of 21.5 meters, beyond the section insulators in the overhead lines and the switches controlling the sanded catch sidings shall be kept in the neutral position. If an electric engine or single or multiple unit train runs into the sanded length of a catch siding, it may possibly be insulated from earth except through the buffers or couplings if connected to other vehicles, therefore these sidings shall not be made alive when an electric engine or single or multiple unit train or any vehicle coupled thereto are standing in the sanded tracks until all staff have been moved away from positions where they are likely to make contact between the permanent way formation and any part of the locomotive or single or multiple unit train or coupled vehicles.

No person shall attempt to enter, or leave or in any other way make contact between the permanent way formation and the electric engine or single or multiple unit train or any vehicles coupled thereto while the overhead

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Sand Hump

Sand hump is an extended portion of rail embedded in sand. It is total 60 m in length, with increasing gradient of 1 in 60, of which the first 30 m is laid with normal track embedded in sand and remaining 30 m is an earthen lump of uniform 4 m width.

Dead End

(i) This is an extended portion of track with an erected obstruction with buffers at the end.
(ii) The length is at least 180 metres.
(iii) This is used to isolate main line from loop line.
(iv) This is an efficient substitute for signal overlap.

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Shunting Neck:

It is a line in a Yard leading to sorting lines on which the actual shunting of the trains maybe done clear of any running lines.

- **OVERRUN LINE**
- The is the point ahead of a stop signal up to which the track **clearing point** must be kept clear of obstructions in order for a train to be accepted from the rear of the signal. In most cases this is with reference to home or outer home signals guarding entrance to station limits from a block section. The distance from the stop signal to the clearing point is the **overlap** (also **overrun**, or **clearing distance**).
- Hot Axle/ Fuel Lines : Theses are the sidings where hot axle vehicle is detached/ fuel is filled into a Locomotive.
- Machine sidings: These are dedicated sidings to place Track machines for Working and stabling after day's work.

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SLIP SIDING

- It protects the Block Section
- It is provided where falling gradient towards block section is steeper than 1 in 100
- It prevents vehicles at station escaping on to the Main line
- It is a Short siding
- Outermost point of the station will be a trailing point if provided

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- Gathering Neck : These are provided in large Stations where no. of Lines are required for freight trains for different purposes. These lines diverge from main line by using a turnout and required no. of lines emerge from that.
- Stabling Lines : These are sidings at a station to Stable a train or Track Machines.



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Derailing Switch

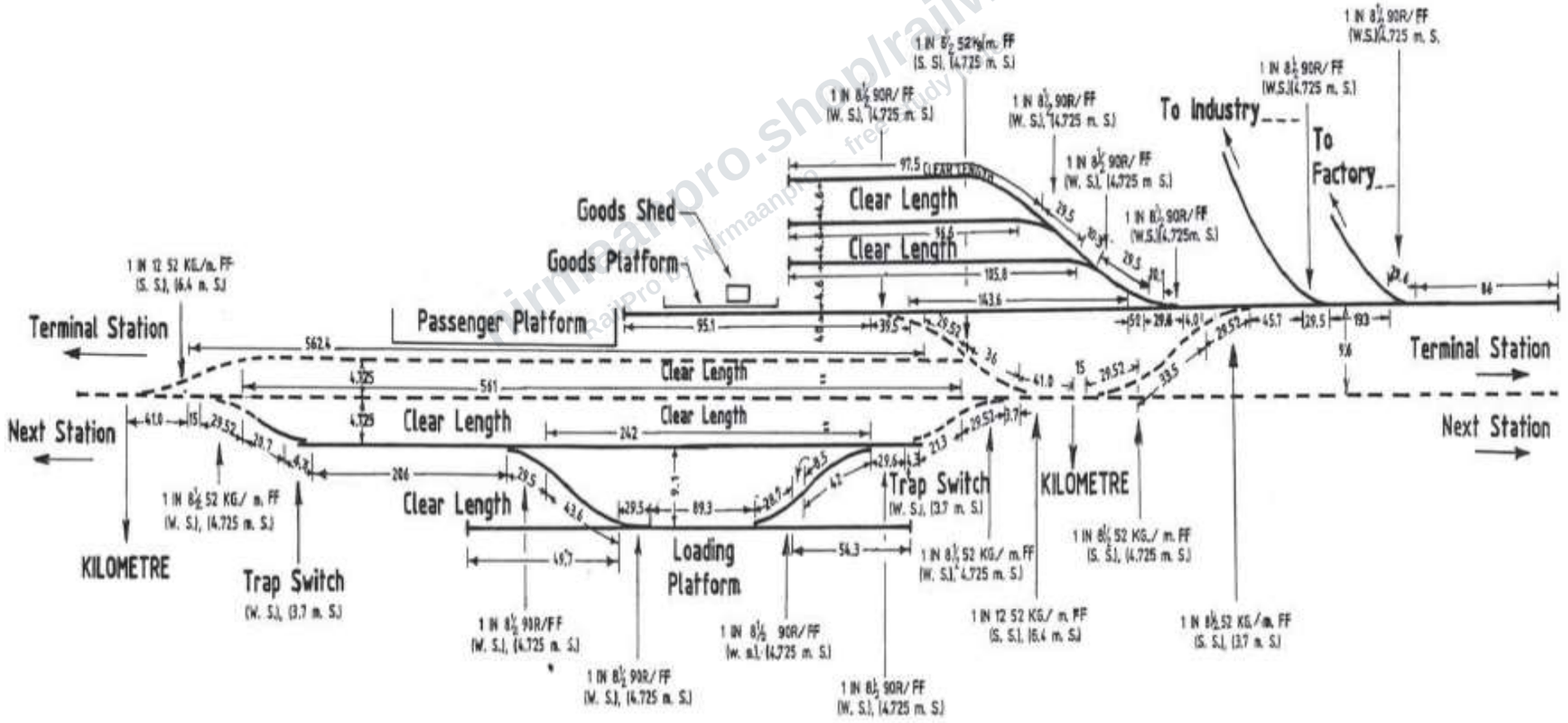
A device to isolate a particular line from adjacent running lines to avoid infringement by train or a part of train which overshoots signal or escapes from yard. The derailing switch should be so located that when a train derails over it, the same does not infringe the adjacent track. A derailing switch so located between running tracks, does not serve the purpose for which it is provided as on derailment, a stock is likely to infringe the adjacent running line.

- The distance from the points is about 15 feet.
- This is used to isolate main line from loop line.
- This is an efficient substitute for signal overlap under approved special instructions.
- The normal setting of points is for derailing switch.
- If the vehicle moves, the vehicle will derail on the sand at the end of the derailing switch.
- Simultaneous reception is possible

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STATION YARD DIAGRAM

COLOUR	RAILS		SLEEPERS	
	TYPE	LENGTH	No. PER Km.	TYPE
----------	52 Kg/ F. F.	13 m.	1538	STEEL LOOSE JAWS
————	90 Lbs/ RFF.	12 m.	1333	STEEL LOOSE JAWS
————	80 Lbs/ B. H.	9 m.	1330	STEEL 2 KEYED



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YARD DRAINAGE

- Drainage Master Plan for each yard.
- Network of longitudinal and cross drains to lead away storm water quickly
  - IRPWM 238 : All drains must be given adequate grade to enable free flow of water upto outfall.
- Surface drain ‘normally’ open.
- Drain top not above cess level. If so provide weep holes/weep slits.
- If outfall available on either end, longitudinal drains sloping in both directions.
- End platforms to slope away from track.

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YARD DRAINAGE contd.

- Drain from PF, shelters, Tea stalls, water sheds etc. in pipes; discharge on non-track side of PF.
- Island Platform : drains to discharge on the side of less important track.
- If run through lines on both sides, covered longitudinal drain on PF.
- Colony drains not to be connected to yard drains.

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09-02-2022

BASIC KNOWLEDGE OF S & T EQUIPMENTS

- Minimum Equipment of Fixed signals at stations provided with manually operated multiple aspect signalling-

a) At Class ‘B’ Stations – A Distant ,A Home and A Starter

b) At Class ‘C’ Stations-A Distant and A Home

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- Minimum Equipment of fixed signals at stations provided with modified lower quadrant signalling-

a) At Class 'B' Stations – A Distant, A Home, A Warner below the Main Home and A Starter

b) At Class 'C' Stations – A Distant and A Home

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- Minimum equipment of fixed signals at other stations provided two-aspect signalling-

a) At class ‘A’ station- a Warner , a Home, and a Starter.

b) At class ‘B’ station-

On a single line: an outer and a Home

On a Double line: an outer, a home and a starter

c) At class ‘C’ station- a Warner and a Home.

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How to improve existing layout?

- Use of elastic fastenings
- Maintenance of P&C by machine
- Provision of similar track structure on the approaches of P&C
- Correctness of longitudinal level
- Necessity to maintain the approaches of P&C to proper standards
- Welding of joints in T/O assembly
- Use of CMS crossing
- CWR through P&C
- Overhauling of P&C
- Special gang for P&C
- Reconditioning of P&C
- Inspection schedule of P&C
- Maintenance of Turn-in curve

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Thanks

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2- BASICS OF RAILWAY TRACK

2.5 Various types of track renewal proposals. Criteria for Complete track renewals ,

Initiation and scrutiny of proposals for track renewals.

(6 Periods)

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Classification of Renewals.-

(1) Complete Track Renewal (Primary) C.T.R.(P)
(2) Complete Track Renewal (Secondary) C.T.R.(S)
(3) Through Rail Renewal (Primary) T.R.R.(P)
(4) Through Rail Renewal (Secondary) T.R.R. (S)
(5) Through Sleeper Renewal (Primary) T.S.R. (P)
(6) Through Sleeper Renewal (Secondary) T.S.R. (S)
(7) Casual Renewals.
(8) Through Turn-out renewal (TTR).
(9) Through Fitting renewal (TFR).
(10) Through Weld renewal (TWR).
(11)Through Bridge Sleeper renewal (TBSR).
(12)Scattered Renewal
(13)Through Ballast Renewal(TBR)

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Track Renewals

- Primary renewals are those where only new materials are used and secondary renewals are those where released serviceable materials are used.
- Scattered Renewal– In this case, unserviceable rails, sleepers and fastenings are replaced by identical sections of serviceable and nearly the same vintage track components. These are carried out in isolated locations and not more than 10 rails and/or 250 sleepers in a gang beat in a year. Such renewals are part of normal maintenance operations.
- Casual Renewal– In this case, unserviceable rails, sleepers and fastenings are replaced by identical sections of serviceable and nearly the same vintage or new track components. These are carried out in isolated locations of continuous but small stretches. Such renewals are not a part of normal maintenance operations and cannot be covered under scattered renewals.
- Through Fitting Renewal (R) – In this case, through fittings renewal without replacement of ERCs is carried out i.e. only liners and GRSPs/CGRSPs are renewed.

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Factors Governing Permanent Way Renewal

RAIL RENEWAL

***Criteria for Rail Renewal*:---**

The following are to be considered in connection with the criteria of rail renewals:--

- **Incidence of rail fractures/failures.**
- **Wear on rails.**
- **Maintainability of track to prescribed standards.**
- **Expected service life in GMT carried.**
- **Plan based renewals.**

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RAIL RENEWAL (contd...)

(a) Incidence of Rail Fractures/Failures-Rail fractures –

- **5 withdrawals per 10 km in a year or more due to fracture and or rail flaws detected by USFD.**
- **Through Rail Renewal is also allowed in locations of track where more than 30 defective welds per track km are existing.**

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RAIL RENEWAL (contd...)

(b) Wear on Rails- **(i) Limiting Loss of Section.--The limiting loss in rail section, as a criterion for recommending rail renewals shall be as under--**

Rail section	% Loss in section
52 Kg	6
60Kg	7

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RAIL RENEWAL (contd...)

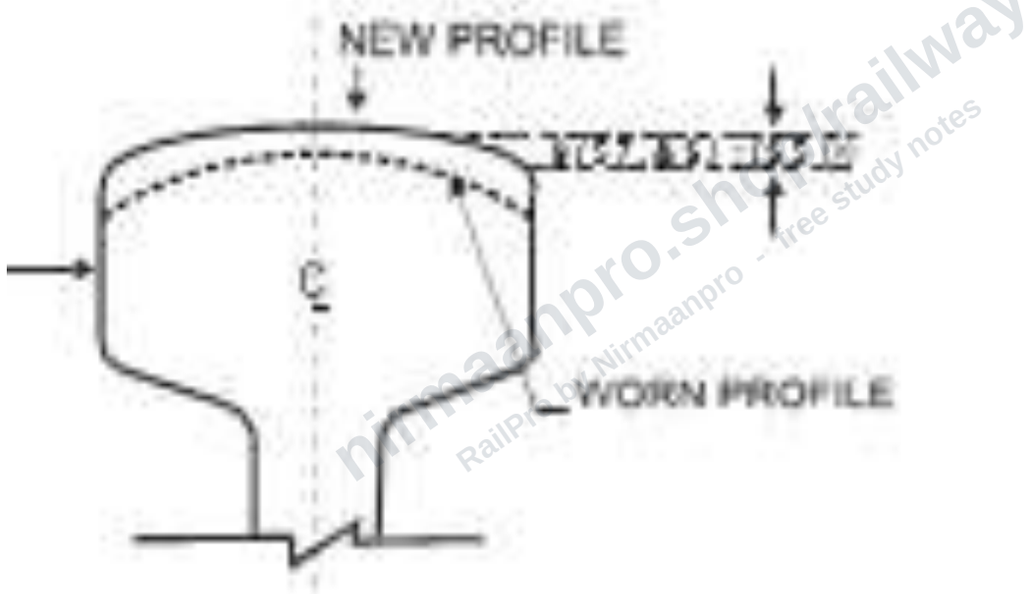
(ii)Wear due to corrosion beyond 1.5 mm in the web.

(iii)Vertical Wear – head depth loss is more than

Rail Section	Vertical Wear in mm
60 Kg.	13
52 Kg.	8

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Typical Profile



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RAIL RENEWAL (contd...)

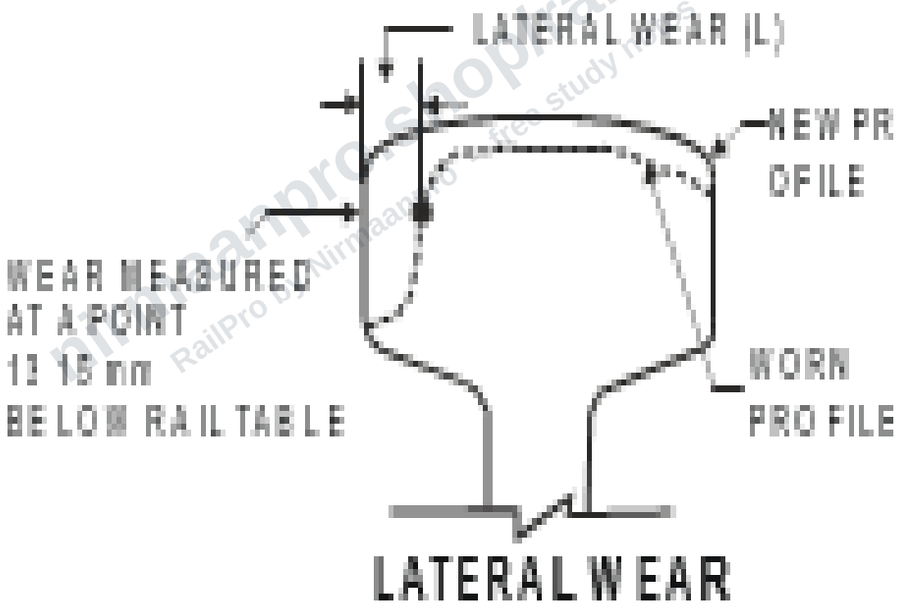
Lateral Wear limits

Section	Category of track	Lateral wear
Curves	A & B Routes	8mm
	C & D Routes	10mm
Straight	A & B Routes	6mm
	C & D Routes	8mm

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Lateral wear is tobe measured at 13 to 15 mm. below the rail top table

Lateral Wear



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RAIL RENEWAL (contd…)

- Maintainability *of track to prescribed standards*–
- There may be cases, where renewals may be necessary on the following considerations viz.,
  - Poor running quality of track in spite of extra maintenance labour engaged for maintaining the same,
  - Disproportionate cost of maintaining the portion of track in safe condition.
  - The condition of rails with regard to hogging/battering, scabbing and wheel burns and other conditions such as excessive corrugation of rail as can be ascertained by visual inspections, which affect the running quality of track, and make the track maintenance difficult and uneconomical, should be taken into account while proposing renewals.
  - Renewals of rail due to hogged and battered rails ends should be considered only if other remedies have not been found to be effective.

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RAIL RENEWAL (contd...)

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Renewals on consideration of service life in terms of total G.M.T. of traffic carried

Rail Section	MM Rail	90UTS rails
60 Kg	550	800
52 Kg	350	525

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The service life in terms of total GMT of traffic carried for considering through rail renewal on the bridge proper and in approaches (upto 100m on either side) for all the important bridges and such of the major bridges where height of bank is in excess of 5.0m, all tunnels and their approaches (upto 100m on either side) shall be half of the GMT specified above.

RAIL RENEWAL (contd…)

- *Plan based Renewals–*
  - Renewals to pre-determined plan with the objective of modernizing the track structure on selected routes in the quickest possible time may be planned even if it involves premature renewals.

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

- Renewal of such special track components to be planned after they have degenerated to a level where they are not able to serve their desired purpose. Life of these components are

S.No	Item	GMT carried	
		52 Kg	60 Kg
1	Ordinary SEJ	150	200
2	Improved SEJ	300	400
3	Glued Joint	200	200

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Secondary Rail Renewals–

- In the case of Secondary Renewals, if the condition of rail is satisfactory, it is a good practice to crop the rail ends and weld them into SWR and use them in lesser important lines. The rails should be ultrasonically tested before use.
- The rails released from primary relaying and not fit for use in secondary relaying should be used in sidings or non-passenger running lines in yards.

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Criteria for Secondary Rail Renewal

- TRR(S) reasons:
  - To eliminate obsolete/old/worn out rails in loop lines, yards, unimportant branch lines etc.
  - When vertical/lateral wear in excess of limitations specified in *para 1602 (1) (b) (ii).*
  - For upgrading the loop lines/unimportant branch lines in phased manner for increasing speed or as a policy etc.
  - When it is unsafe to continue the existing rails based on condition such as excessive corrosion etc.

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Secondary Rail Renewal

- In the case of TRR(S), if the condition of rail is satisfactory, it is a good practice to crop the rail ends and weld them into ten rail panels with flash butt welding and use them in lesser important lines. The rails should be ultrasonically tested before use.
- Building up of chipped rail ends by welding will also improve the service life.

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Secondary Rail Renewal

- Released from primary renewals for use in secondary renewals, in loop lines, yards, other unimportant branch lines after converting them into 10 rail panels
- The rails released from primary relaying and not fit for use in secondary relayings should be used in sidings.
- Before using the released rails, they shall be tested with USFD and shall be defect free.

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Criteria for Sleeper Renewal

- The sleepers which cannot hold gauge, provide satisfactory rail seat, does not permit rail fastenings being maintained in tight condition and not able to retain the packing underneath are required to be renewed.
- Broken/cracked sleepers, sleepers with broken / cracked / elongated / ineffective inserts are required to be renewed.
- Obsolete/non standard sleepers in continuous stretches require through sleeper renewal.

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Criteria for Sleeper Renewal

- Locations where 30% or more sleepers qualify in any of the above criteria in continuous stretches shall be planned for Through sleeper Renewal, other wise scattered renewal to be resorted to.
- On girder bridges, when 30% or more sleepers are defective and qualify for renewal, then, renewal should be carried out for the full span, the released serviceable sleepers may be used for casual renewals on other spans.

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Service Life in plain track Fittings of PSC

S. No	Item	Location	Criteria for Renewal
1	GFN-66 Liners	Plain Track	200 GMT or 4 years whichever is earlier or on condition basis
2	Metal Liner	Plain Track	300 GMT or 8 years whichever is earlier or on condition basis
3	ERC	Plain Track	300 GMT or 8 years whichever is earlier or on condition basis
4	GRSP	Plain Track	200 GMT or 4 years whichever is earlier or on condition basis
5	CGRSP	Plain Track	300 GMT or 8 years whichever is earlier or on condition basis
6	PSC Sleepers	Plain Track	2000 GMT or 35 years whichever is earlier or on condition basis

Note: The service life of P.Way components at special locations like turnout, CC aprons, Curves sharper than 6 Degree, SEJ, Gradient sharper than 1 in 100, coastal areas, station yards including approaches etc. is 50 % that of plain track or on condition basis as decided by CTE.

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Service Life in plain track Fittings of PSC

Renewal of fastenings: -
The cause for large-scale development of defects must be investigated by the Assistant Divisional Engineer.
(1) Periodicity of measurement of performance of Elastic Fastening Components–Samples, Size and Testing Frequency–
(a) Sample Size–
Toe load of elastic rail clip should be measured on 1% of ERCs randomly on every 100 sleepers (all 4 ERCs to be measured on one sleeper).

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Service Life in plain track Fittings of PSC

Renewal of fastenings: -

(b) Testing Frequency–

The testing of ERCs is to be done after four years or passage of 200 GMT of traffic, whichever is earlier. In corrosion prone area, the initial testing of ERC is to be done after two years or passage of 100 GMT, whichever is earlier

However, if 20% or more of sample size records toe load below 600 kg, both frequency of inspection and sample size are to be doubled.

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REPLACEMENT OF ERC

- If 20% or more of sample size records toe load below 400 kg which is to be confirmed by 5% sample size, proposal of through fastening renewal should be initiated
- The provisions given above are only for guidance of Railways. The Railways on the basis of the overall condition of track, pattern of traffic and the required level of maintenance should undertake the large-scale replacement of the fastening
- Further, as the loss of toe load is reflective of conditions of other elastic fastening components like groove rubber sole plate, GFN/metal liners etc. as well, the railways may also record condition of these components along with measuring toe loads for elastic rail clips

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RENEWAL OF FASTENINGS

If such renewals are not planned, ERC should be planned for renewal, once in 5-10 years as per the codal life, according to route of the section.

Route	A, B & C (Sub)	D / E
Average life of ERC	5- 8 years	8 - 10 years

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Grooved Rubber Pad (GRP) renewal

To be renewed:-

When crushed

When the grooves of rubber pads are flattened.

Loss of toe load can also be due to ineffective/missing rubber pads.

- GRP shall be renewed along with major track renewal works such as CTR/TRR/TSR/TFR.

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Grooved Rubber Pad (GRP) renewal

- If such renewals are not planned, Through rubber pad renewal shall be carried out once in 2 to 6 years, as per the codal life according to route of the section.

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Route	A, B & C(Sub)	D	E
Average life of GRP	2 - 4 years	4 years	4 - 6 years

Renewal of Liners

- Nylon/composite insulating liners used with pandrol clip shall be examined periodically for sign of cracking and breakage.
- All cracked/ineffective insulating liners should be replaced with fresh ones.
- Metal liners shall be examined for dents/corrosion and other deterioration effects. Unserviceable liners shall be renewed with new/serviceable liners.
- Preferably, should be renewed along with ERC renewal and along with major track renewal work.
- Frequency similar to codal life of GRP.

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Switch renewal of P&C

- The life of fan-shaped layout (PSC turnout sleepers) is much more compared to the life of other track components, such as rails, switches, crossings and fittings. Hence these track components require planned renewals, throughout the life of PSC layout.
- Service life of fabricated switches

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Rail section	Service life (In GMT)
60 Kg	200
52 Kg	150

Through switch renewal of P&C

- Codal life of switches.

Route	A & B	C (Sub)	D
Average life of switch	4 years	2-3 years	5 years

- Switches shall be planned for renewal, before they cross the above service life. Renewals may also be planned based on the codal life specified according to the route of the section.

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Through switch renewal of P&C

- All fan shaped switches should be replaced with thick web switches in phased manner considering the priority and GMT of the section. Priority should be given to A & B routes followed by C, D and E routes.
- Before carrying out renewals, the option of reconditioning of switches with approved means should be explored to extend the life of switches. Considering the condition of switch, reconditioning should be carried out not more than three times.

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Renewal of CMS crossing

- Service life of CMS crossing in GMT

Rail Section	Service Life in GMT
60 kg	200
52 kg	150

- Codal life of crossings.

Route	A & B	C(Sub)	D	E
Avg Life of Crossing	5 yrs	4-5 yrs	8 yrs	

- Before renewals, reconditioning of CMS with approved means such as translamatic robotic welding/latest approved welding carrried out by the RDSO approved firms as per the procedure laid down, not more than 3 times.

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RENEWAL OF POINTS & CROSSINGS

Criteria for renewal

- **Wear exceeding laid down limits.**
- **Sleepers not able to hold the gauge and maintain cross level.**
- **Rail section on either side is changed to a higher section.**

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CRITERIA OF POINTS & CROSSING RENEWAL:

717 Renewal of Points and Crossing–

(1) Renewal of Points and Crossing shall be planned under following conditions:

(a) *Wear on switches and crossing reaches as per* ***Para 429 (2) (c)*** *and* ***Para 429 (3) (e)***.

(b) After it has carried the minimum total traffic as shown below or on condition basis

S. No	Item	GMT carried	
		52 Kg	60 Kg
1	Fabricated switch (ORS)	150	200
2	Thick Web Switch	500	500
3	CMS crossing	300	300

(c) Renewal of Sleepers when they become due as per ***Para 702 (2)***

(d) When the rail section on either side is changed to a higher section in through running lines.

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RENEWAL OF POINTS & CROSSINGS

- **Non- standard crossing in main line, loops and sidings should be replaced with standard crossing.**
- **All T/out negotiated by passenger trains should be 1 in 12 or a flatter.**
- **Where adequate spacing is not available, 1in 8 ½ may be used.**

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Renewal of Switch Expansion Joints

- Service life of SEJ in GMT

Item	Service Life in GMT	
	60 Kg	52 Kg
Ordinary SEJ	200	150
Improved SEJ	400	300

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Renewal of Glued Joints

- Glued joints shall be planned for renewal on the basis of service life or on condition basis such as insulation failure or crack in the GJ etc.
- Service life of glued joint in GMT

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Rail Section	Service Life in GMT
60 Kg	200
52 kg	150

THROUGH WELD RENEWAL

- **Through Weld Renewal should be planned after the welds have carried 50% of the stipulated GMT of rails. (Para 7.8.2.3 of USFD Manual)**

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Through Ballast Renewal

Due based on:

- 1. Age , 2. GMT , 3. Condition

IRPWM CS-132:

- Deep screening of Track shall be done after 500 GMT or 10 years, whichever is earlier. However, deep screening shall also be carried out if the existing clean ballast cushion is less than 150 mm to ensure proper machine tamping.

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CRITERIA OF TBR

(2) *Criteria for Deep Screening:*

Deep screening should be carried out in the following situations by providing full ballast cushion–

(a) Prior to complete track renewal.

(b) Prior to through sleeper renewal.

(c) Where the caking of ballast has resulted in unsatisfactory riding.

(d) Before converting existing track, fish plated or SWR into LWR or CWR, unless the ballast was screened in recent past.

(e) Deep screening of Track shall be done after 500 GMT or 10 years, whichever is earlier. However, deep screening shall also be carried out if the existing clean ballast cushion is less than 150 mm to ensure proper machine tamping.

All the loop lines should be deep screened once in 15 years.

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Through Bridge Sleeper renewal (TBSR).

On girder bridges when several sleepers are defective, renewals should be carried out for the full span, the released serviceable sleepers being used for casual renewals on the other spans

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Scattered Renewal–

- In this case, unserviceable rails, sleepers and fastenings are replaced by identical sections of serviceable and nearly the same vintage track components.

- These are carried out in isolated locations and not more than 10 rails and/or 250 sleepers in a gang beat in a year.

- Such renewals are part of normal maintenance operations.

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Casual Renewal–

- ✓ In this case, unserviceable rails, sleepers and fastenings are replaced by identical sections of serviceable and nearly the same vintage or new track components.

- ✓ These are carried out in isolated locations of continuous but small stretches.

- ✓ Such renewals are not a part of normal maintenance operations and cannot be covered under scattered renewals.

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Planning of Renewals

- Renewals planned in as long and continuous lengths with available resources with priorities to meet the projected traffic.
- Short isolated stretches of 10 km and less, not due for renewal can be with the adjoining lengths
- Priority in planning renewals should be given to busy and important lines.
- Track renewal programmes shall be framed by the CTE

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Planning of Renewals

Track Renewal Programme–

(1) Initiation of Proposals– Track renewal proposals are submitted to the DEN by the ADEN on condition basis and on the basis of various inspections carried out during the year. The DEN shall personally check the details submitted by the ADEN at site, compile and initiate the track renewal proposal indicating the priorities. The justification for track works shall be prepared on the basis of factually correct data and submitted through IRPSM. It shall include an abstract estimate of the cost of work and detailed narrative justification covering technical and financial aspects.

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Planning of Renewals

Track Renewal Programme .. Contd..–

The DEN should personally satisfy himself about the reasonableness of the proposal and certify that the justification furnished is factually correct. The ADEN should keep a close watch on the condition of all track on their sub-divisions so that every length which after careful and judicious examination requires renewal, is included in the proposals, bearing in mind that the programme is prepared a year in advance and as much as two years may elapse before renewals are carried out. The proposals should reach the Chief Engineer's Office as per the schedule prescribed under IRPSM from time to time.

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2. Verification of proposals by the Track Cell

Verification of proposals by the Track Cell in the Chief Engineer's Office–Important items relating to complete track renewal, through sleeper renewal or through rail renewal shall be test checked by the nominated administrative officer of the Headquarters who will–

(a) Co-ordinate the proposals received from the divisions;

(b) Frame programmes for renewal taking into account the sections planned for renewal;

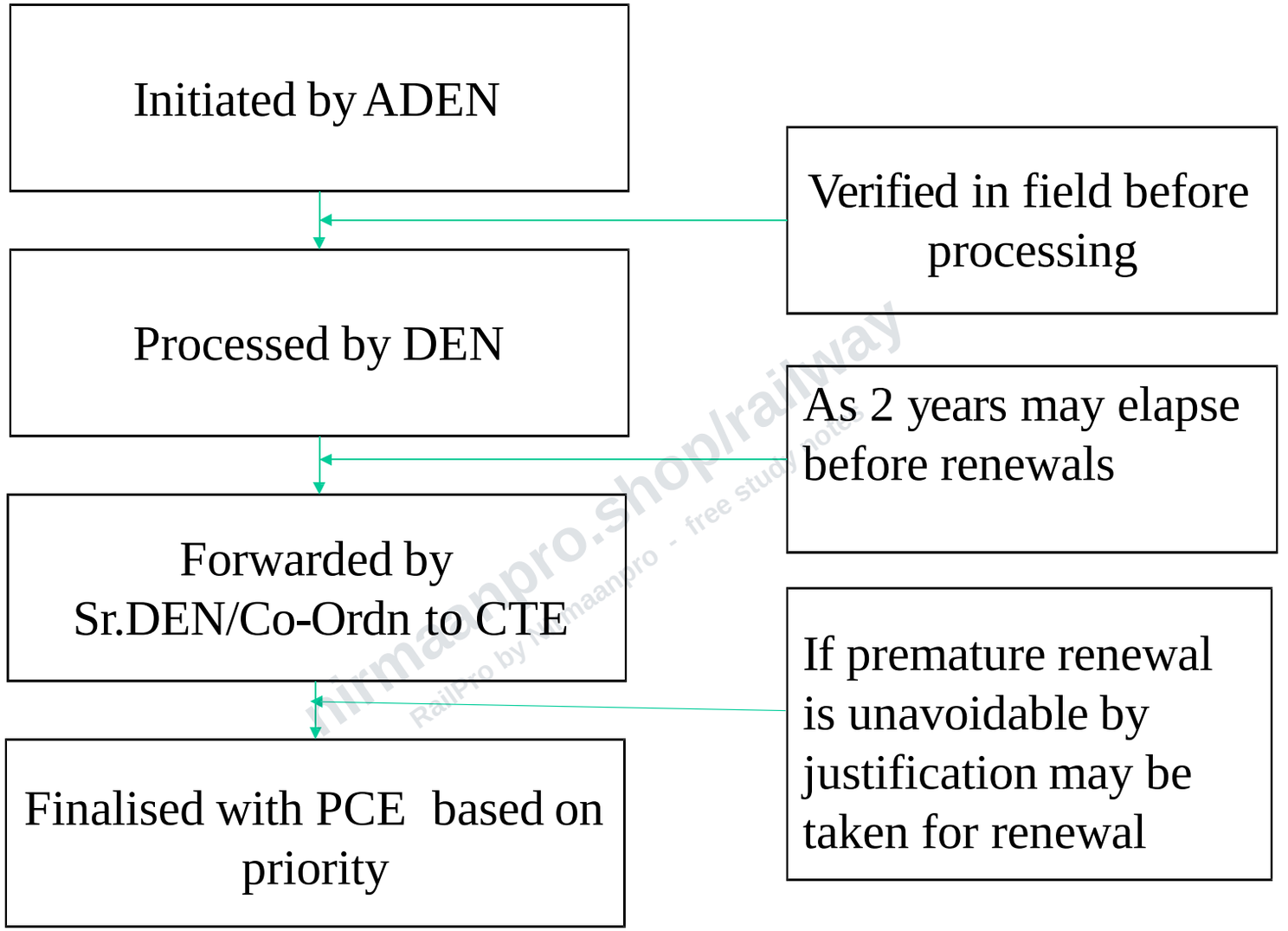
(c) Decide priority for the works;

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2. Verification of proposals by the Track Cell

Verification of proposals by the Track Cell in the Chief Engineer's Office–
(d) Satisfy himself that the renewal is unavoidable in the case of track renewal proposals which are justified primarily on condition basis but are premature as far as quantum of traffic carried (GMT) is concerned and ;
(e) Finalise the track renewal proposal and submit the same to the Chief Track Engineer/Chief Engineer for his approval. On receipt of Railway Board's sanction to the track renewal proposal, arrangements will be made by the Headquarters for supply of track materials to the Divisions and for co-ordinated execution and control over the works.

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LAYING STANDARD OF TRACK

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Rails

Main line	**60 Kg with 90 UTS** **<5 GMT 60 Kg SH rail**	
Loop line	**60 Kg SH or 52 Kg SH rails** New rail with Rly. Bd. Approval	
Sidings	1.Feeder route to DFC 2.Other than feeder route with > 50 Kmph	**60 Kg**
	Other than Feeder route to DFC & <50 Kmph speed **60 Kg SH or 52 Kg SH**	

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SLEEPERS

- All lines inclusive of sidings and loop lines with PRC sleeper

Main line	**1660 Nos/KM**
All other lines with <50 Kmph	1540 Nos/KM
All other lines with >50 Kmph	1660 Nos/KM

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Ballast

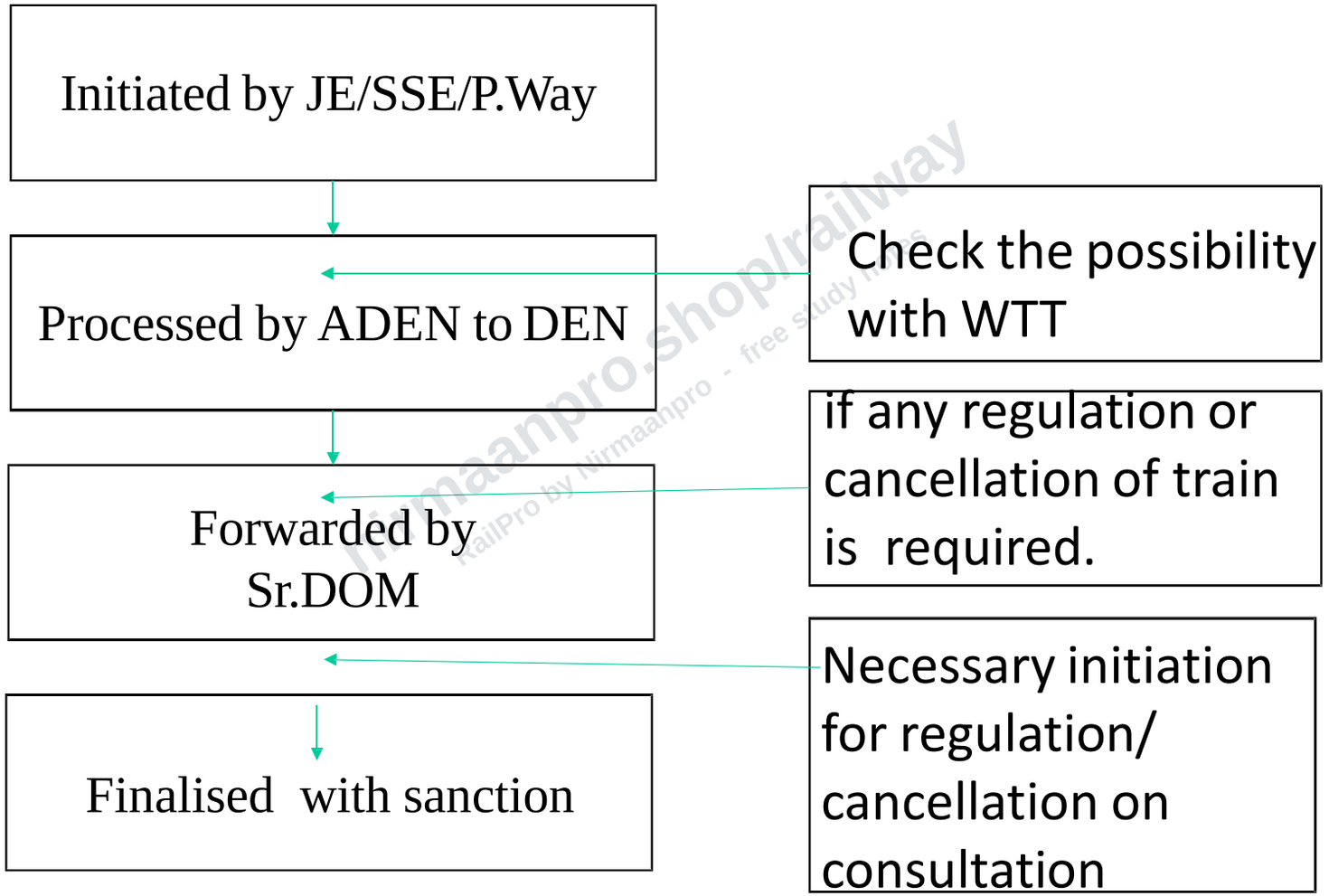
In case of	Ballast cushion Minimum
CTR/TSR	300 mm If possible 350 mm
All Doubling, GC& new line	350 mm
Loop Line	250 mm
Private siding <50 Kmph	300 mm
Private siding >50 Kmph	350mm

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- Special JE/SSEs (P.Way) with clerical staff at the executive and office levels as provided in the estimates shall be posted
- The JE/SSE/P.Way (In-charge) of track renewal will be responsible for maintenance till the section is handed over to the maintenance after completion of the work.
- Watchman from the permanent gangs for depot material at site.
- A fully equipped First Aid Box should be kept at the site of work

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Traffic block (Field work)



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Work	Minimum LB required
Manual renewal	2-3 Hrs.
Mechanical relaying	3-4 Hrs.

- On double line, the traffic of both lines may be worked over the unaffected line under the “Single line-working” regulations.
- There are triple or more lines, two lines may be worked as the up line and the down line respectively

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Speed Restrictions: 1. MANUAL PACKING

Manual Packing

Day	Sequence of events	Speed in Kmph
1st	Opening, relaying and initial packing	20
2nd	1st through packing	20
3rd	2nd through packing	20
4th to 9th	Picking up of slacks as required	45 (after 2nd through packing)
10th	3rd through packing	45
11th to 19th	Picking up of slacks as required	75 (after 3rd through packing)
Speed raised to normal sectional speed, only after one round of tamping by machine in design mode and stabilisation in controlled settlement mode		

Note– The work of Track renewals on double line should normally proceed in the direction opposite to Traffic.

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Speed Restrictions: 2.Machine Packing followed by stabilisation using DTS

(Manual laying of sleepers)

Day	Sequence of Events	Speed in Kmph
1st	Opening , Relaying and Packing	20
2nd	Ballasting and Manual packing	20
3rd	1st Tamping in smoothening mode and 1st stabilisation in maximum settlement mode.	40 (after tamping and stabilisation)
4th& 5th	Ballasting	40
6th	2nd tamping in smoothening mode and 2nd stabilisation in maximum settlement mode.	75 (after tamping and stabilisation)
7th & 8th	Survey of track for design tamping as per IRTMM, boxing of ballast etc.,	75
9th	3rd tamping in design mode and 3rd stabilisation in controlled settlement mode.	Speed up to 110 (after tamping and stabilisation)
10th	checking ride quality and attention as required	Normal speed

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Speed Restrictions: Machine Packing followed by stabilisation using DTS (Mechanised laying of Track by TLE)

Day	Sequence of Events	Speed in Kmph
1st	Opening, Relaying and equalisation of ballast	20
2nd& 3rd	Rail renewal and welding & attention to track as required	20
4th	1st tamping in smoothening mode and 1st stabilisation in maximum settlement mode.	40 (after tamping and stabilisation)
5th	Ballasting	40
6th	2nd tamping in smoothening mode and 2nd stabilisation in maximum settlement mode.	75 (after tamping and stabilisation)
7th& 8th	Survey of track for design tamping as per IRTMM, boxing of ballast etc.	75
9th	3rd tamping in design mode and 3rd stabilisation in controlled settlement mode.	Speed up to 110 (after tamping and stabilisation
10th	checking ride quality and attention as required	Normal speed

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(Machine Packing followed by stabilisation using DTS Mechanised laying of Track by TRT)

Day	Sequence of Events	Speed in Kmph
1st	Opening, Relaying and equalisation of ballast	30
2nd	Welding and Manual attention to track as required	30
3rd	1st tamping in smoothening mode and 1st stabilisation in maximum settlement mode.	40 (after tamping and stabilisation)
4th	Ballasting	40
5th	2nd tamping in smoothening mode and 2nd stabilisation in maximum settlement mode.	75 (after tamping and stabilisation)
6th& 7th	Survey of track for design tamping as per IRTMM, boxing of ballast etc.	75
8th	3rd tamping in design mode and 3rd stabilisation in controlled settlement mode.	Speed up to 110 (after tamping and stabilisation)
9th	checking ride quality and attention as required	Normal speed

Note: The above schedule for relaxing speed is based only on expected track Parameters and consolidation likely to be achieved after tamping and stabilisation. Other factors like ballast deficiency, rail condition or joints in track may further restrict the speed mentioned above

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Material Planning–

- The material requirement should indicate the materials to be arranged by the headquarters and by the Divisions.
- Against each material, the proper nomenclature and drawing number should be indicated. Rails nos. and sizes (including lead rails, check rails etc.), sleepers (including specials), rails and sleeper fastenings, switches and crossings, level crossing and bridge sleepers and fittings, etc. should be fully covered.
- The consignee particulars and the destination, the mode of transport should also be indicated.
- After the material is received by SSE/P.Way, he should ensure that the requisite material is arranged at site of renewal well in advance. Proper accountal should be maintained for the released as well as new P.Way materials.

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Protection of site- safety

Working of Track Maintenance Machines

(1) All ‘On Track’ machines shall be worked only under traffic block with the permission of the concerned Station Masters and in accordance with the special instructions issued in this regard.

(2) (a) Each machine shall be in direct charge of a nominated track machine operator. The operator shall be responsible for the working of the machine under his charge. He shall be fully conversant with the rules of working of trains and of protection in case of emergency. He shall also ensure that the other staff deployed on the machine are fully conversant with the protection rules. He shall hold a valid certificate of competency for driving and working of the machine.

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Protection of site- safety
Working of Track Maintenance Machines

(b)The track machine shall work under the direct supervision of an engineering official not below the rank of JE/SSE/P.Way who will be responsible for taking the traffic block, for protection of the line while the work is in progress and clearing of the block after completion of the work when the last machine clears the block section and certifying that the track is fit for train movement.

(c)When the track machine is required to move from one block station to another block station, the operator shall run the machine with the proper authority to proceed as defined in Para 1.02 (6) of General Rules

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Protection of site- safety
Working of Track Maintenance Machines

Each unit shall carry all safety equipment as specified under IRTMM.

(4) When more than one track machine is running in a block section, there should be a minimum distance of 200 metres between two units.

(5) While working on double/multiple lines, the engineering officials supervising the work of track machine shall ensure that no part of the machine fouls the adjacent track. In case infringement to adjacent track is inherent to the machine working which can be cleared at a short notice, the work should be carried out by protecting the infringed line by Engineering signals by JE/SSE/P.Way as envisaged in Para 806.

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Protection of site- safety
Working of Track Maintenance Machines

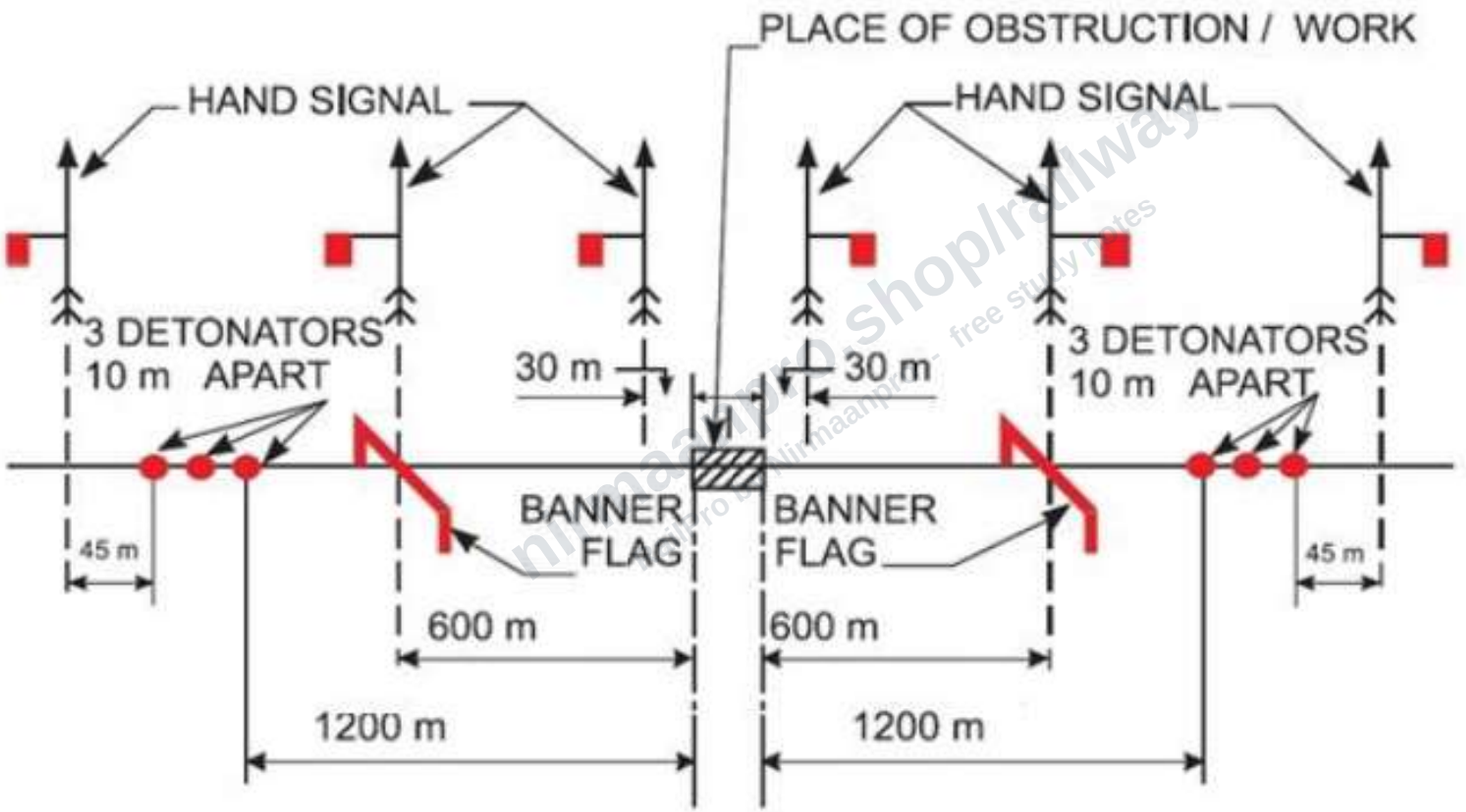
(6) Each unit will run within the maximum permissible speed sanctioned for that type of machine on that section.

(7) All track machine shall work as per provision given in Para 4.65 of General Rules for Indian Railways (1976) supplemented by Subsidiary Rules of Railways. For detailed working of track machines provisions in IRTMM may be referred.

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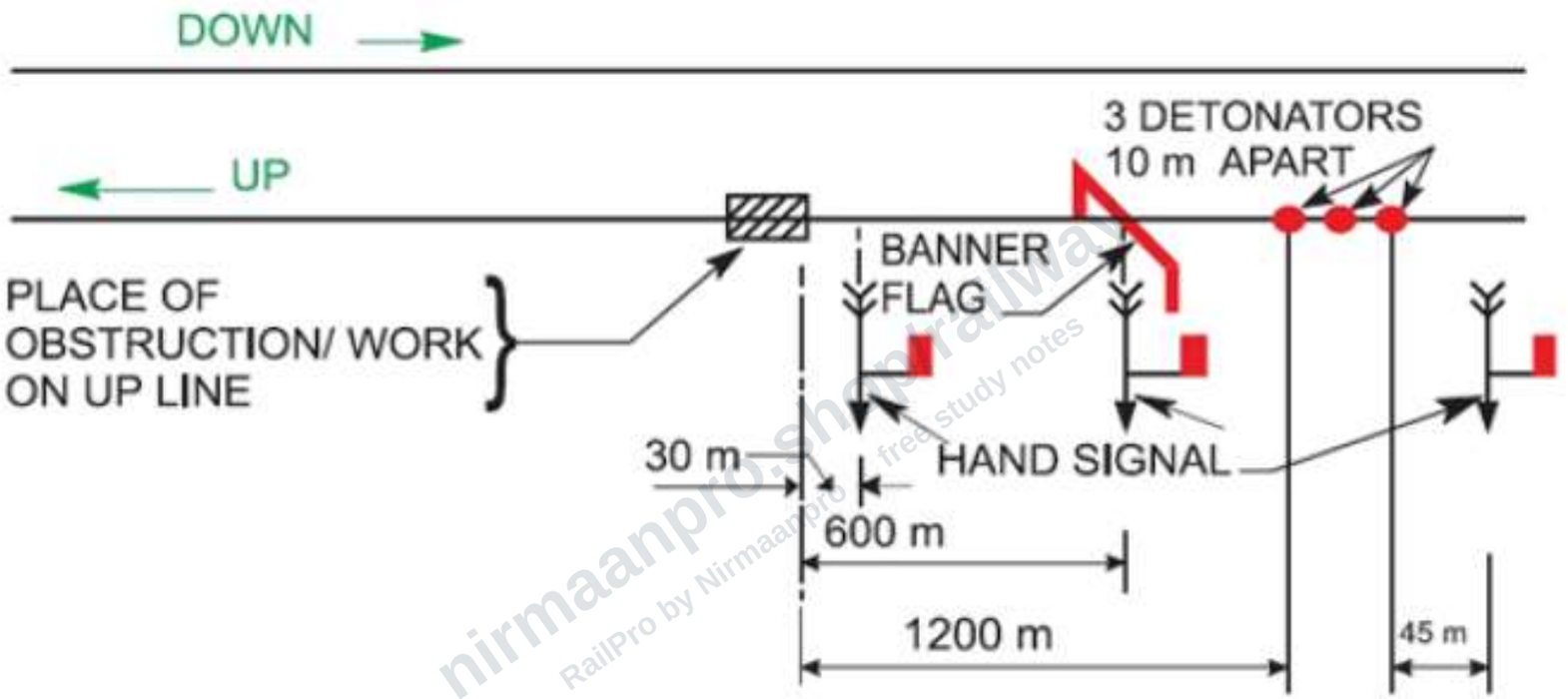
Annexure - 8/1 - *Para 806(1)*

WORKS OF SHORT DURATION - PROTECTION OF LINE IN CASE OF STOP DEAD RESTRICTION



SINGLE LINE

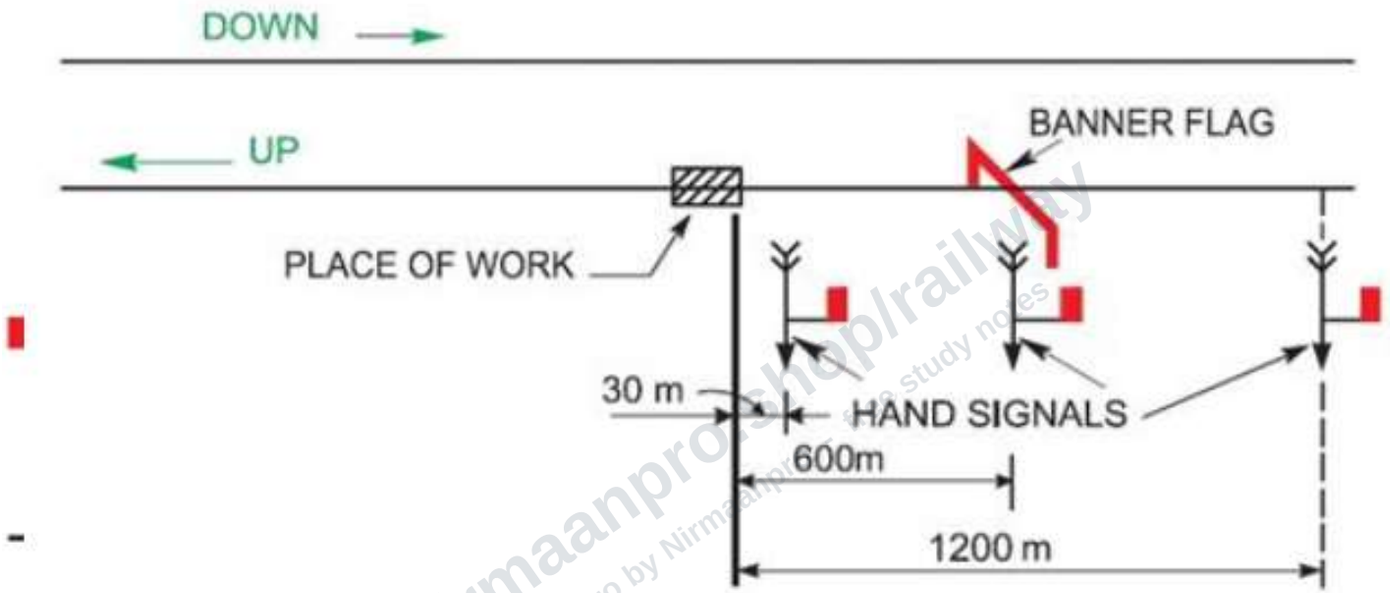
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DOUBLE LINE

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Annexure - 8/2 - *Para 806(2)*



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DOUBLE LINE

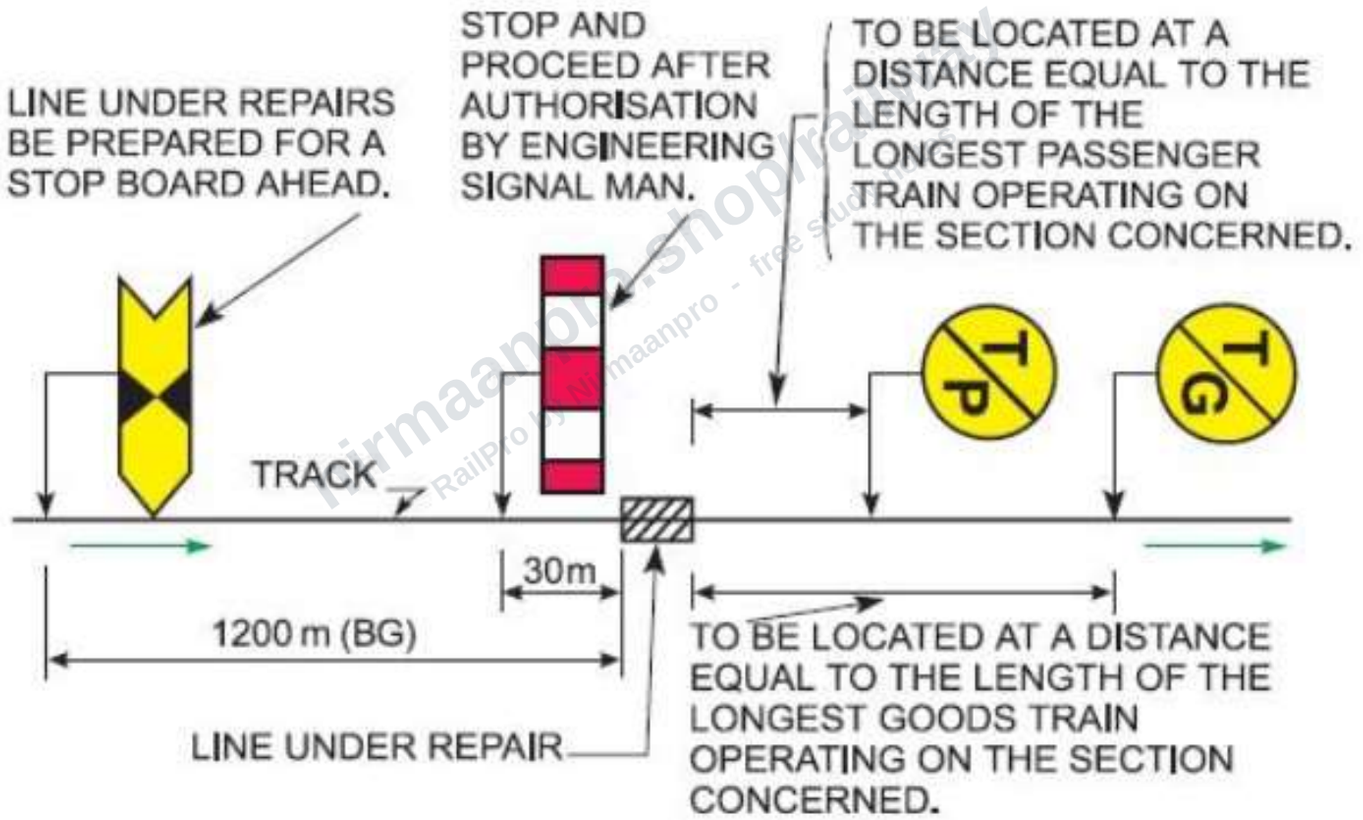
Note-

INTERMEDIATE FLAGMAN WILL KEEP BANNER FLAG UNTIL THE SPEED OF THE TRAIN HAS BEEN REDUCED, AFTER WHICH THE BANNER FLAG WILL BE REMOVED AND TRAIN HAND - SIGNALLED FORWARD.

Annexure - 8/3 *Para* 807, 808, 814

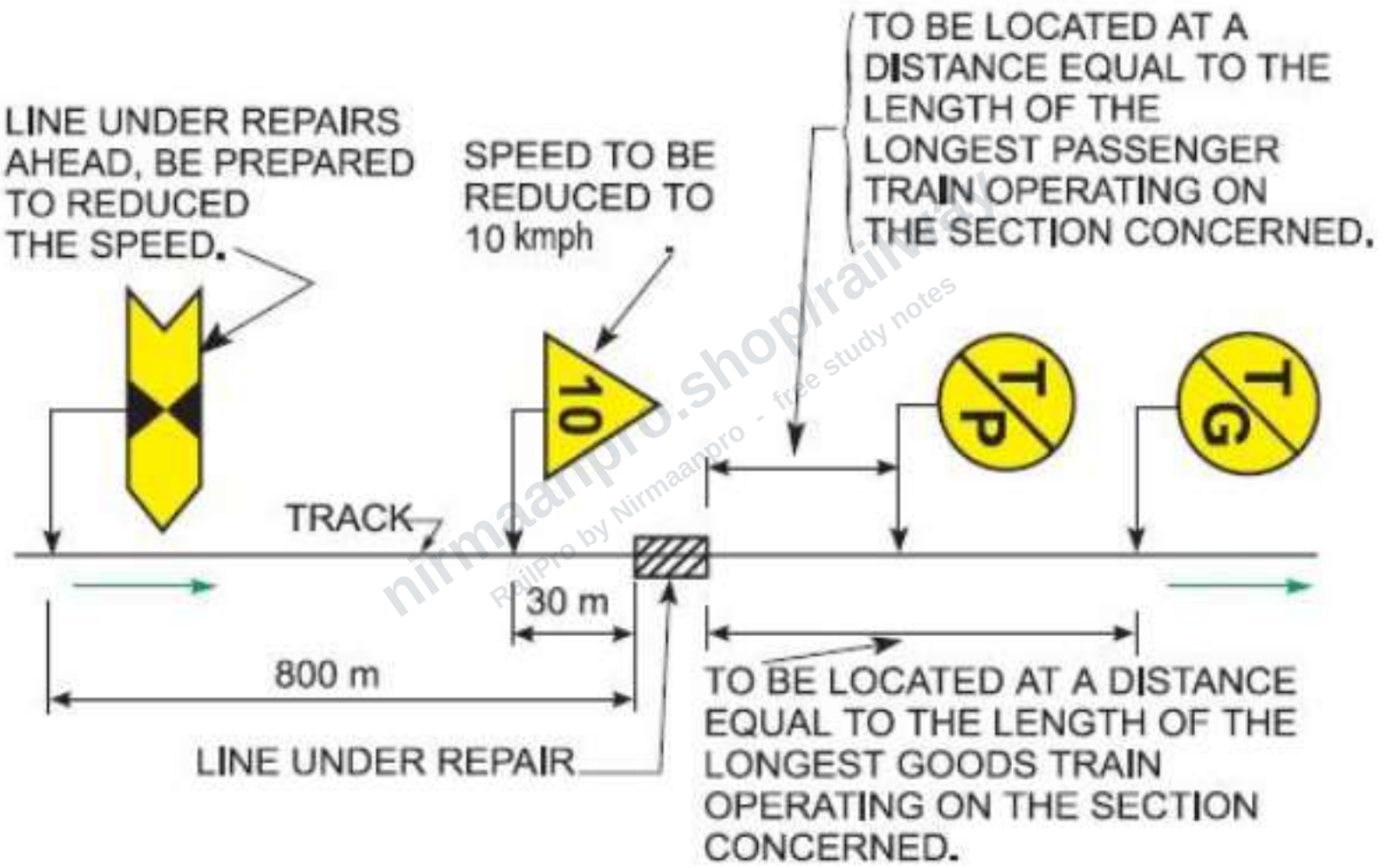
RETRO REFLECTIVE TYPE BOARDS - TO BE PROVIDED IN NEW CONSTRUCTION AND DURING REPLACEMENT OF EXISTING BOARDS

FOR STOP - DEAD RESTRICTIONS



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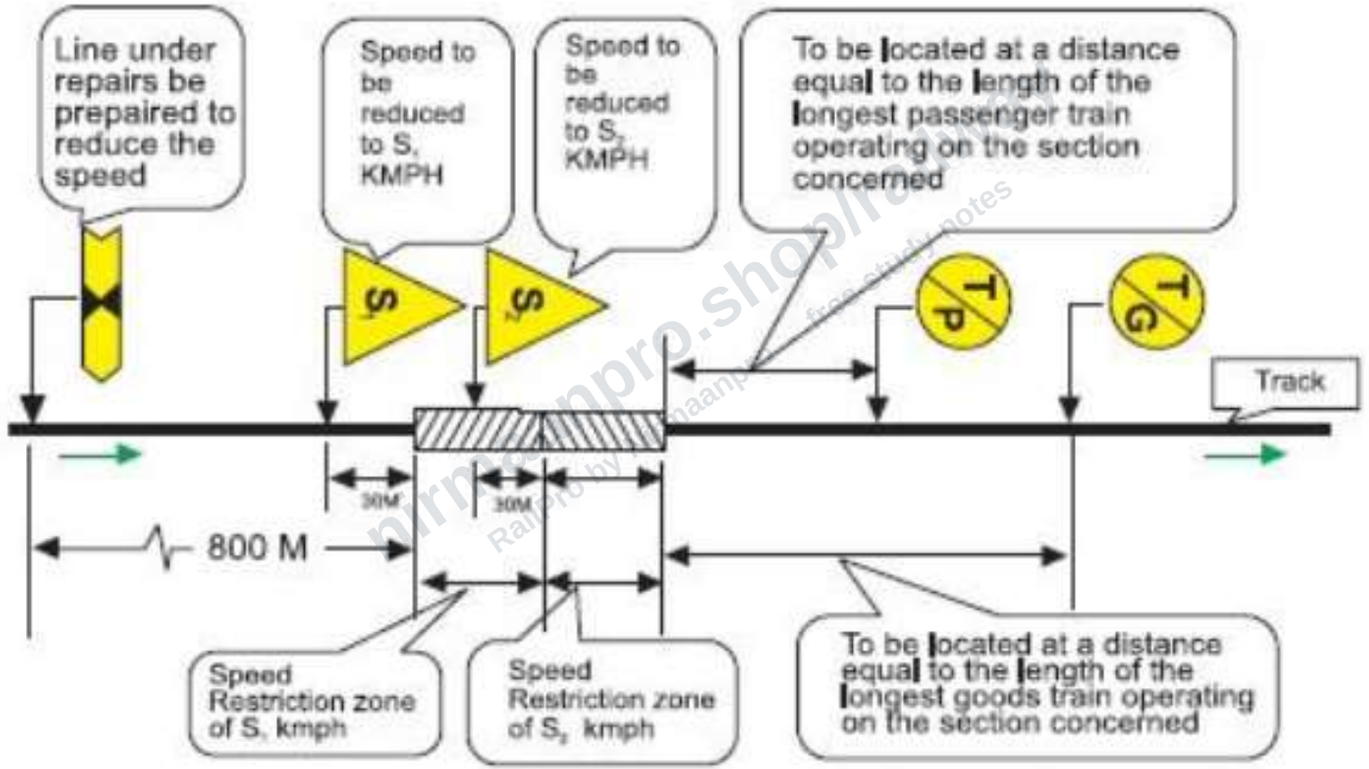
FOR REDUCED SPEED



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POSITION OF ENGINEERING INDICATORS IN CASE OF MULTI SPEED RESTRICTIONS

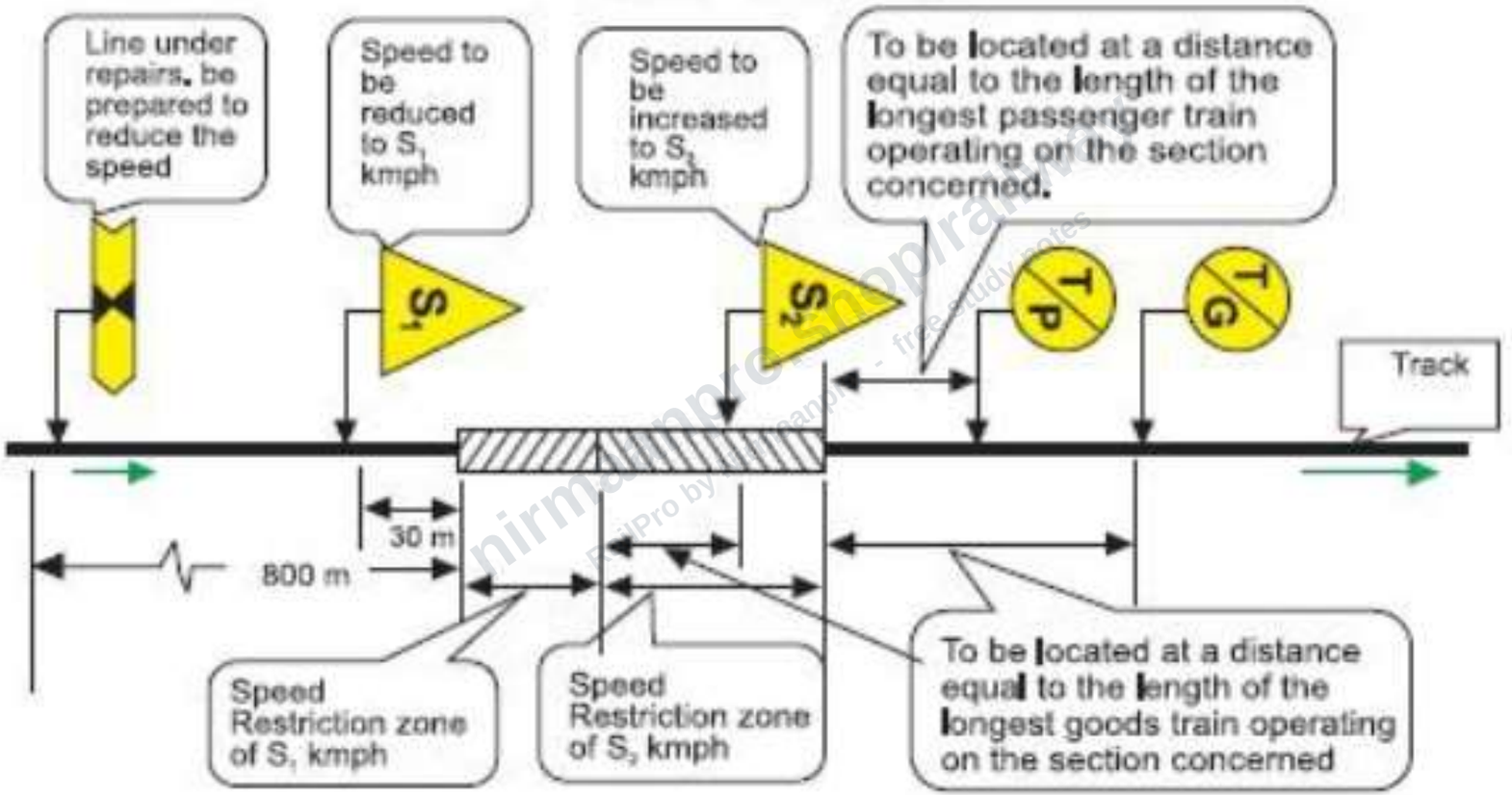
CASE - I : $S_2 < S_1$



Note : Min length of speed restriction zone of S_1 kmph should be 200 m. otherwise speed indicator board S_2 shall be provided at the place of S_1

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CASE - II : $S_2 > S_1$



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Thanks

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RECEIVED 19/7/21 CE'S OFFICE

भारत सरकार (GOVERNMENT OF INDIA)
रेल मंत्रालय (MINISTRY OF RAILWAYS)
रेलवे बोर्ड (RAILWAY BOARD)

No.: 2021/CE-II/TSC/10th Extraordinary

New Delhi, Date: 16 /07/2021

NR/ Principal Chief Engineers,
All Zonal Railways.

Sub: Revised norms of track maintenance and criteria of track renewal

Over period of time, various advancements have taken place in the field of track maintenance. Manual packing of track has altogether been replaced with machine packing. Life of rails has improved with use of rail grinding to remove surface flaws and increasing the contact area. Therefore, with the improvement of technology of track, review of norms of track maintenance and renewal criteria has been done to suit to the changing conditions of increased axle load, increased speed of trains and constraints of manpower etc, after discussion in 10th Extra Ordinary meeting of Track Standards Committee held on 22nd June, 2021.

Revised norms of track maintenance and criteria of track renewal duly approved by Board (MI) is given below:

S. No.	Description of Item	Existing norms/Criteria	Revised norms/Criteria
1	Deep Screening of Plain track and turnout	Deep screening of Track shall be done after 500 GMT or 10 years, whichever is earlier. However, deep screening shall also be carried out if the existing clean ballast cushion is less than 150 mm to ensure proper machine tamping. All the loop lines should be deep screened once in 15 years. **(Para 636(2)(e) of IRPWM 2020)**	1. Deep screening of Track shall be carried out **a. For Plain Track on Main line** i. if the clean ballast cushion is less than 200mm for section having sectional speed of 130 kmph and above ii. if the clean ballast cushion is less than 150mm for section having sectional speed less than 130kmph **b. For Turnout on Main line** if the clean ballast cushion is less than 200mm 2. All the loop lines should be deep screened once in 15 years.
2	Service life of rails	Service life of 60 kg 90 UTS rails in terms of GMT is 800 GMT. **(Para 702(1)(d) of IRPWM 2020)**	**1) Routes covered by Rail Grinding** Service life of 60 kg 90 UTS rails in terms of GMT is 1000 GMT. All other existing criteria of rail renewal shall continue.

PR. CE
SECY./Pr. CE ALL HOD'S
CPD/TMS CPD/BW
CPD/SD CBE
CTE CE/MRTS
CE/G CE/TMC
CE/P&D CE/RC
CE/HQ CE/TMS
CE/TSP CE/SD
CE/TP CE/TM
DY/CE CE/WORKS
OS CHOS/COORD

20.7.21

16/7/21

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S. No.	Description of Item	Existing norms/Criteria	Revised norms/Criteria
			2) Routes not covered by Rail Grinding Existing service life and other criteria of rail renewal shall continue.
3	Service life of PSC sleepers	2000 GMT or 35 years whichever is earlier or on condition basis as decided by CTE. **(Para 718 of IRPWM 2020)**	Condition basis viz. rail seat grooving, insert corrosion, cracking in continuous stretches etc. as decided by CTE.
4	Service life of Turnout	**Switches** i) 52kg -150 GMT or condition basis. ii) 60 kg-200 GMT or condition basis. **CMS Crossing** 52 kg & 60 kg -300 GMT or condition basis. **Thick web Switches** 52 kg & 60 kg -500 GMT or condition basis. **(Para 717(1)(b) of IRPWM 2020)**	**Switches** 52kg -250 GMT or condition basis as decided by CTE. 60kg -300 GMT or condition basis as decided by CTE. **CMS Crossing** i) 52 kg & 60 kg -350 GMT with replacement of fittings on condition basis, in case of in-situ reconditioning using Robotic Welding machine. ii) 52 kg & 60 kg -300 GMT, in case of reconditioning using H3B/H3C IRS electrodes. **Thick web Switches** 52 kg & 60 kg -800 GMT or on condition basis as decided by CTE.
5	Service life of P.Way components (Fittings)	**Metal Liner** 300 GMT or 8 years whichever is earlier or on condition basis **ERC** 300 GMT or 8 years whichever is earlier or on condition basis **CGSRP** 300 GMT or 8 years whichever is earlier or on condition basis **(Para 718 of IRPWM 2020)**	**Metal Liner** 400 GMT or 8 years whichever is earlier or on condition basis **ERC** 400 GMT or 8 years whichever is earlier or on condition basis **CGSRP** 400 GMT or 8 years whichever is earlier or on condition basis
6	Service life of Glued Joint	Service life of glued joint is 200 GMT. **(RDSO's letter no. CT/GJ/Manual dated 28.08.2012)** Renewal of special track components like SEJ, Glued joints etc. to be planned after	Tentative life of glued joint shall be enhanced to 400 GMT for 60kg glued joints with 6mm gap. However, renewal of such special track components shall continue to be planned on condition basis after they have degenerated to a level where they are not able to serve

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S. No.	Description of Item	Existing norms/Criteria	Revised norms/Criteria
		they have degenerated to a level where they are not able to serve their desired purpose.**(Para 702(1)(f) of IRPWM 2020)**	their desired purpose as per provisions of Para 702 (1) (f) of IRPWM, 2020.
7	Service life of Channel Sleeper	14 years/400 GMT or on condition basis. **(RDSO letter no. CT/PTX/TSC dated 07.12.18)**	1) Service life of galvanized channel sleeper - 14 years / 800 GMT or on condition basis as decided by Chief Track Engineer of the Railway, whichever is earlier, with replacement of fittings as and when necessary. 2) Service life of rubber components of galvanized channel sleeper shall however be kept as 400 GMT or on condition basis as decided by Chief Track Engineer of the Railway, whichever is earlier.

The above revision in norms of maintenance and renewal criteria shall come into force with immediate effect. Zonal Railways are advised to plan track maintenance and renewal based on above.

16/7/21

(Pradeep Nagar)
Director Civil Engg. (Plg.)
Railway Board

Copy to: CAO(Con)/All Zonal Railways for information and necessary action please.

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2.14. INTRODUCTION TO TRACK MACHINES- (12 Periods)

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2.14 Introduction to different types of track machines viz. Duomatic, CSM, tamping express, DTS, Unimat, BRM, FRM, BCM etc.

(12 Periods)

UNIMAT
BALLAST CLEANING MACHINES, DYNAMIC TRACK STABILISATION AND BRM

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UNIMAT



UNIMAT

Types of UNIMAT machines available-

2S- Only 2 lifting points, one on each rail,

3S- Additional lifting hook for IIIrd rail,

- **2S machines have trouble in correcting XL in crossing portion,**
- **3S can attend crossing better. (at many places IIIrd rail not being used)**

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UNIMAT

- **Main line tamped first - While tamping main line alignment, LL, XL are attended,**
- **Then machine moved to loop line for tamping only ,**
- **While packing main line, T/O side also gets lifted,**
  - **If LL side is not supported , XL will be disturbed, machine brought on LL ,**
  - **So T/O side needs to be packed manually or supported on wooden blocks.**

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DEVELOPMENTS IN UNIMAT

- **Now UNIMAT 08-475 4S has been designed, which can tamp rail seats of farthest rail while moving on main line,**
- **Rest of seats are packed when machine is brought on loop line for tamping,**
- **90-100 minutes are required for one 1:12 turnout.**

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ADJUSTMENT IN TAMPING UNIT

- **Tamping unit, rotation -** To suit fan shaped sleeper layout,

- **Tamping unit, lateral movement** – To suit location of tamping.

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TOOL TILTING ARRANGEMENT



LIFTING ARRANGEMENT

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IIIRD RAIL LIFTING ARRANGEMENT

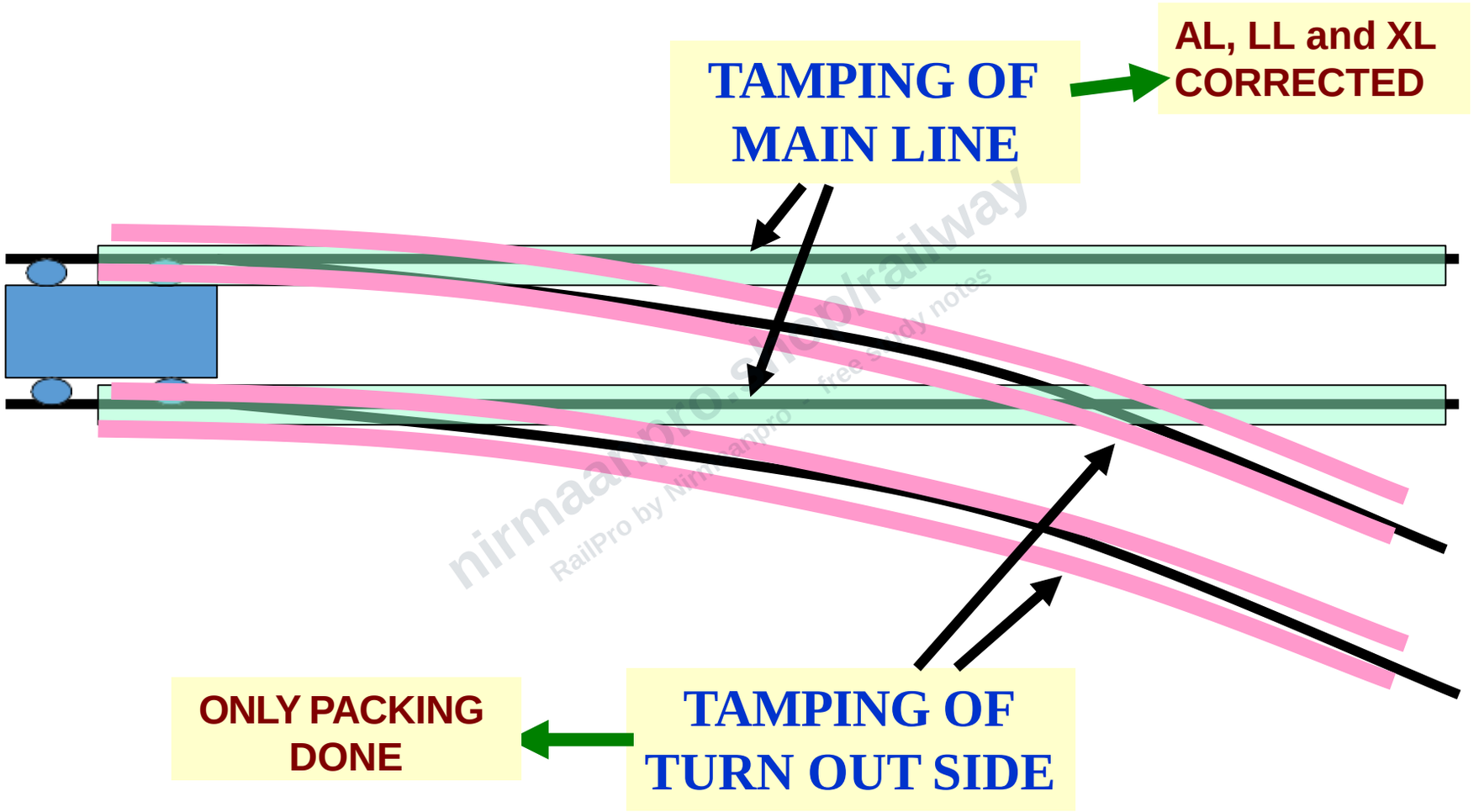
❖ To limit lifting force in lifting unit-



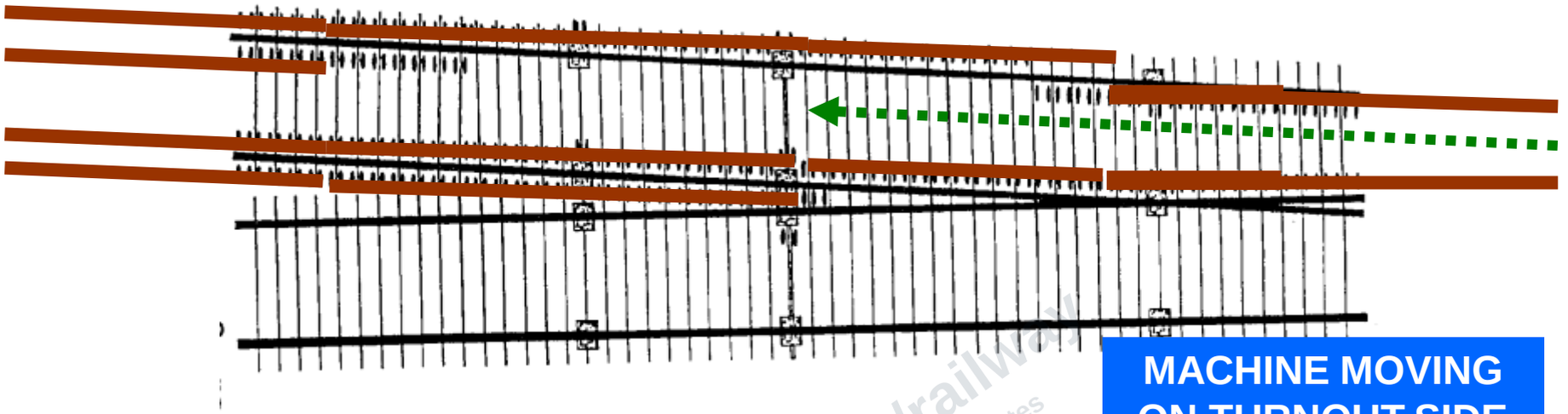


UNIMAT 09- 475 4S

TAMPING OF TURNOUT

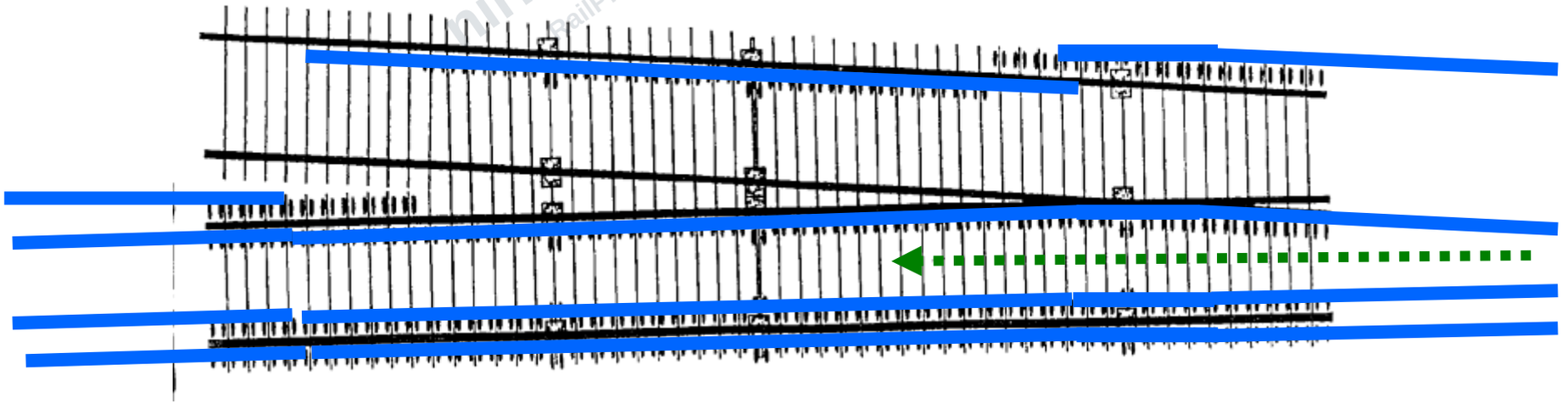


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MACHINE MOVING ON TURNOUT SIDE

WHEN BOTH THE PACKING SUPERIMPOSED ALL RAILSEATS ARE COVERED



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UNIMAT 08-475 4S

IMPORTANT FEATURES

- Single sleeper tamping,
- All the rail seats can be tamped from ML only,
- 3rd rail lifting by roller clamp on telescopic arm,
- Outer tamping units, installed on telescopic outriggers, can move out,
- Inner tamping units can also be shifted laterally.

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UNIMAT 08-475 4S

- Ballast hopper with distributing device for intake and placement of the surplus ballast (Optional),
- Cabin at the front with driver's desk and ALC automatic guiding computer,
- Work cabin with excellent view onto the work area.

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BALLAST CLEANING MACHINE



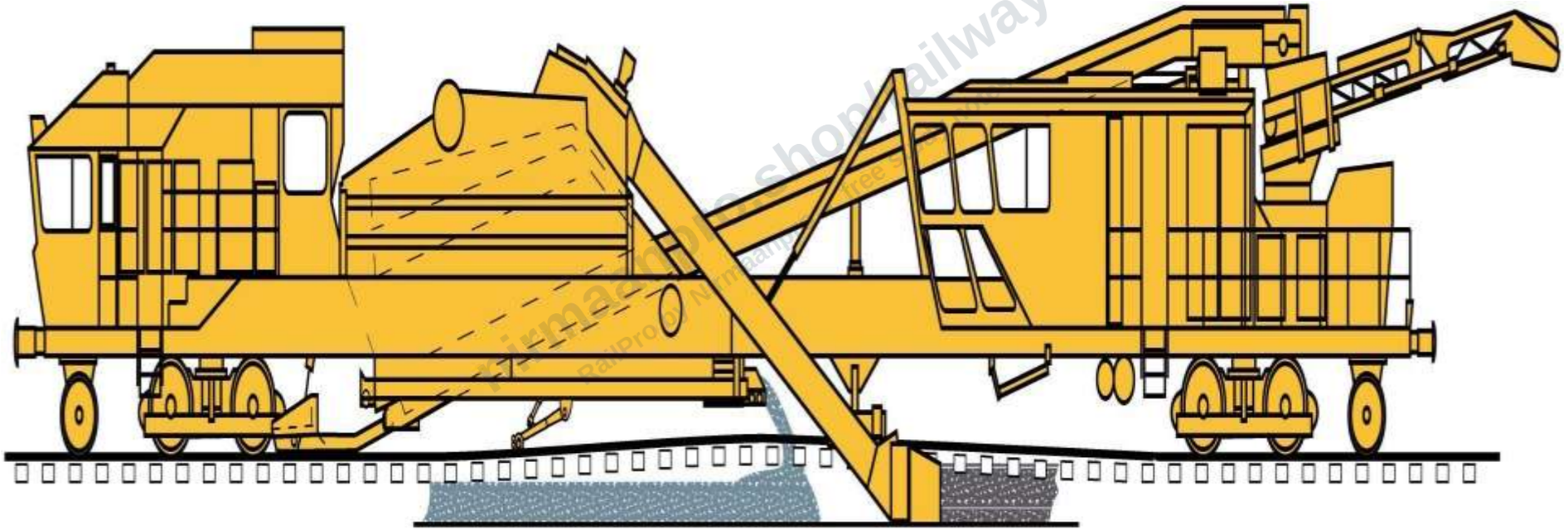
BALLAST CLEANING MACHINE

Basic Units-

1. Excavating unit,
2. Screening unit,
3. Conveyor system for distribution of ballast and disposal of muck,
4. Track lifting and slewing device,
5. Recording unit.

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SCHEMATIC DIAGRAM OF BCM



CUTTER CHAIN



SCRAPER& FINGER CHISELS



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CUTTING CHAIN ASSEMBLY



BALLAST CLEANING

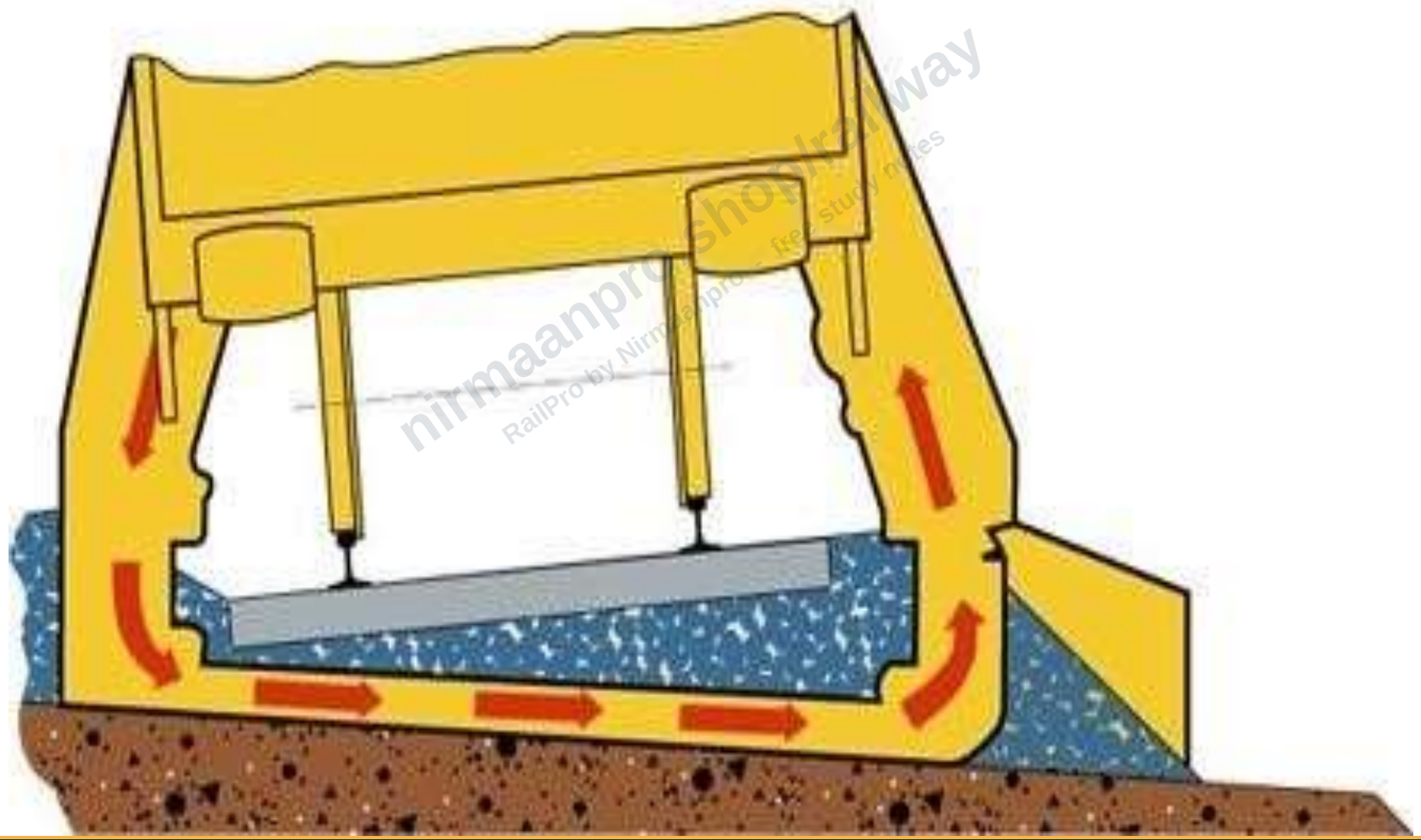


OPENING OF TRACK AT 40kmph, AFTER BCM

For BG- Relaxation of speed after deep screening by BCM followed by TTM and DTS-

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CROSS SLOPE ADJUSTMENT



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MEASUREMENT OF CUTTING DEPTH



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PROVISION OF FORMATION SLOPE

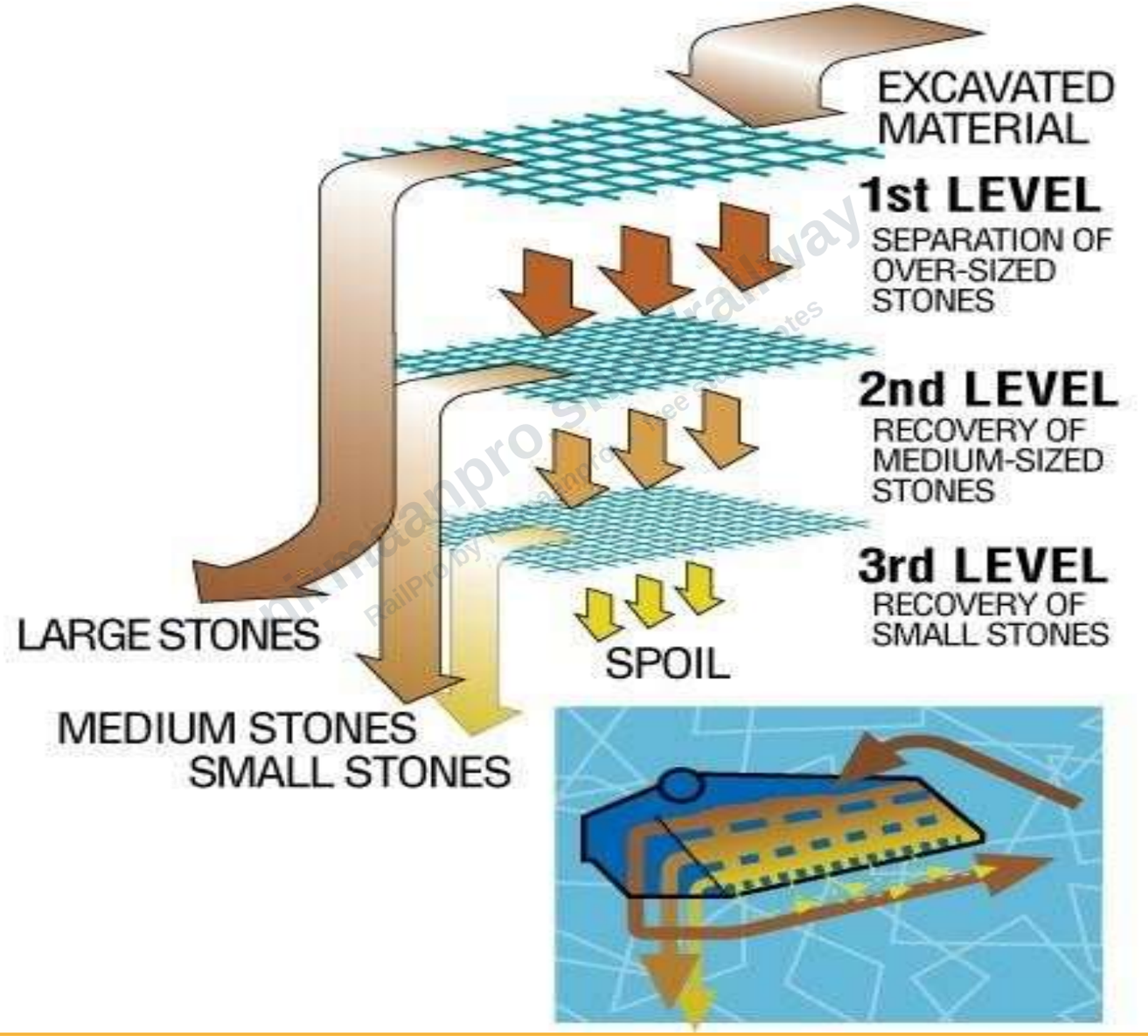
- **Non calculation of cutting depths may lead to-**
  - **Cutting too steep slope i.e. extra depth (LH curve),**
  - **Inadequate slope even reverse slope in worst condition (RH curve).**

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SCREENS



SYSTEM OF SCREENING



SCREENING OF BALLAST



43

DISTRIBUTION OF CLEAN BALLAST



DISTRIBUTION OF CLEAN BALLAST



BALLAST DISTRIBUTION BY BCM

- **During deep screening if not cared in time on curve, more ballast is likely to fall on inner side,**
- **Screening unit is required to be leveled on canted track, which will make distribution equal,**
- **A moveable flap in screening unit can further change ballast distribution.**

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DISPOSAL OF MUCK



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BALLAST CLEANING OF TURNOUT



48

DEEP SCREENING OF PSC TURNOUT

- Clear opening in crib available is very less (aprox. 35-40 cm),
- Longitudinal shifting of sleeper is not possible,
- Sleepers are too heavy to be moved
- Sleepers are very long, formation slope management is difficult.
- Hence deep screening of PSC Turnout is very difficult.

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DEEP SCREENING OF PSC TURNOUT

- **Deep screening of T/O is possible with RM-80-92U and RM-76,**

- **Block required-**

  RM-80-92U ------ 3.5 Hrs

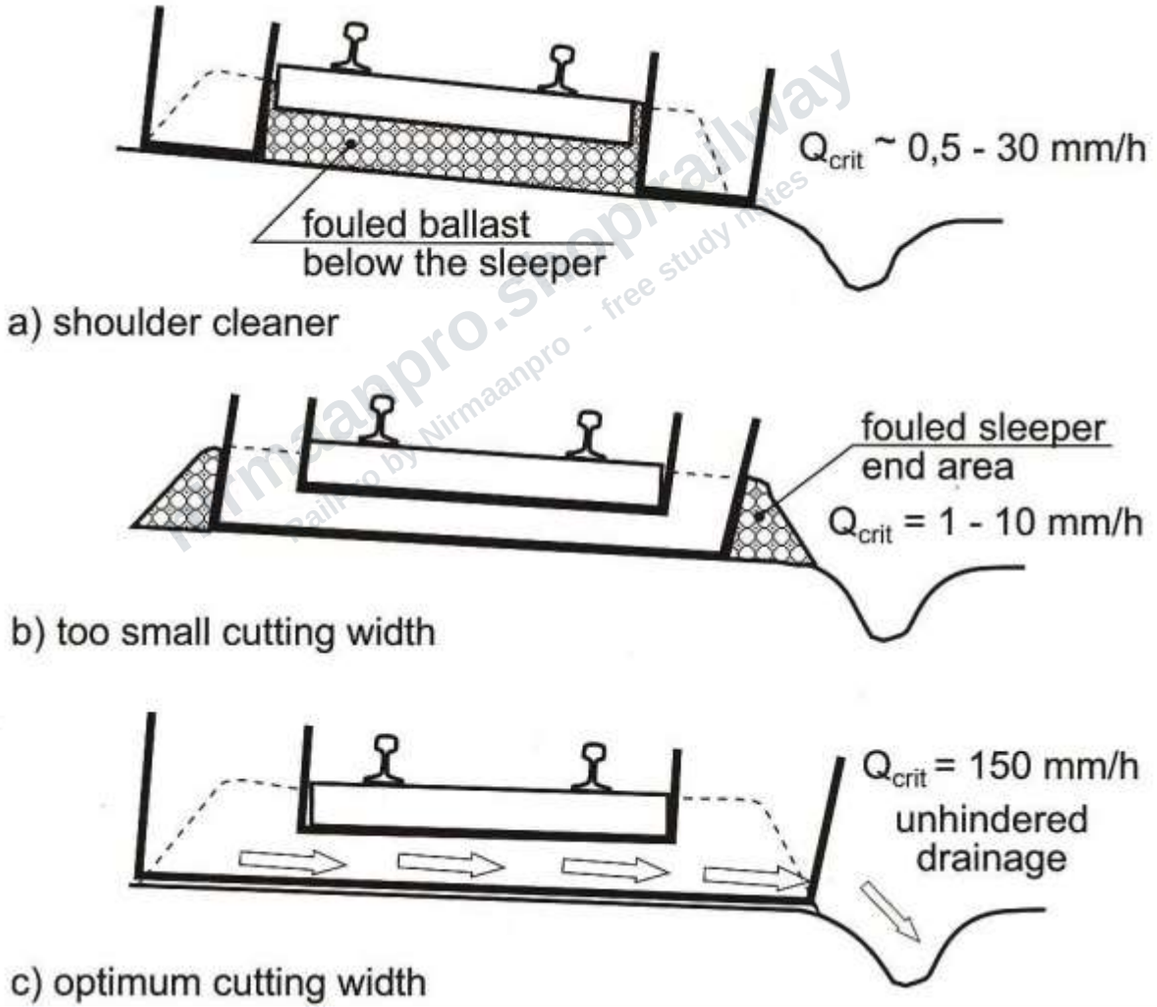
  RM76 ------ 5.0 Hrs

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DEEP SCREENING OF T/O BY RM-80-92U

BCM- EFFECT ON NON REMOVAL OF CONTAMINATED CORE



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LAYING OF GEOTEXTILE/GEOGRID

- During deep screening by BCM geo-textile/geo-grid can also be laid at the same time.

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SHOULDER BALLAST CLEANING MACHINES

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Plasser & Theurer

Features

- **The machine is used for cleaning of shoulder ballast to improve the track drainage.**
- **Types: FRM-80 and KSC-600.**
- **The main features are similar to RM-80.**
- **It is provided with 2 excavating cutter chains, one on either side. Each chain excavates** and **picks up the shoulder ballast and directs it to a set of vibrating screens where muck is screened away and cleaned ballast is deposited on shoulders of the ballast profile.**

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DYNAMIC TRACK STABILISATION

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Plasser & Theurer

AIMS

- **The aim of dynamic track stabilization is to achieve an improved anchoring of the track skeleton in the ballast bed.**
- **To permit maximum permissible/ enhanced speed after maintenance.**
- **It also aims at retention of track geometry for a longer period.**
- **Savings in operation & maintenance cost.**

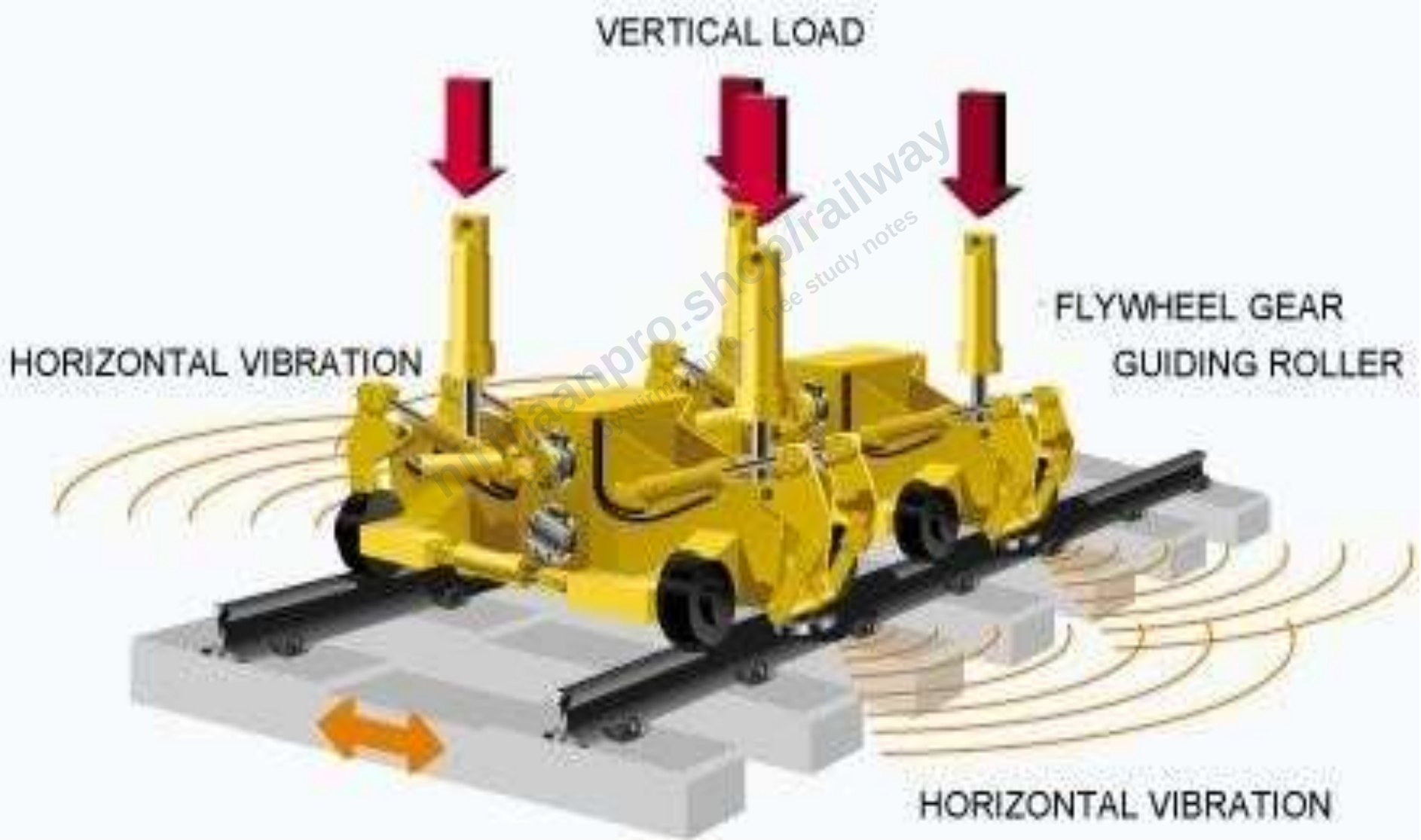
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PRINCIPLE OF DYNAMIC TRACK STABILISATION

The dynamic track stabilizer sets the track in horizontal oscillations whilst applying a static vertical load at the same time. This causes the ballast stones to re-arrange their position, with the result that the track is lowered and gets “fixed" into the ballast bed.

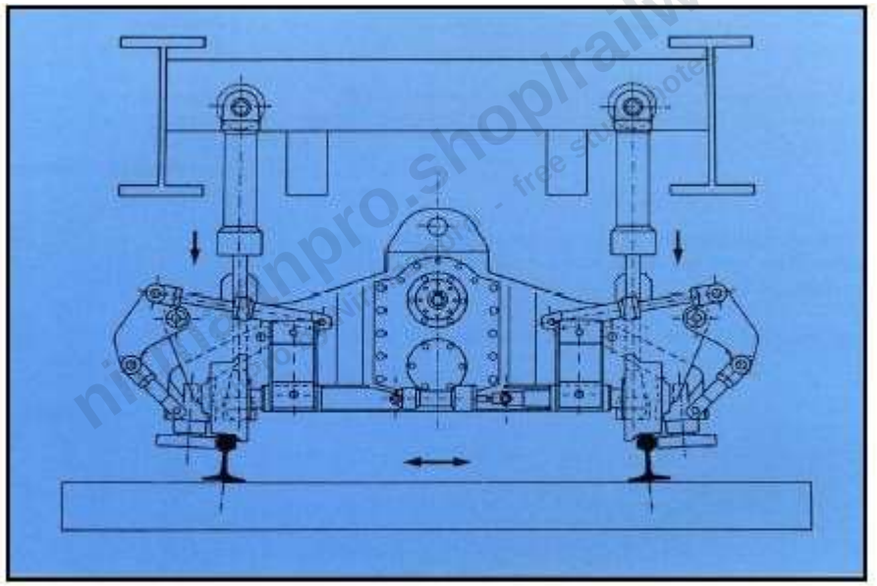
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PRINCIPLE OF DYNAMIC TRACK STABILISATION



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DGS 62 N



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DGS62 N

- Two stabilizing units, located between the bogies,
- Four flanged rollers and two pressing rollers, acting as a clamp, on each unit,
- Synchronous- action flywheel gear to produce the horizontal oscillation directed crosswise to the track axis.

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DGS62 N

- 0 - 45 Hz,
- Hydraulic cylinders for applying the vertical load (up to 356 kN),
- Proportional leveling system for an automatic, measured lowering,
- In one of the two cabins, the operating and monitoring controls for working operation are clearly laid out.

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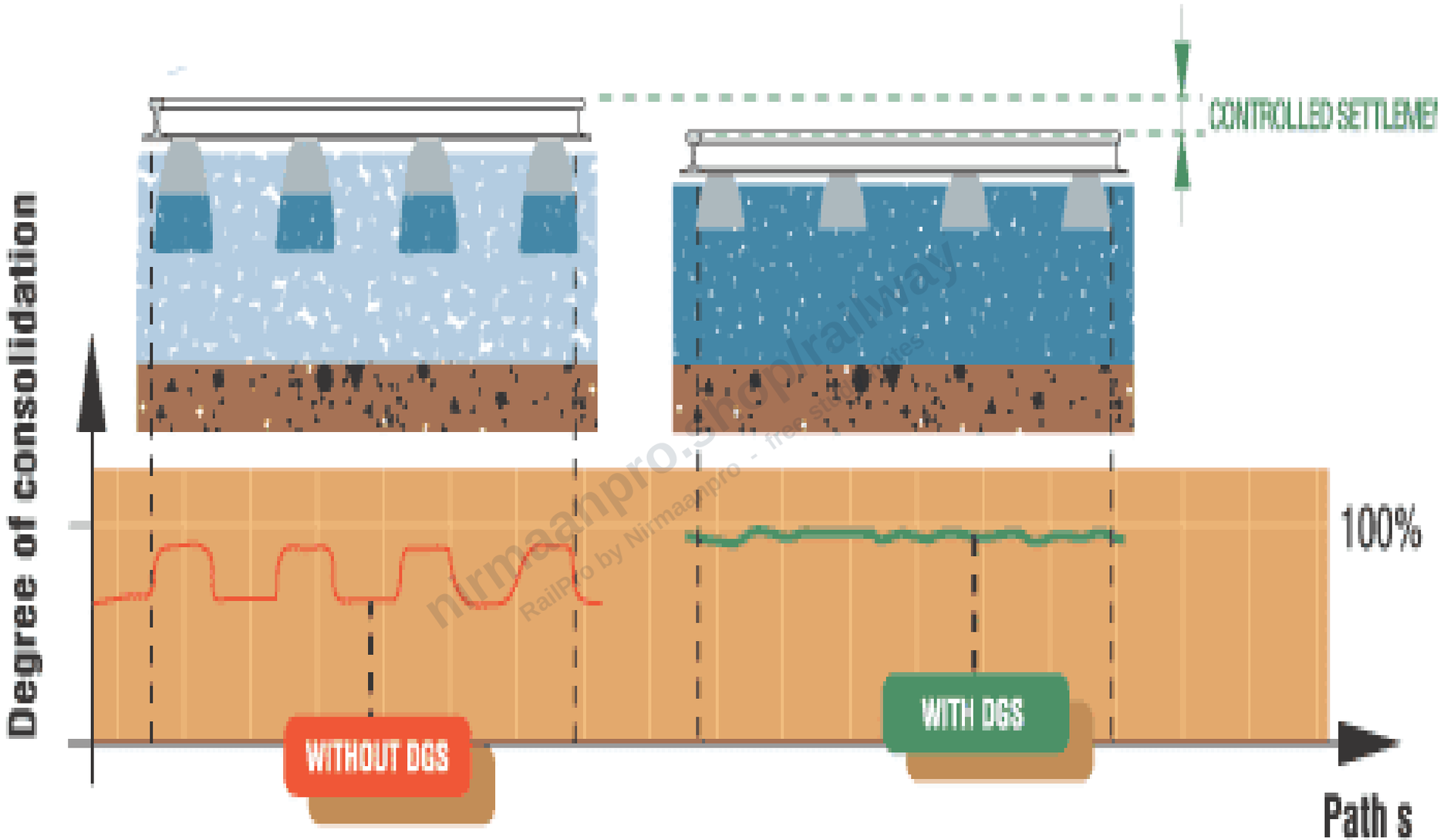
STABILISING UNIT



APPLICATION OF VERTICAL LOAD



CONSOLIDATION EFFECT ON THE BALLAST BED WITH AND WITHOUT DGS

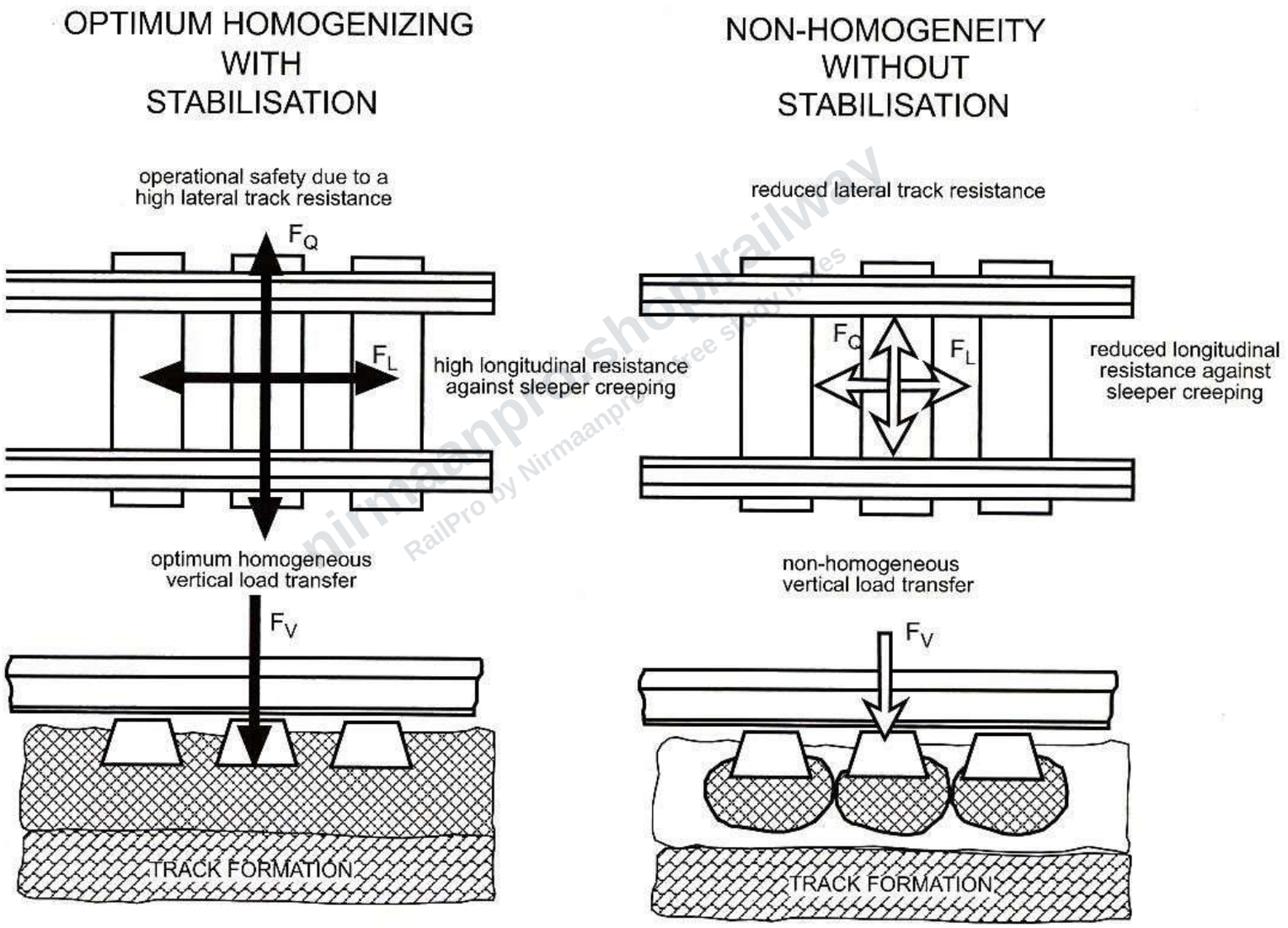


NO UNIFORM CONSOLIDATION OF THE ENTIRE BALLAST BED

IDEAL, HOMOGENEOUS CONSOLIDATION & STABILISATION (SPATIAL CONSOLIDATION)

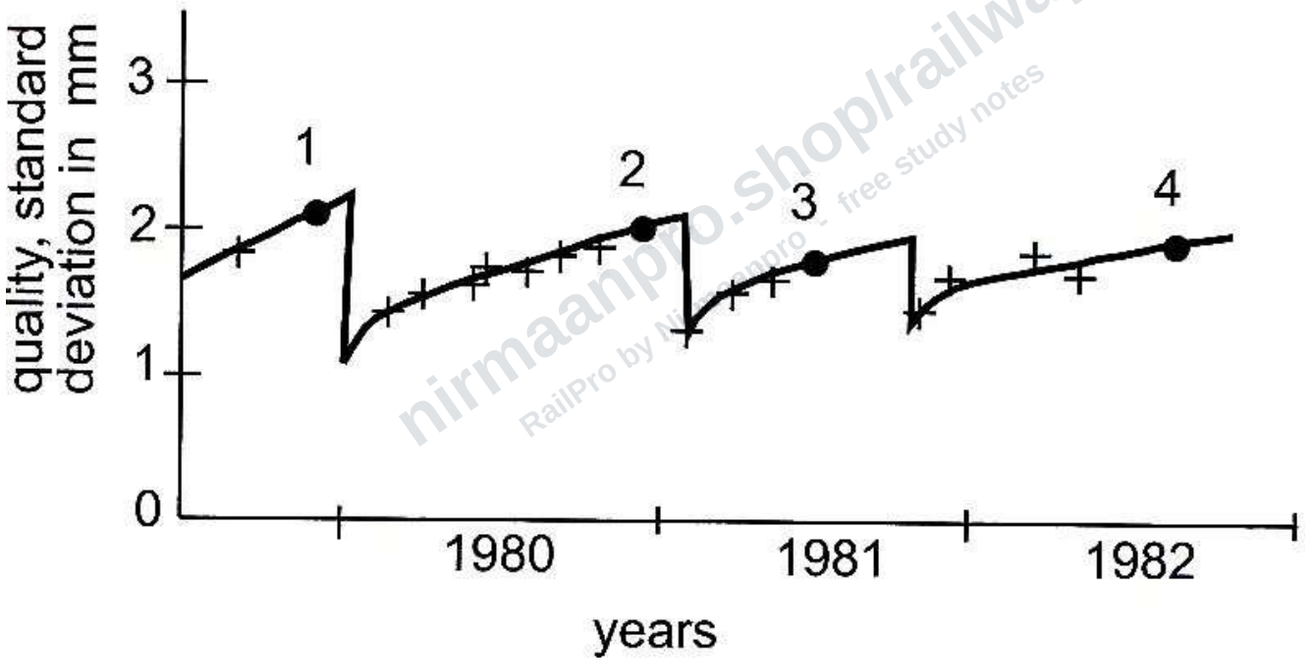
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EFFECT OF DYNAMIC STABILISATION



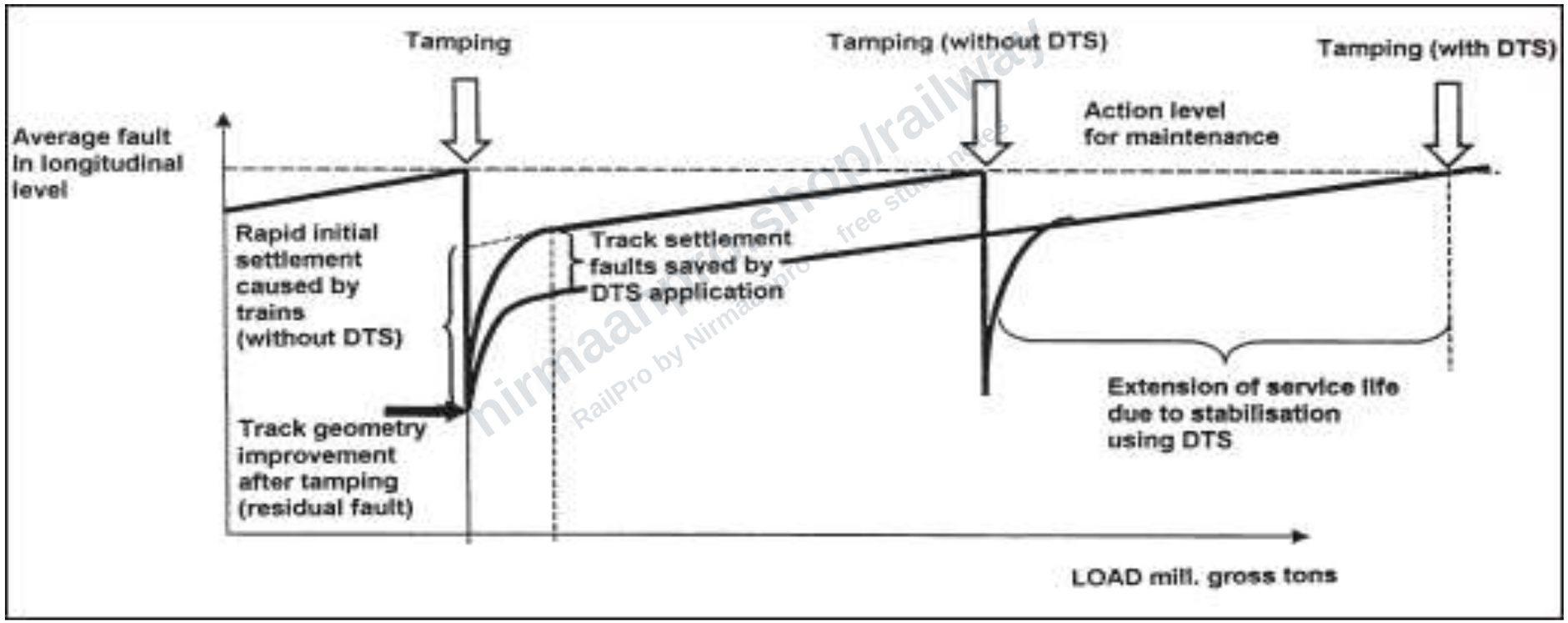
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DETERIORATION OF TRACK GEOMETRY AFTER TAMPING

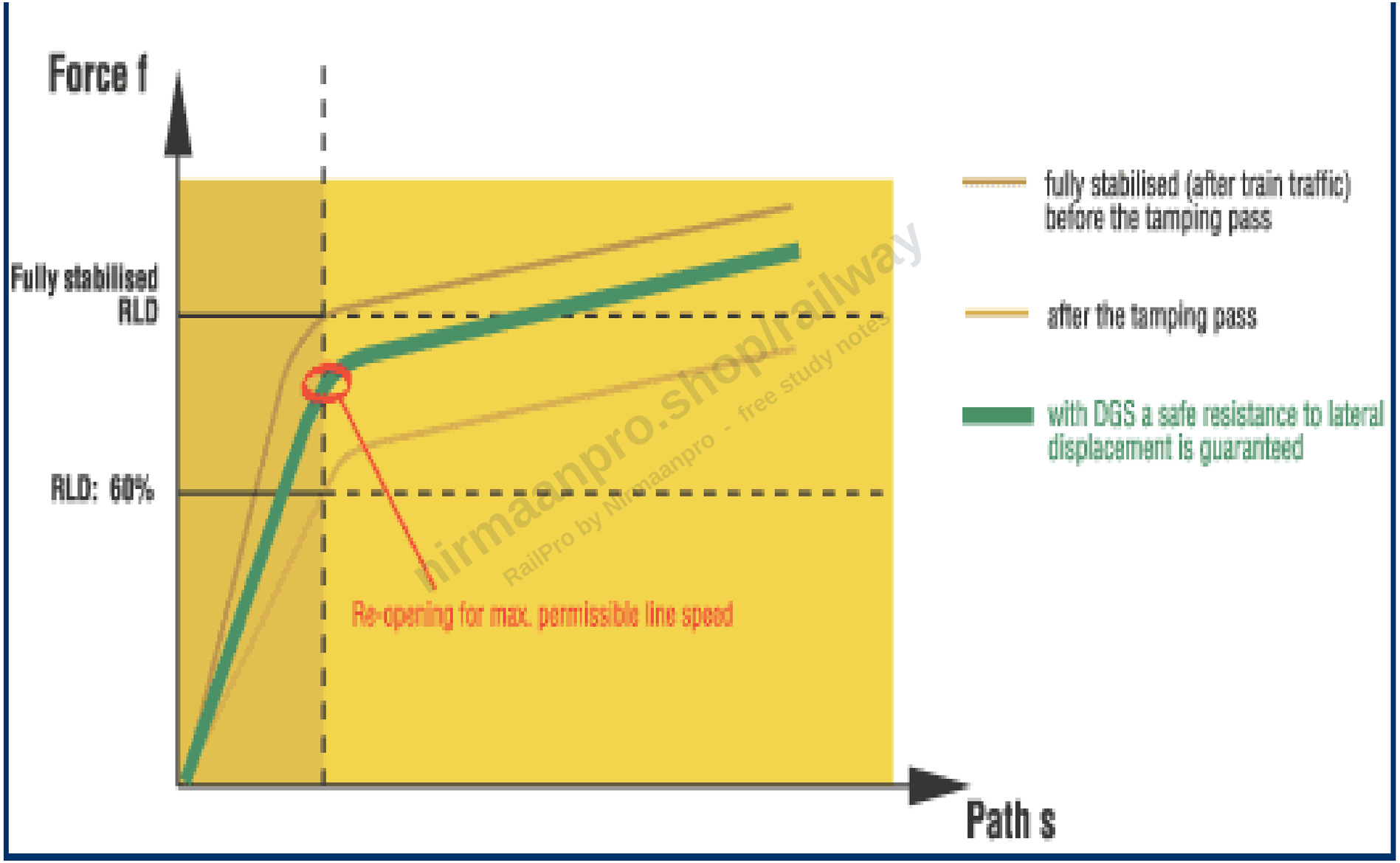


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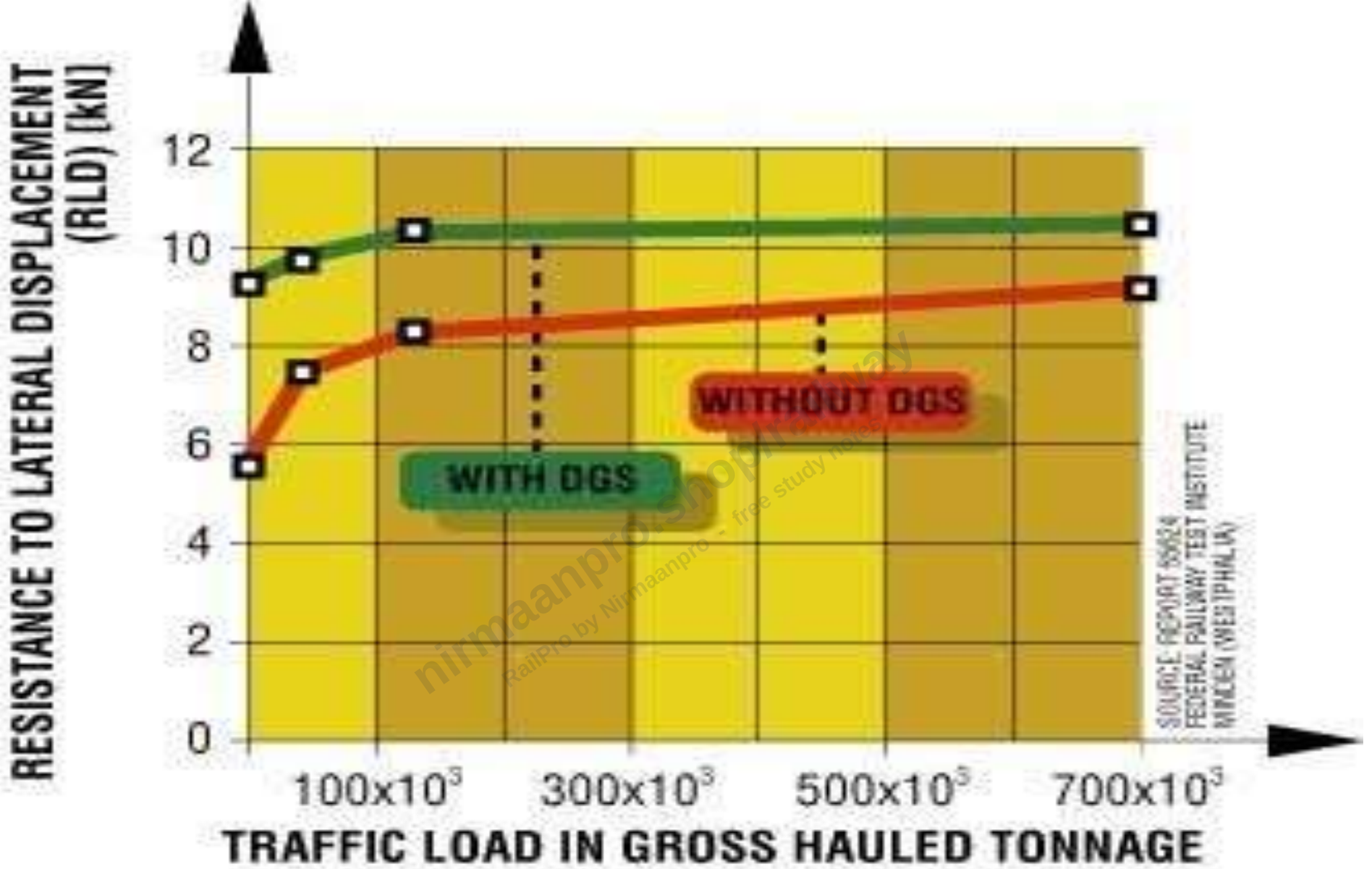
DETERIORATION OF TRACK GEOMETRY AFTER TAMPING



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RISE IN RESISTANCE TO LATERAL DISPLACEMENT WITH THE TRAFFIC LOAD AFTER TRACK RENEWAL

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ADVANTAGES OF DYNAMIC TRACKSTABILISATION

- Homogeneous, spatial consolidation of the entire ballast bed,
- Increase of the resistance to lateral displacement,
- Careful treatment of the ballast material by dynamic re-arrangement of the ballast stones to avoid fines,
- The danger of track buckling is reduced.

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- Durability of the accurate track geometry over a longer period, raising the quality reserve of the track,
- The intervals between maintenance are extended,
- Great savings in the regular track maintenance and operational hindrance costs when the technique is applied regularly,
- Dynamic stabilization raises the safety and helps to lower costs.

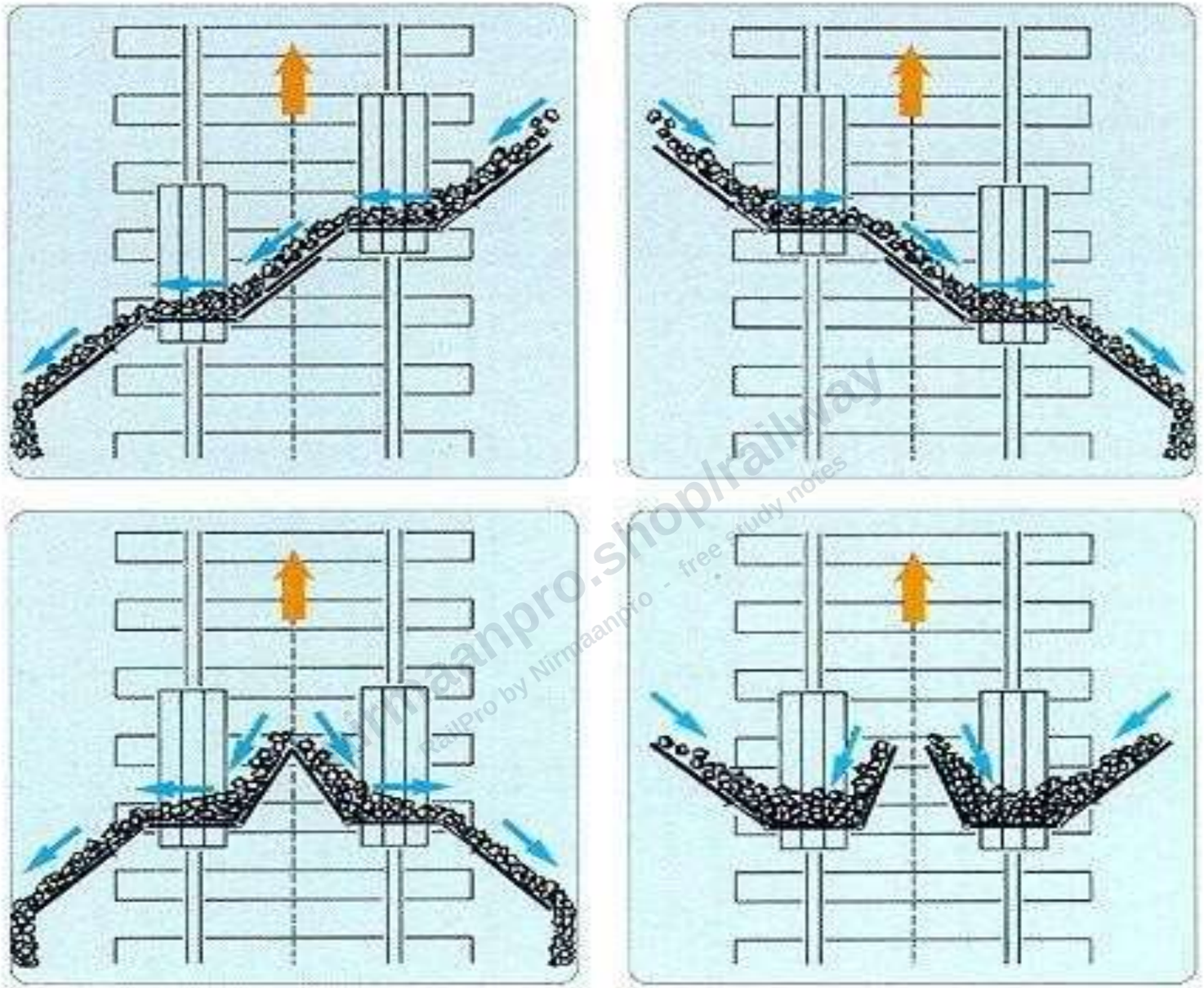
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Ballast Regulating Machine

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BALLAST REGULATOR (23)



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PROCESS OF BALLAST REGULATION

Features

1. Models available:
   a) 66-4,
   b) 56-3.

2. Speed:

	66-4	56-3
Self propelled-	50 kmph	60 kmph
In train formation-	40 kmph	40 kmph

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Necessity

Ballast regulation and profiling becomes necessary primarily due to:

1. After a maintenance operation such as tamping of track or screening of ballast,

2. After relaying work,

3. After training out ballast.

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Components

1. Engine: Cummins diesel engine supplies the power. A close circuit high pressure hydrostatic transmission powers the final drive.

2. Brakes: The machine is equipped with clasp air brakes on all the wheels.

3. Horn, Brakes, plow locks, broom locks : Are operated pneumatically. The pressure is maintained between 110-120 psi.

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Components

4. Electrical system:

This of 24 volts.

The system has 30 ampere alternator and two 205 ampere hour batteries wired in series.

Protection is provided by circuit breakers.

5. One pass transfer plow (Ballast plow):

It has 2 blades pivoted on a common shaft.

The plow can be positioned to plow out, plow in or to transfer ballast to either side of track with machine traveling either forward or backward.

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Components

6. Ballast Wings:

These are attached to the sides of the machine and hydraulically operated.

Machine can be equipped with standard fixed width ballast wings or optional variable width ballast wings for better profile shaping.

7. Broom:

Mounted at the rear of the machine.

It dresses the track by removing ballast from sleepers, fills up empty cribs and places excess ballast on the shoulders for final regulating and dressing.

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GENERAL

1. The operators ingenuity is called for to use the **'Wings Plow'** and **'Brooms'** to complete the operations in the minimum number of passes effectively.
2. Utmost care must be taken while lowering the wings to avoid infringement to the adjacent track.
3. Similar caution is necessary while winding up. Since machine wings are likely to hit hidden obstacles which may cause derailment of machine,
4. Extra care is required to select depth and speed.
5. Adequate re-railing equipment i.e. Traverser jack, wooden blocks should be available to handle derailments.

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CSM Machines

Operation

and

Working principles

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Important Works Done By the Tamping Machines

- **Tamping Work.**

  (Tamping unit)

- **Slewing Of Track.**

  (Alignment Corrections.)

- **Lifting Of track**

  (Cross Level and Longitudinal level Corrections.)

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Tamping Unit

Tamping Depth Zero Point



Tamping Depth Setting in Machine

PSC Sleeper Height	**= 210 mm (at Rail Seat)**
Wooden sleeper Height	**= 125 mm (at Rail Seat)**
60 KG Rail Height	**= 172 mm**
52 KG Rail Height	**= 156 mm**
Liner Height	**= 5 mm**
Bearing Plate Height	**= 20 mm**

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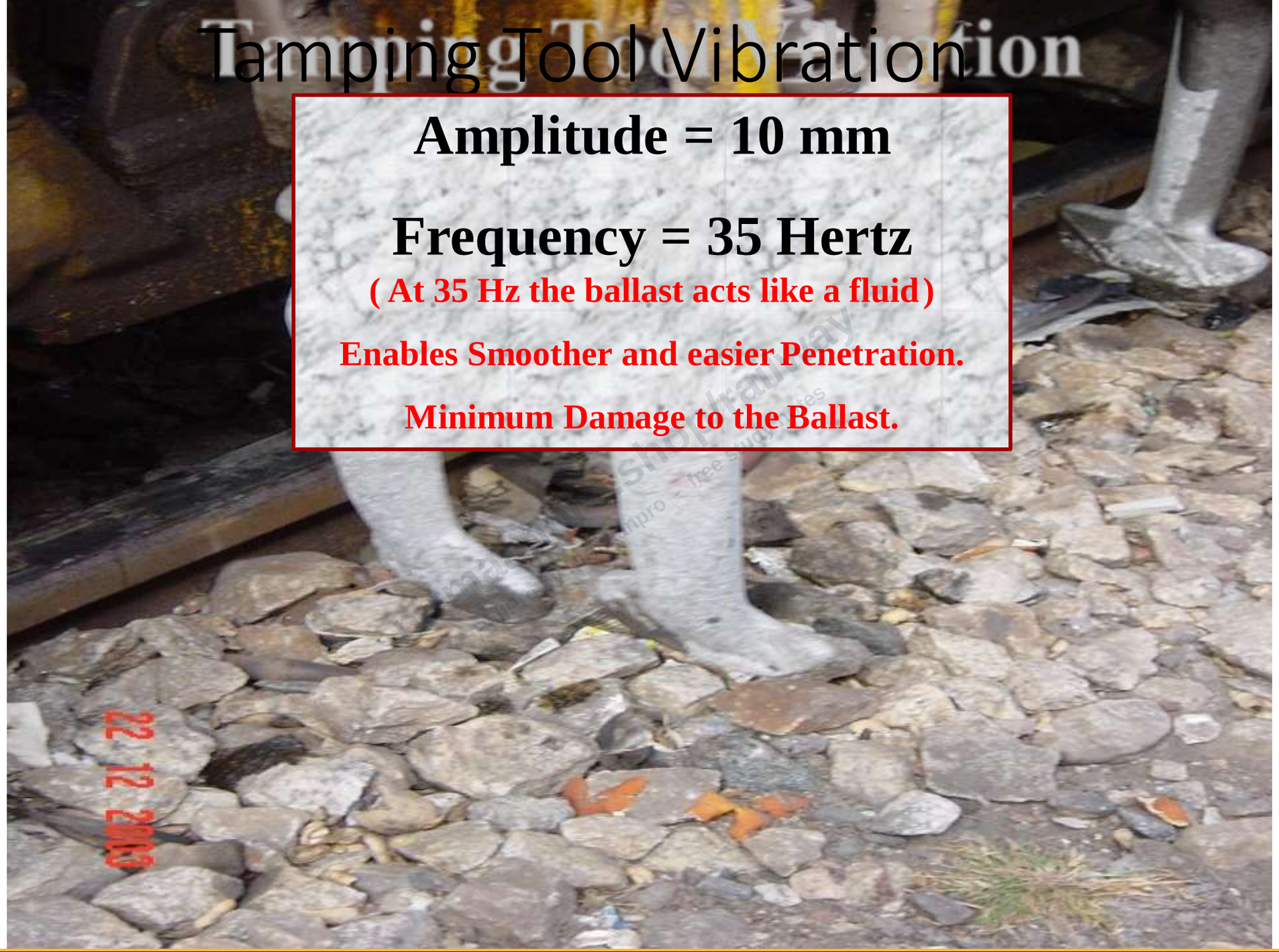
Tamping Depths to be set in the Machine

= Sleeper Height +Rail Height +liner Height

(e.g) PSC 60 KG Rail = 210 + 172 + 5 = 387 mm

Wooden 60 KG Rail = 210 + 125 + 20 = 355 mm

Tamping Tool Vibration



Amplitude = 10 mm

Frequency = 35 Hertz

(At 35 Hz the ballast acts like a fluid)

Enables Smoother and easier Penetration.

Minimum Damage to the Ballast.

Squeezing Time and Pressure

Squeezing Pressure for various Sleepers.

- Wooden sleepers : 90 bars
- CST & steel sleepers : 100 bars
- PSC sleepers : 110 bars

Squeezing Time

- Adjustable in 10 steps each step of 0.2 seconds.
- Adjusted while working as per the Track / Ballast Conditions.

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Squeezing Pressure Gauges



Tamping Unit Control



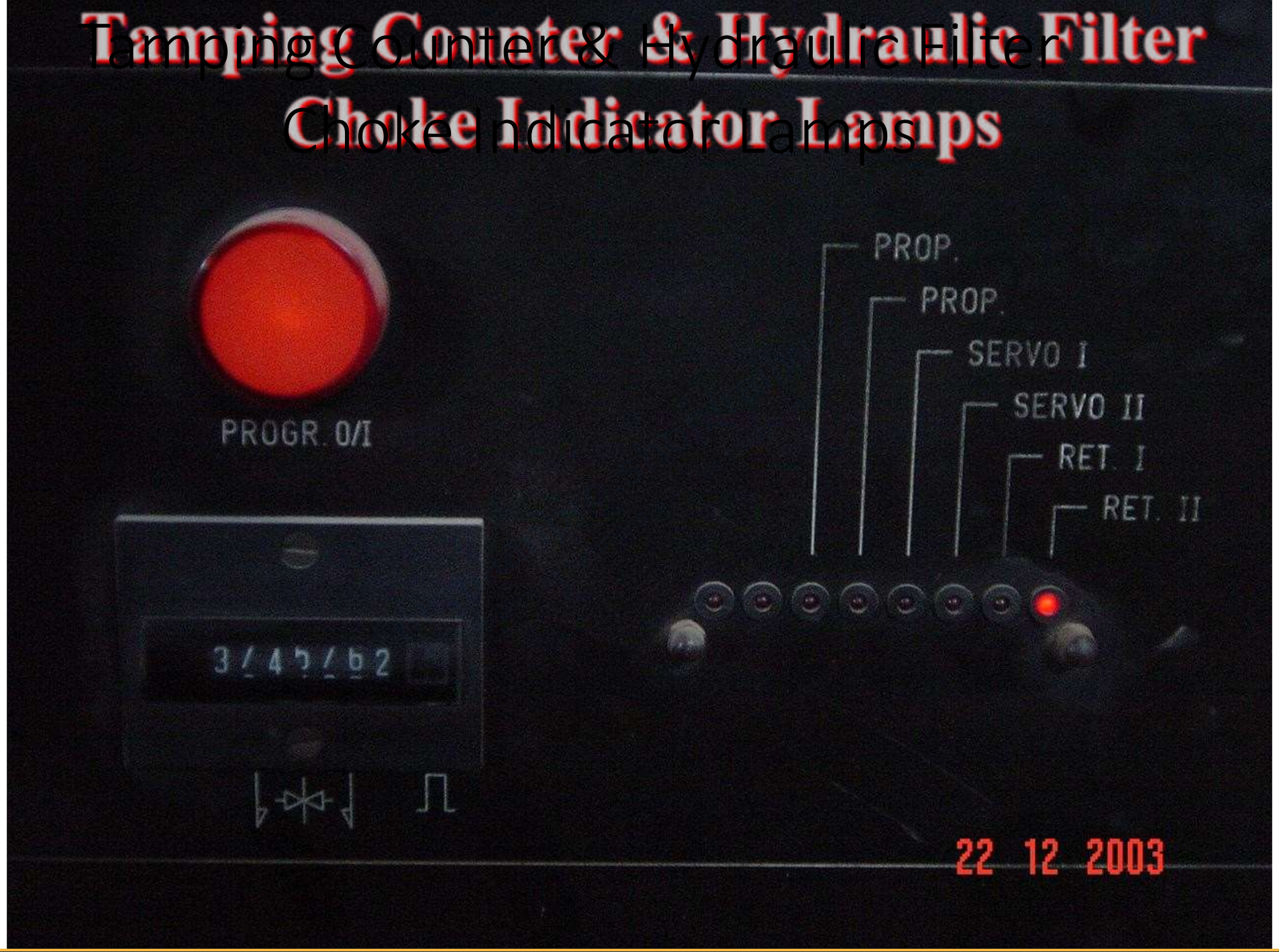
Tamping Pedals and Auto Positioning



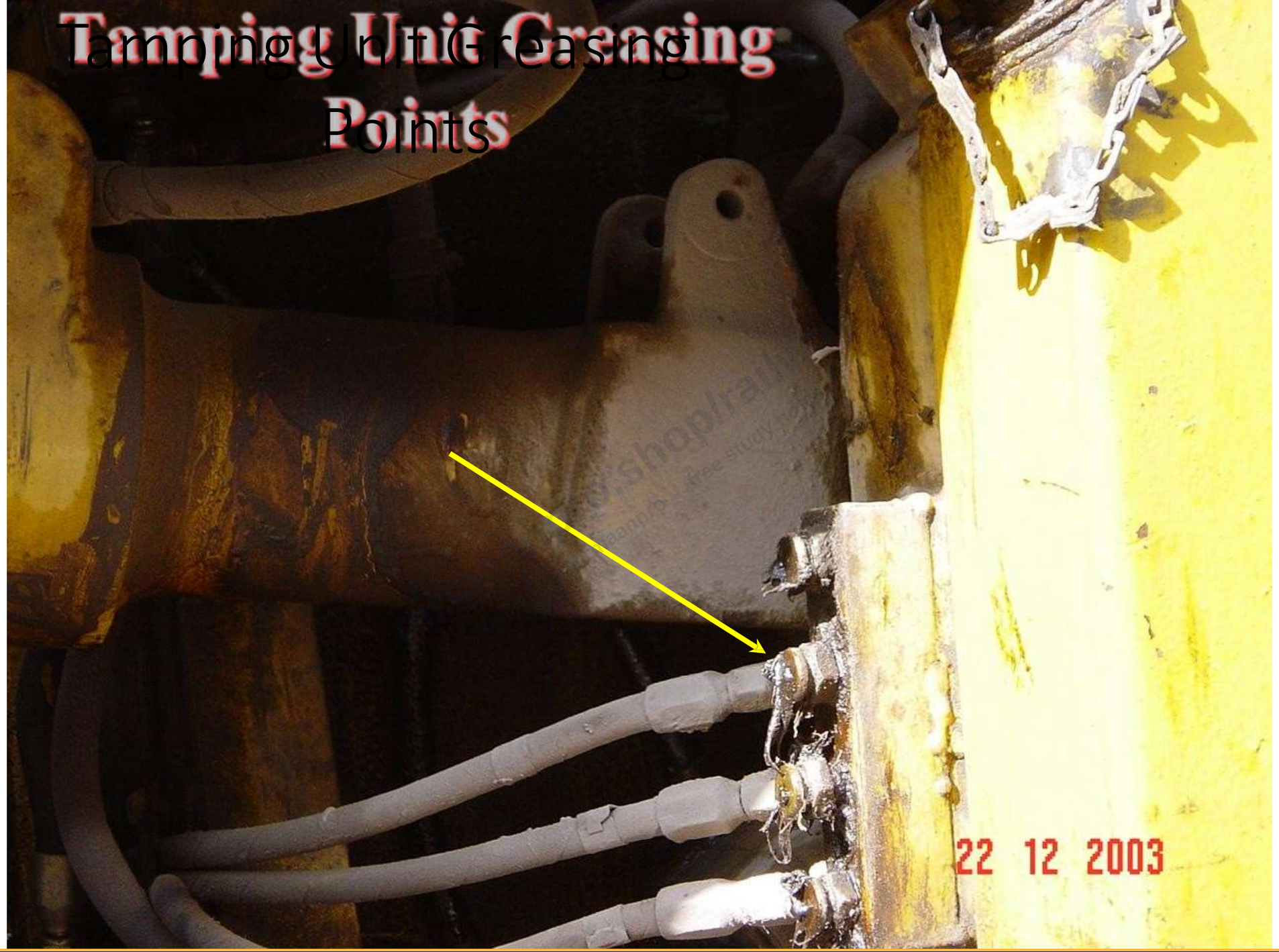
Worn Out and Reconditioned Tamping Tools



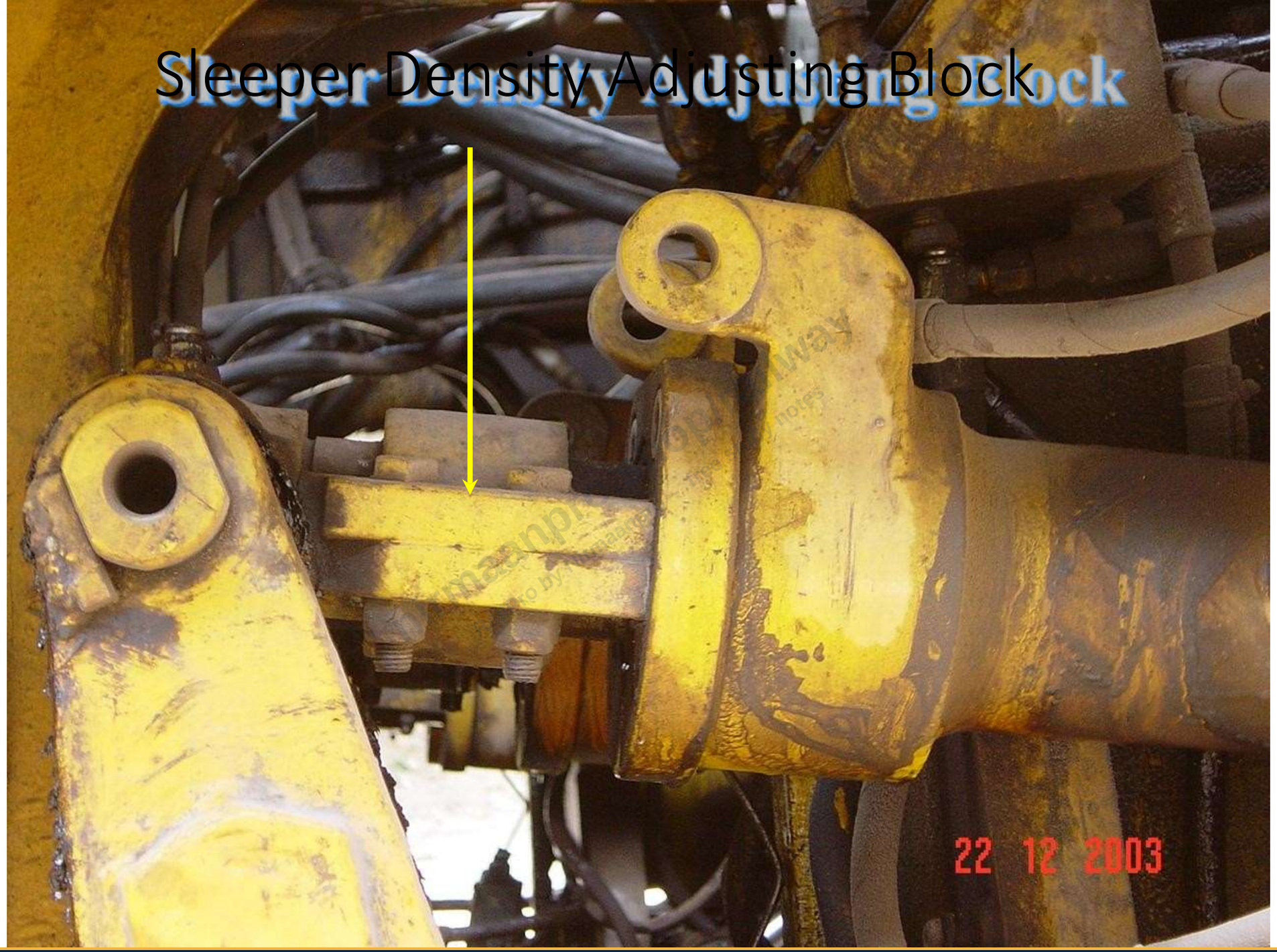
Tamping Counter & Hydraulic Filter Choke Indicator Lamps



Tamping Unit Greasing Points



Sleeper Density Adjusting Block





Machine Full View (Working Mode)

Lifting of the Track

Important Points to be noted

1. **The Track can not be Lowered with Tamping Machines !**
2. **The Tamping Machines are equipped with a proportional leveling System for measuring and correcting the Track Geometry !!**

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Turnout Renewal Machine T-28



Turnout Renewal Machine T-28



Turnout Renewal Machine T-28

- Imported from **M/s Ameca of Italy** for laying Turnouts on PSC Sleepers.
- These can lift and handle **turnouts** as well as **plain tracks**.
- These are equipped with **crawlers** and **rail wheels**.
- It permits **adjustments** of **span and height**
- **No power block** required for working

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Turnout Renewal Machine T-28

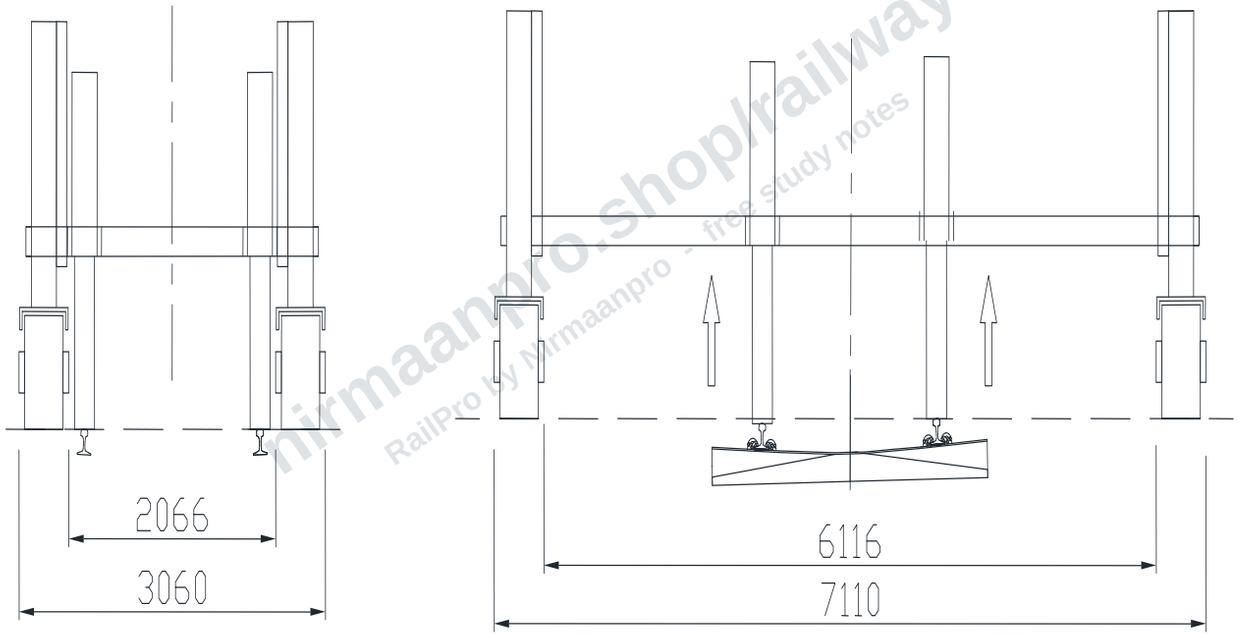
- Each set consist of
  - 2- self propelled portal cranes
  - 2- motorized rail trolley units & 2- non motorized rail trolley, and
  - 1-Jib crane

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Turnout Renewal Machine T-28

Portal Cranes	
Parameter	**Value**
Load capacity (max.)	30 tonnes
Speed with full load (max.)	0.8 km/h
Speed with no load	10 km/h
Max. lift with full load	2300 mm
Height in closed position	3065 mm
Height in lifted position	4744 mm
Crawler width	360 mm
Crawler lateral clearance	2066 mm (min.) 6116mm (max.)
Moving width	3060mm (min.) 7110mm (max.)
Max. axle load	6.0 tonnes
Total weight	24.0 tonnes

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Turnout Renewal Machine T-28

- The trolleys are used to transport the t/out assembly on track.
- The motorized trolleys have the facility to move laterally by 300 mm on either side and lift vertically by 300 mm.
- One trolley is placed below each of the crossing portion and switch portion and used for shifting the turnout laterally or vertically for clearing any obstructions e.g. signal post, OHE mast, platform etc. during transportation.

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Trolley for transportation of T/out

Trolleys for Transportation of Panel

Motorised Trolley	
Parameter	**Value**
Height	510 mm
Lateral Shift	+(-) 300 mm
Upper table rotation	+ 10°
Vertical lift	+ 300 mm
Capacity	25 tonnes

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T-28 Machine - Portal Crane

Features

- Complete **turnout** assembly is laid at a time as **one unit**
- Capable of shifting turnouts **downwards**, **leftwards**, **rightwards**, **front and back**
- Maximum lateral shifting of switch side machine is **1.5 m** per shift, and on crossing side is **0.75 m per shift**.
- Each lateral shifting takes about **3 minutes (rotation ± 5°)**
- Each machine is provided with **2 aligning chains** for aligning of turn out after laying
- Equipped with **lighting arrangements** for night working
- With motorized **trolley** assembled turn out can be **transported to long distances** in major yards

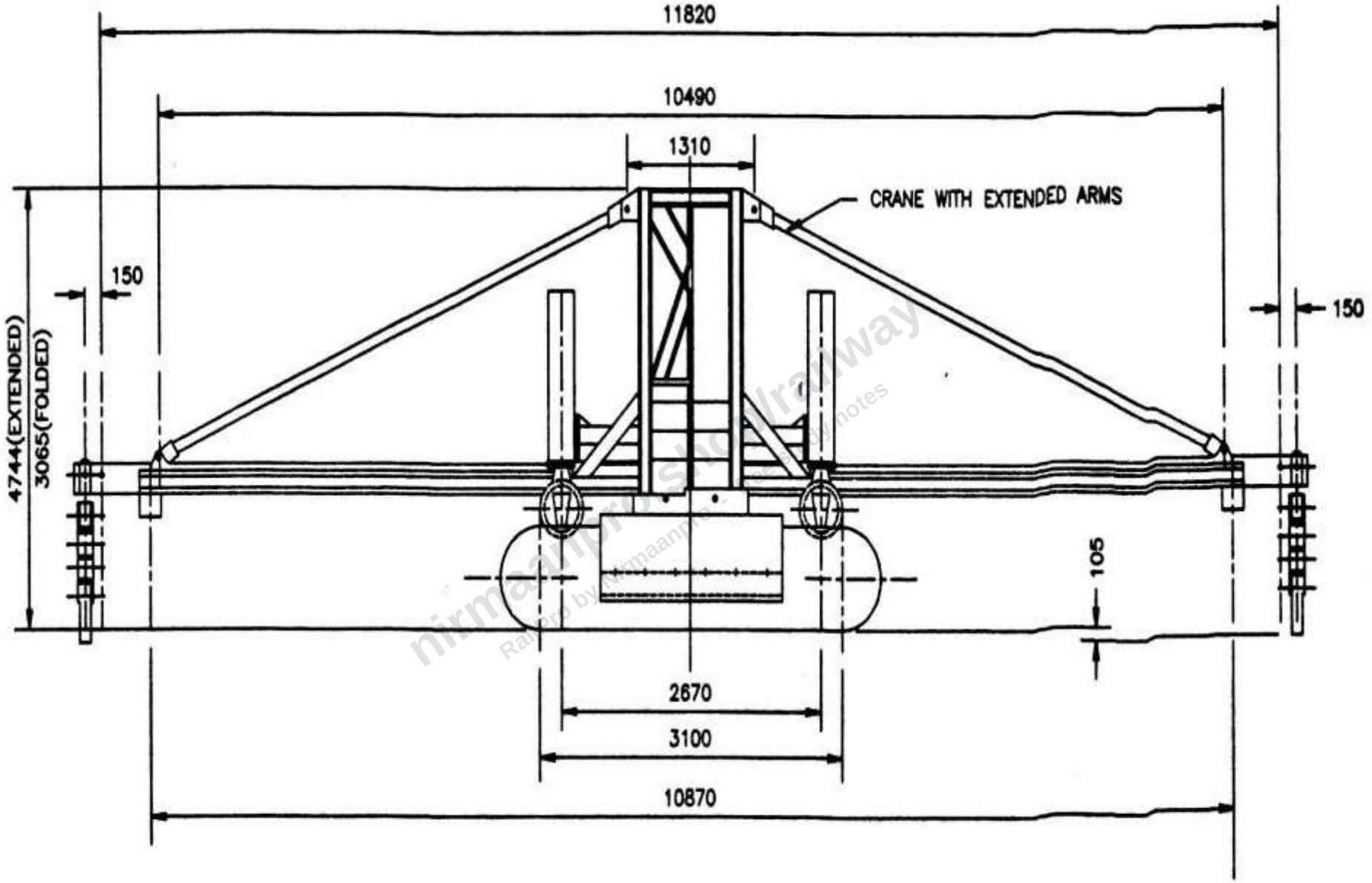
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T-28 Machine - Portal Crane

Limitations

- **Cannot** travel on **rail wheels** with **load**
- Can travel on **crawlers only** with **load**
- **Clamping** of turn out is to be done **manually**
- **Non-synchronization** (both portal work independently) – only connection through turnout
- For **two turn outs facing each other**, clamping unit has to be interchanged/machine has to be turned by 180°
- **Small wheel dia** – avoid fixed diamond crossings

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P & C CHANGING MACHINE

AMECA T-28

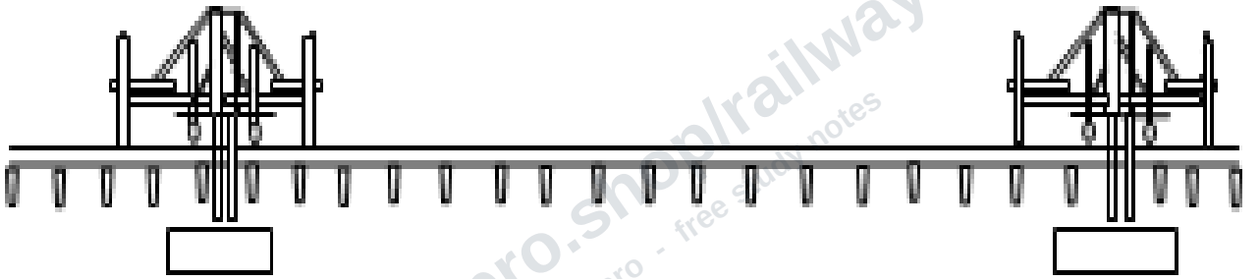
Laying Mechanism

- Two Methods of Laying
  - **Longitudinal/Forward Launching**
    - Always when assembly is transported to site on trolleys
  - **Transverse/Side Launching**
    - When assembly is by the side of site of laying.

Normally it is a combination of longitudinal and lateral shifting whenever launching is done without trolleys

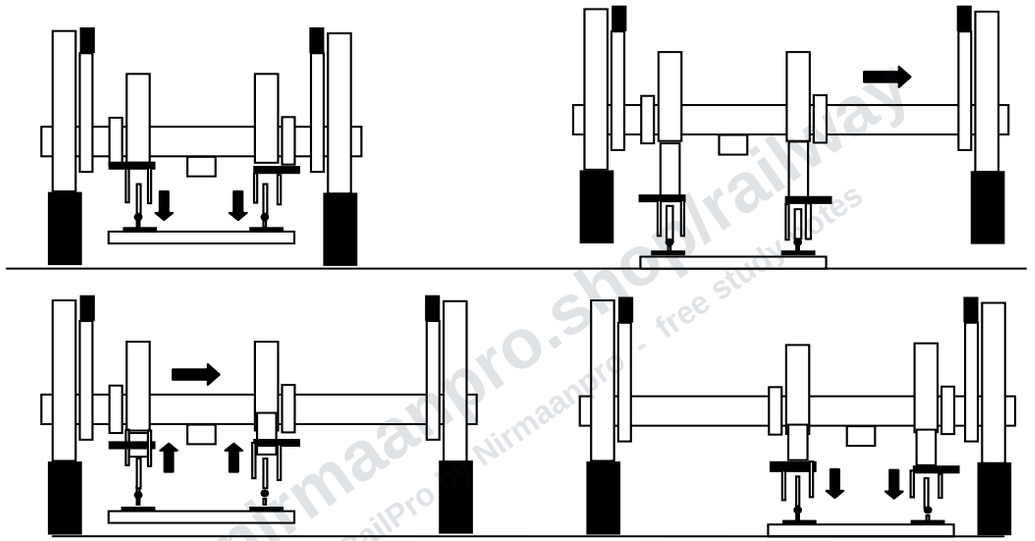
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Longitudinal/Forward Launching

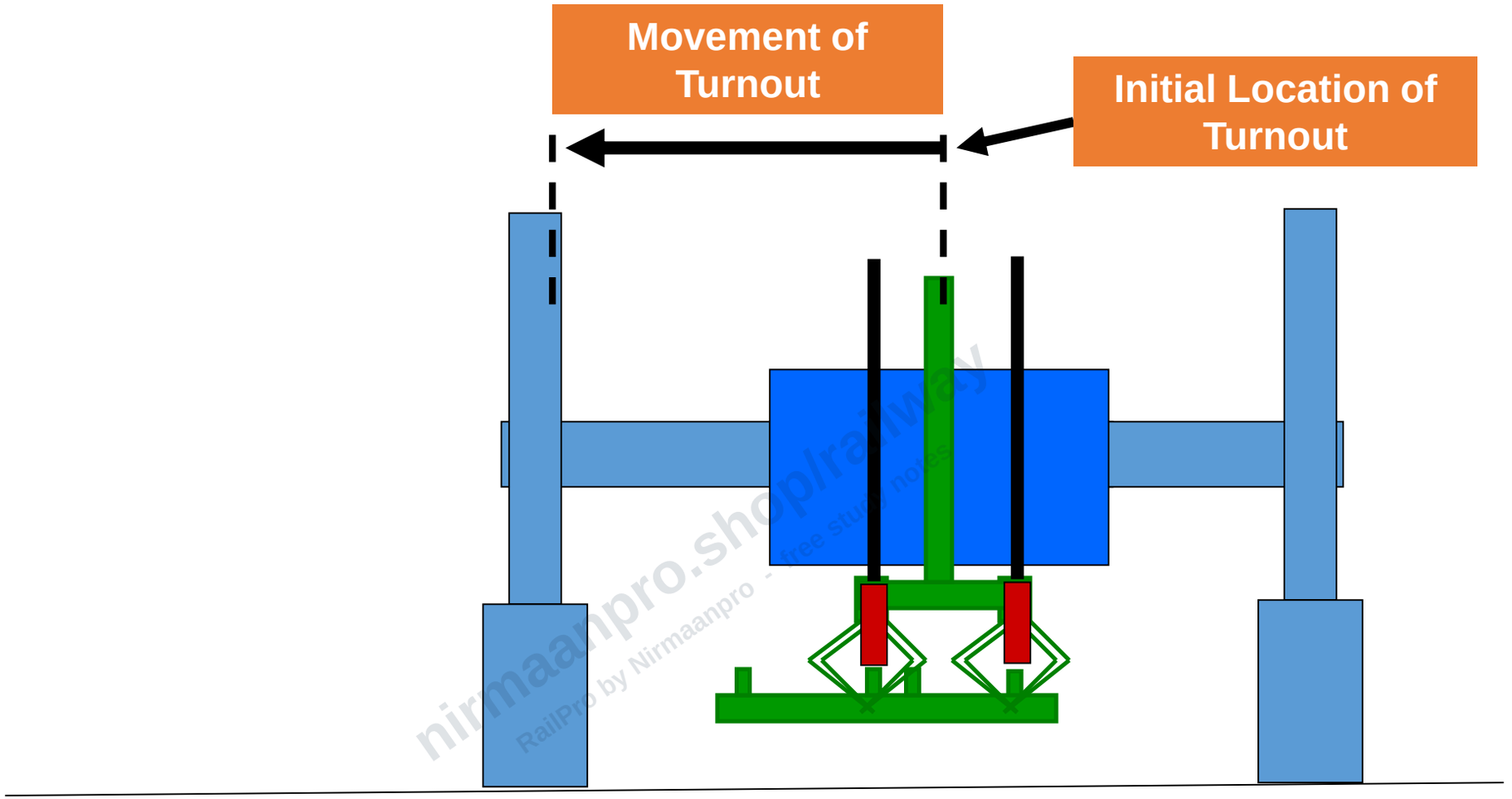


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Transverse/Side Launching



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Lateral Movement Of Turnout By T-28

Pre-Arrangement and Transportation of Materials

- **Survey**
  - **SRJ** position is checked. Rail requirement may change.
  - Sufficient length on either side of Turnout is surveyed and **plotted** for both Main Line and Turnout .
- **Arrangement of Materials**
  - Foot by foot survey of yard by AEN, ASTE, PWI & SI
  - Prepare **Checklist** of materials required for each turnout
  - All **materials** should be **made available** well in advance
- **Transportation of Materials**
  - Heavy material such as PSC sleeper, switches, single rail, glued joints etc. should be transported to site.

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Survey and selection of Turnout assembly site

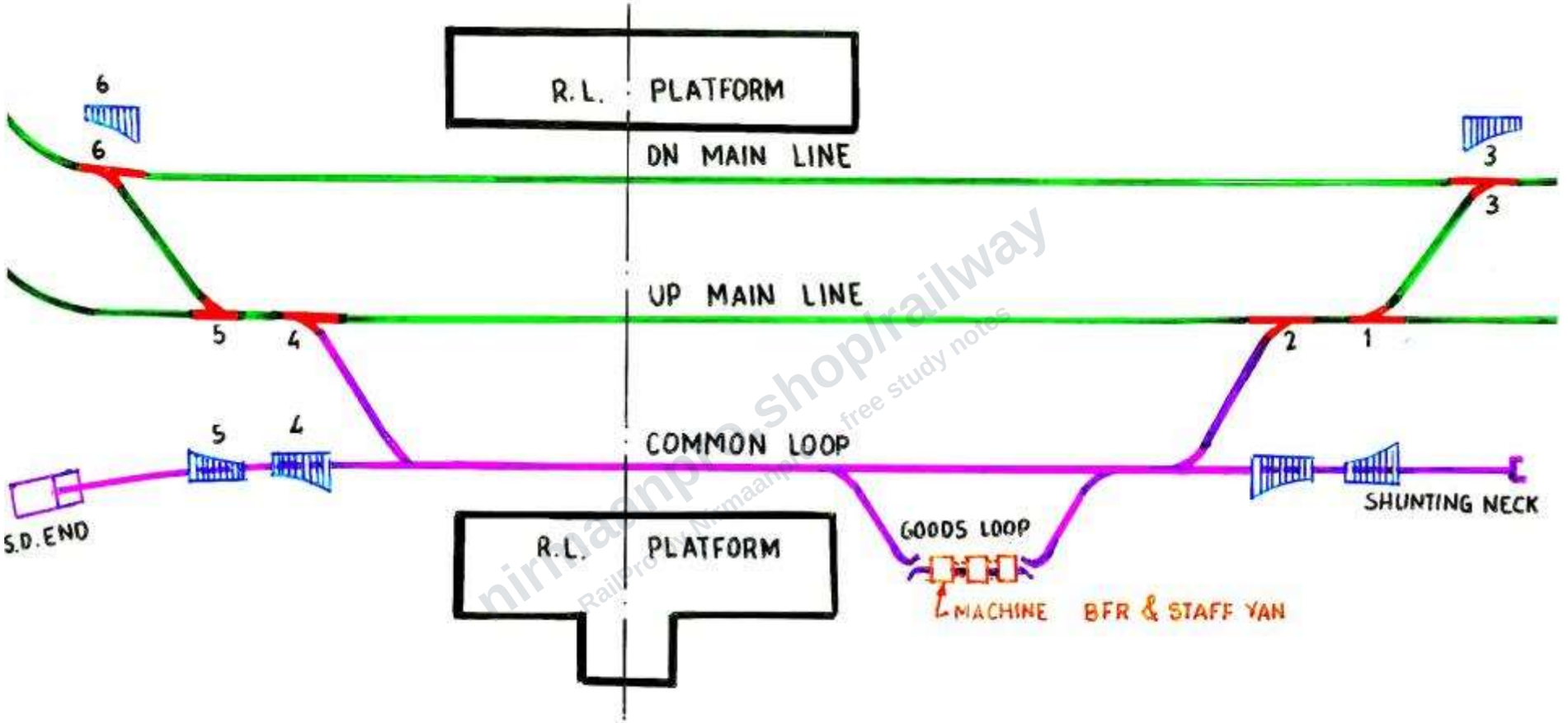
- **Factor governing selection for site for assembly**

(Most important factor in deciding the requirement of traffic block)

- Assembly site should be **near** to the **existing turn out**
- Level and consolidated ground
- Earth work, if required, should be done in advance
- Site should be free from signaling rodding and equipment as far as possible
- Path for movement or shifting should be obstruction free or negotiable.

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THREE LINE STATION
ON GROUP 'A' ELECTRIFIED ROUTE

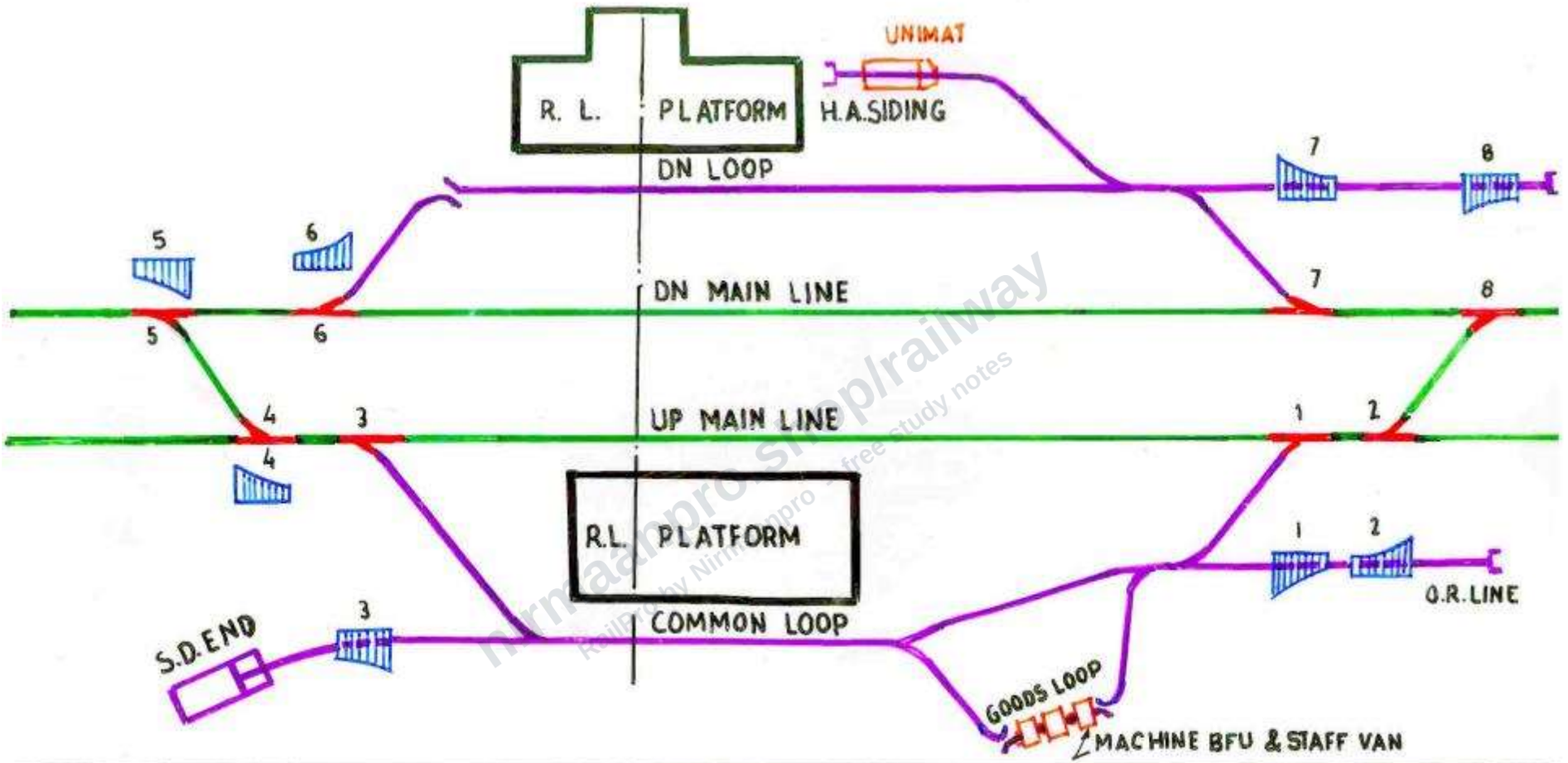


BLOCK HOURS

DAY - 1	DAY - 2
2 HRS, POINTS 1&2 :: :: UP: X DN: ✓	2 HRS, POINTS 4 & 5 :: :: UP: X DN: ✓
1½ HRS, POINT 3 :: :: UP: ✓ DN: X	1½ HRS, POINT 6 :: :: UP: ✓ DN: X

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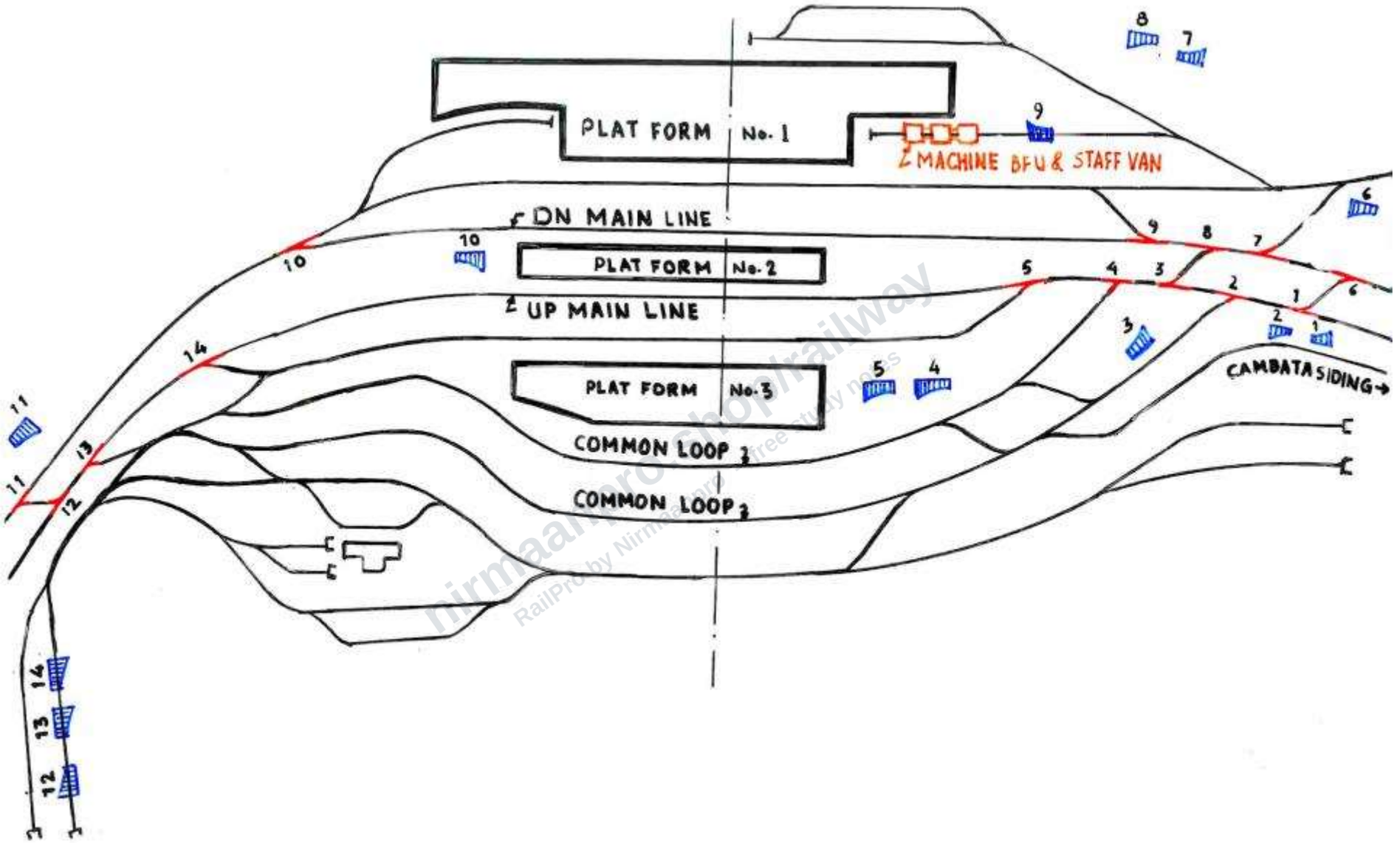
FOUR LINE STATION
ON GROUP 'A' ELECTRIFIED ROUTE



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BLOCK HOURS

DAY - 1	DAY - 2	DAY - 3
2 HRS, POINTS 1&2 : : UP: X DN: ✓	2 HRS, POINTS 3 &4 : : UP: X DN: ✓	2 1/2 HRS, POINTS 6&7 : : UP: ✓ DN: ✓
1 1/2 HRS, POINT 8 : : UP: ✓ DN: X	1 1/2 HRS, POINT 5 : : UP: ✓ DN: X	



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Pre-block preparations

- **Deep screening** to be done well **in advance**, including approach track. Level shoulder ballast and build up cess for ease in crawler movement
- **Sufficient ballast cushion** to be maintained.
- **Approach Special sleeper** should be inserted.
- 60 kg **new rails** should be kept ready on both ends **for replacing mismatch** rails, if any.
- In case **SRJ shifting, new foundation for signaling gear** should be made well in advance if required.
- **Lubricate nut and bolts** for easy removal during block
- **Mark location** for crane clamp holding *(on turnout)*

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Pre-block preparations

- The turnout assembly is **fabricated** at level surface **adjacent to site of laying or** from where the turnout can be taken near the site of laying on the **trolleys**.
- **Path** of crawlers is decided and any **signal rod etc.** are taken care off by using **wooden blocks**.
- **60 wooden blocks**, each approx. **60 cm long** should be kept ready for facilitating passage of crawler on the obstacles.
- **8 nos. of rail pieces** , each **70cm long** (welded block at extremes) should be kept ready for housing below the rail wheels of the crane.
- **Adequate Protection** of the line and adjacent lines while the machine is working.

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Pre-block preparations

- T-28 machine should be **shifted over to turn out** a day in **advance** and **clamped, wherever possible**, and all obstructions in the movement be removed.
- Maximum possible **ballast should be removed** out of turn out. Remove ballast from Crib/Shoulders **up-to sleeper bottom**
- **Point machine** should be **disengaged** & turnout should be **non-interlocked** before taking up its replacement.
- **Jumpering** of both ends of the turnout should be done by electrical staff before lifting and removing of existing turnout.

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Pre-block preparations

- About one hour before the block, **one line of the turn** out should be **dismantled** by **clamping the turn out** to the running line.
- **Signalling equipment** i.e., facing point lock and electrical point detector should be **removed**.
- Availability of **Two sets** of **gas cutting** equipment should be ensured.
- Ensure **Prompt communication** facility.
- **New turn out** should be **clamped to main line** before being lifted by machine.

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Man-Power Requirement

Sl. No.	Day	Labour Required
	for Laying one turn out in a day	
1	Pre block day	25
2	Block day	110
3	Next day	25
	For laying 3 turnout in a day	
1	Pre block day	50
2	Block day	175
3	Next day	50

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Block Working (Dismantling By M/c)

- Immediately after getting traffic block, the fish bolts of existing turnouts should be opened.
- Both cranes should be traversed and brought in position for handling the existing turnout at the demarcated position.
- Old turnout should be lifted by cranes and traversed to suitable location for further dismantling after the block.
- The cranes should be traversed to the pre-assembled concrete sleeper turnout and both the cranes should be taken to demarcated position on turnout.

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Block Working (Dismantling Manually)

- During traffic block the existing t/o is **dismantled manually** and **ballast bed is leveled**
- The gangs should **scarify the ballast** from the location from where the turnout has been removed. The **ballast bed is lowered** to accommodate extra height in case of concrete sleepers.
- The **turnout assembly is lifted by portal cranes** which **moves ahead** slowly in a **synchronized** manner and brought in position. The assembly is then **lowered and placed in position**.
- The **other line traffic block** for **15-20 minutes** due to infringement of Xing side Crawler

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Precautions

- **8 pieces of cut rail of 60R/75R/90R rail section** and about 0.70 to 1.25M in length is required for lowering of rail wheel.
- **200 Nos. wooden gutkas** of about 70 cm length made out of unserviceable wooden sleepers should be kept ready for crawlers movement.
- Wooden blocks should be well spread on uneven surface for ease movement of crawler and to avoid swinging of portal crane.
- The turnout should be centrally located on trolley. The loaded trolleys should not be pushed manually on down gradient.

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Block Working (Labour requirement)

Sl. No.	Activities	Labour Required
1	Dismantling of rails	20
2	Removing of old sleepers	20
3	Leveling of ballast	20
4	Renewal of mismatch rail on crossing side	15
5	Renewal of mismatch rail on SRJ side	15
6	Assisting Machine	8
7	Miscellanious	12

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Note: Above simultaneous operations takes about 45 min for a turnout

Block Working

- After completion of the above operations another **15 minutes** time is required for the following works.
  - **Fixing of fish plates** on SRJ and crossing sides.
  - **Alignment** by T-28/UNIMAT machine.
  - **Removal of T-28 machine** from running track.
- During Block Tamping:
  - UNIMAT should work during block immediately after laying of turn out, for correcting alignment and levels.

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Post-block works

- **Ballast** to be put back and deficiency, if any, to be recouped & **cess** to be repaired.
- **Ballast boxing/profiling** to be done.
- **Welding of SRJ** and other joints .
- **Proper interlocking & earthing** to be done.
- Post Block tamping by UNIMAT:
  - **3 rounds** of tamping be done after ballasting of turn out before normalizing the speed.
  - After about **three months one more round of packing** to be done for stabilizing of turn out.

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Thanks

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2.15.3	Equipment at LC	1
2.15.4	Features of track at and on approaches of level crossings, overhauling of LC, Maintenance of road surface and approach track, Check rails-types, Visibility at LC.	1
2.15.5	Checking of equipment and knowledge of rules of gatemen, competency, medical, Refresher Statutory provisions of Railway Act on LC. GWR Protection diagram, Slide boom operation. Height gauge.	1
2.15.6	Tutorial on Census at L- xing.	1
2.15.7	Inspection of L-xing, Duties of gatekeeper in case of fire, Hot axle, train parting, hanging part, flat tyre.	1
2.15.8	Speed breakers, Road sign Boards, Provision of new LC, Manning, De- manning, interlocking and replacement with ROB, closure, shifting and replacement with limited height subways/ RUBs , Elimination of LC.	1
2.15.9	Field visit to nearest LC gate and Calculation of census.	1
2.15.10	Technical Film/Video clip/Photographs pertaining to LC gate, safe operation & precautions.	1

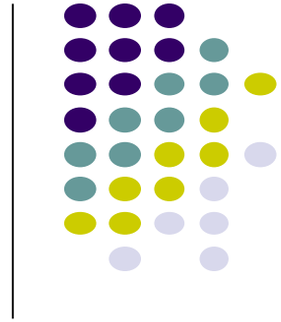
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2.15.1_Level crossings: Classification, types
Periods 1



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Level Crossings



- Definition:-
- Intersection of road with railway track at same level is called LEVEL CROSSING

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Rail Road Crossings

Surface Crossings –

- Road-Road- Road crossing
- Rail-Rail – Rail crossing/Turnout
- Rail-Road – Level Crossing

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Rail Road Crossings

Crossing at Grade-

- Rail-Rail Crossing – Rail Flyover
- Road-road crossing – Road Flyover
- Rail over Road – Road under Bridge/ Limited Height Subway
- Road over Rail – ROB (Road over Bridge)

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Location of LC

- As far as possible, new Level Crossings may not be located in busy station yards where heavy detention to the road traffic and other operational problems are likely to be encountered.

If provision of Level Crossing is inescapable, it may be located outside the outermost facing points.

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Location of LC

- For Level Crossings already located within busy station yards affecting Railway operations and causing heavy detention to the road traffic, efforts should be made to replace them by **ROB/RUB** as per extant rules or shift them outside the outer most facing points, especially during planning of gauge conversions, yard re- modeling and doublings and its operation from the cabin should be possible.

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Provision of New LC

- ON NH, SH & their bypasses and important city roads only grade separators are to be provided. Relaxation of this clause will require Board's prior approval.
- In case of other important roads, it is preferable to provide grade separators. However, depending upon the traffic density, manned LC can also be considered.
- If provision of new LC is inescapable, only manned LC will be provided. (not applicable in private siding)

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Classification of LC

Class	Criteria
Special Class	**TVU > 50,000**.
'A' Class	**TVU 50,000 - 30,000** Or Line Capacity utilization 80 percent (On single line) and Number of Road Vehicles greater than 1000
'B' Class **'B1' Class** **'B2' Class**	TVU **30,000 -20,000** and No. of Road Vehicles >750. **TVU 30,000-25,000.** **TVU between 25,000 - 20,000**.
'C' Class	All other Level Crossings for Roads not covered in above classes.

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Line Capacity of a Section

Line capacity :

Number of Trains that can be run on the section in 24 hrs.

$$= \frac{24 \times 60 \times 80}{L + 5 \quad 100}$$

- Where L = Maximum time taken in minutes by longest goods train to clear longest block section.
- 5 minutes added for block instrument, which will not be added in case of automatic block section.

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Classification of LC

- Level crossings over colliery, factory and other similar sidings where Railway traffic is light may however be dealt with according to local conditions, subject to the approval of the Commissioner of Railway Safety consent being obtained in each case to the measures adopted for the safe working of trains over the crossing.

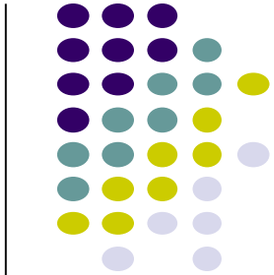
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Classification of Road

Class	Criteria
Class I road	National Highways, State Highways, Important roads within Municipal towns, Roads in/around towns with heavy traffic
Class II road	Major District Road, Other District Road, Unimportant roads within municipal towns, Roads within non-municipal towns, Other surfaced roads
Class III road	Earth roads, Cart tracks

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TYPES OF LC



- On the basis of crossing angles :-
  - Right angle level crossing
  - Skew level crossing
- On the basis of departments:-
  - Engineering level crossing
  - Traffic level crossing
- On the basis of gatemen:-
  - Manned level crossing
  - Unmanned level crossing

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TYPES OF LC

- On the basis of locking arrangements:-
  - Interlocked level crossing
  - Non interlocked level crossing

- On the basis of operation:-
  - Open to road traffic level crossing
  - Close to road traffic level crossing

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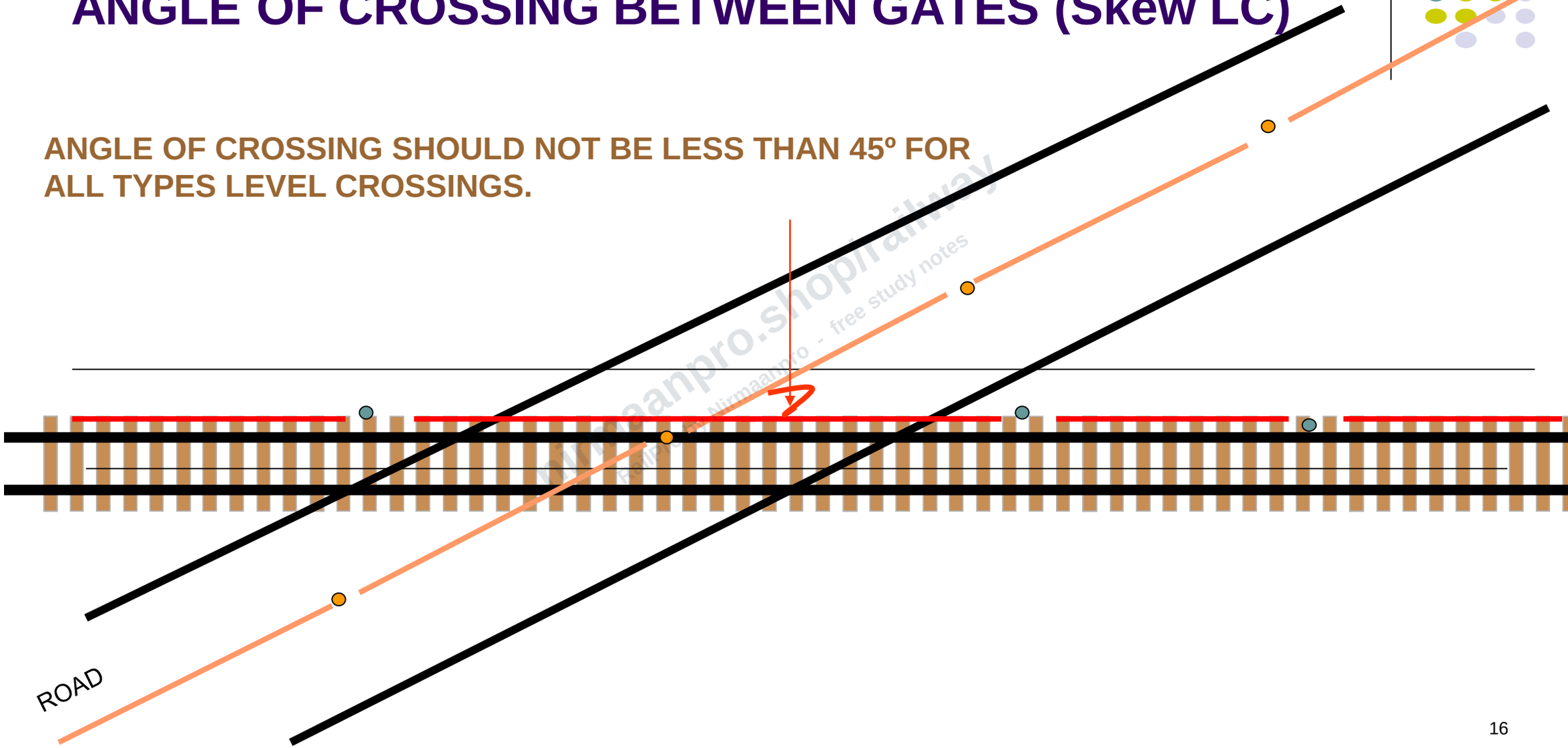
Skew Level Crossings

- All roads should preferably cross the Rly line at right angles.
- Angle of crossing should not be less than 45^0
- Gate post of LC shall be fixed square to the road.

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ANGLE OF CROSSING BETWEEN GATES (Skew LC)

ANGLE OF CROSSING SHOULD NOT BE LESS THAN 45º FOR ALL TYPES LEVEL CROSSINGS.



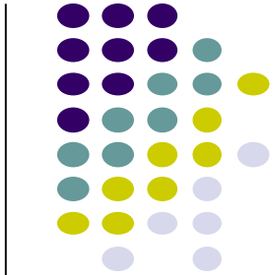
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Traffic LC Gates

- Manning and operation of LC gates between the outermost stop signal shall be under the control of Operating department. Civil Infrastructure (Road, Gate Lodge, water, toilet & drinking water facility etc) pertaining to these LC gates shall be maintained by the engineering department.

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Traffic LC Gates



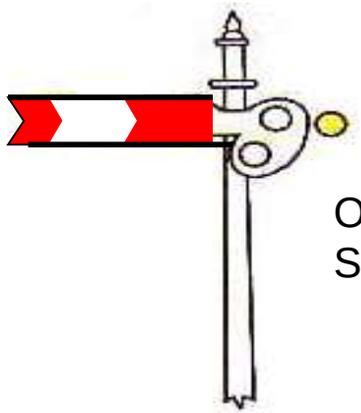
- Competency certificate to GK will be issued by TI & SSE/Sig(for interlocked gate) and countersigned by AOM.
- Validity of comp certificate-3years
- Medical category of GK- A2

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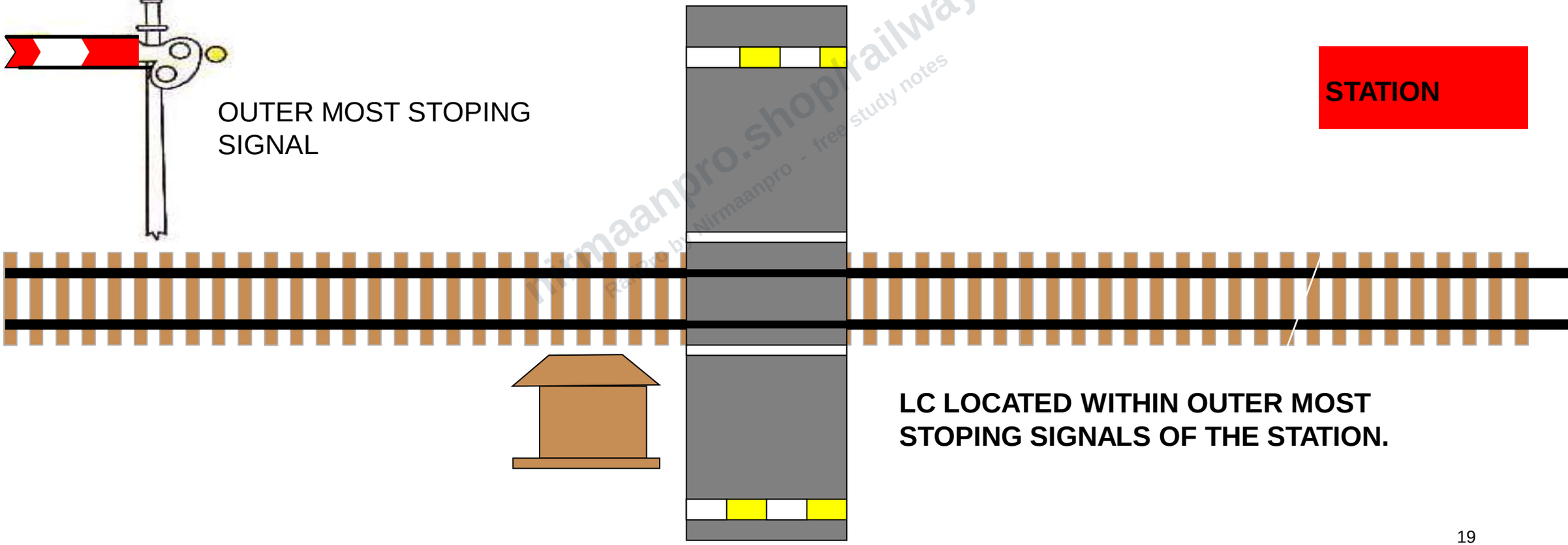
CLSSIFICATION OF LEVEL CROSSING

ON THE BASIS OF THEIR SITUATION --

TRAFFIC GATES ----



OUTER MOST STOPING SIGNAL



STATION

LC LOCATED WITHIN OUTER MOST STOPING SIGNALS OF THE STATION.

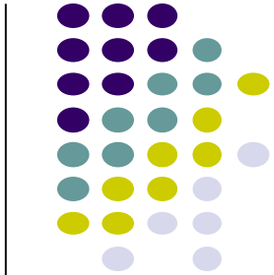
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Engineering LC Gates

- Operation and maintenance of LC beyond the outermost signals shall be under the control of Engg deptt
- Competency certificate to GK will be issued by SSE/P.Way/Divisional Training Centre & SSE/Sig(for interlocked gate) and countersigned by ADEN.
- Validity of comp certificate-5 years
- Medical category of GK- A3

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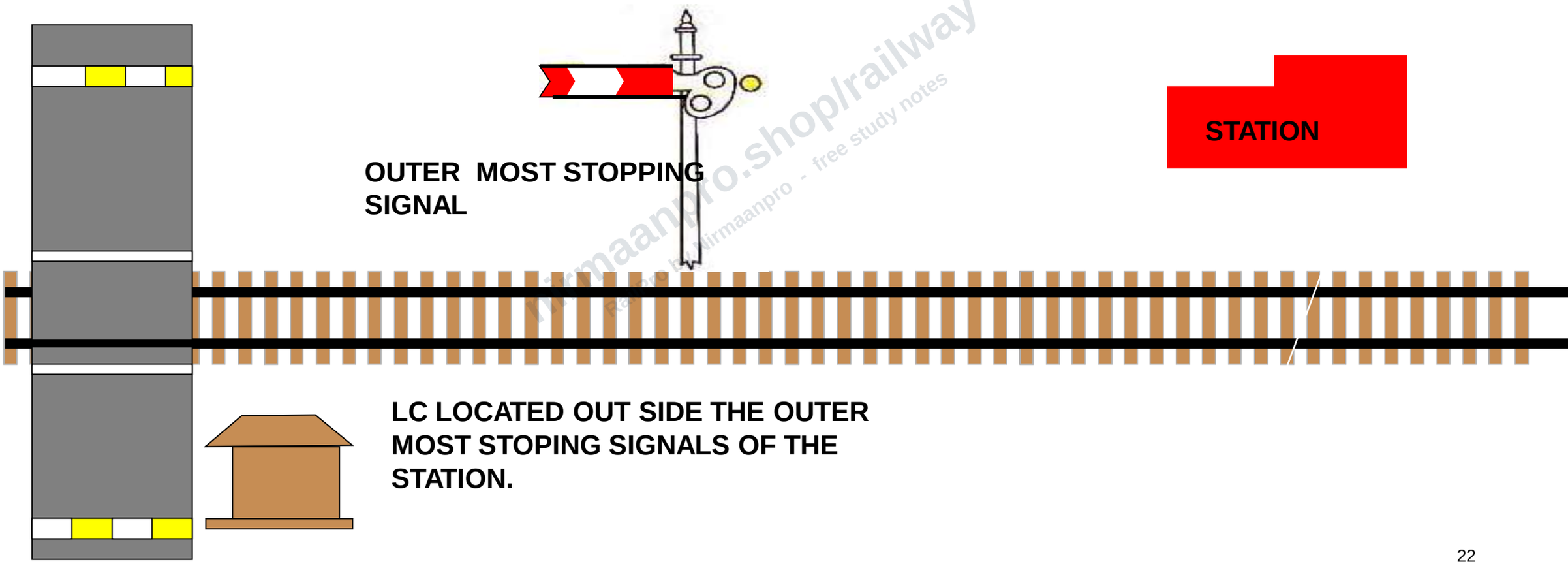
- If gate is protected by signals, fixed signals shall be provided. (GR 3.34 New Rules)
- Maintenance of signals,interlocking,lifting barriers at interlocked gate & communication will rest with S & T deptt in the case of all LC

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CLSSIFICATION OF LEVEL CROSSING

ON THE BASIS OF THEIR SITUATION --

ENGINEERING GATES --



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Level Crossings

2.15.2_Normal Position of Gates, Locking arrangement.

Periods 1



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Normal position of gates

General–

Subject to such Special Instructions in that behalf as are permitted by **GR 16.03**, all gates at level crossings shall be kept constantly closed and securely fastened across the through fare on both sides of the railway and shall only be opened when it is necessary and safe to open them for the passage of road traffic.

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Normal position of gates

Any Railway Administration may from time to time issue special instructions for any particular level crossing or class of level crossing and may by such special instructions permit the gates at any level crossing or class of level crossings to be normally kept open to road traffic and may therein prescribe the conditions under which gates are to be kept closed against road traffic for the passage of a train or trains or for the purposes of any other railway operation.

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Normal position of gates

- Gateman shall at all level crossings be prepared, wherever level crossings be open to road traffic, to show a danger signal to any approaching train and for this purpose invariably keep a hand signal lit during night to show Red throughout the period the level crossing is open to Road traffic.
- Fixed station signals not being regarded as affording any protection unless the gates are interlocked with signals.

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Interlocked level crossings:

- All interlocked level crossings shall be kept ***'Normally Open to Road Traffic'*** and may only be closed against the road traffic for the passage of trains or for any other Railway operation by taking off the signals.

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Non-Interlocked Level crossings:

- The gates must normally be kept closed and securely fastened against road traffic and may only be opened for the passage of road traffic when it is necessary and safe to do so. The Railway Administration may under special instructions permit gates of level crossings not protected by signals to be normally kept open to road traffic prescribing the conditions under which they may be kept closed against road traffic for passage of trains or any other railway operation.

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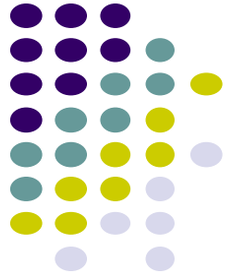
Level crossings having heavy seasonal traffic:

- In case of level crossings having heavy seasonal road traffic with normal position of gates closed to road traffic, the Railway Administration may permit gates of such level crossings, to be kept open to the road traffic during the busy season, when road traffic is heavy, by issuing special instructions and prescribing the conditions, under which they may be kept closed to road traffic for passage of trains or any other railway operation. The special instructions should be incorporated in the working rules for the gates and stations concerned.

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Changing of Normal position from “Closed to Road Traffic to “Open to Road Traffic” of a non Interlocked Gate.

(Letter No. 2006/CE-IV/LX/WP dated 02.05.2012)



- TVUs>20,000 (As an interim measure till interlocking or elimination of LC, Normal position can be changed from “Closed to Road Traffic to “Open to Road Traffic”)

OR

- If manned LC is situated on a section where average number of trains during 24 hrs period is very less (say upto 14)

Note: Decision taking authority is DRM with the approval of PCE and COM after fulfilling certain conditions

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Interlocking of LC Gates

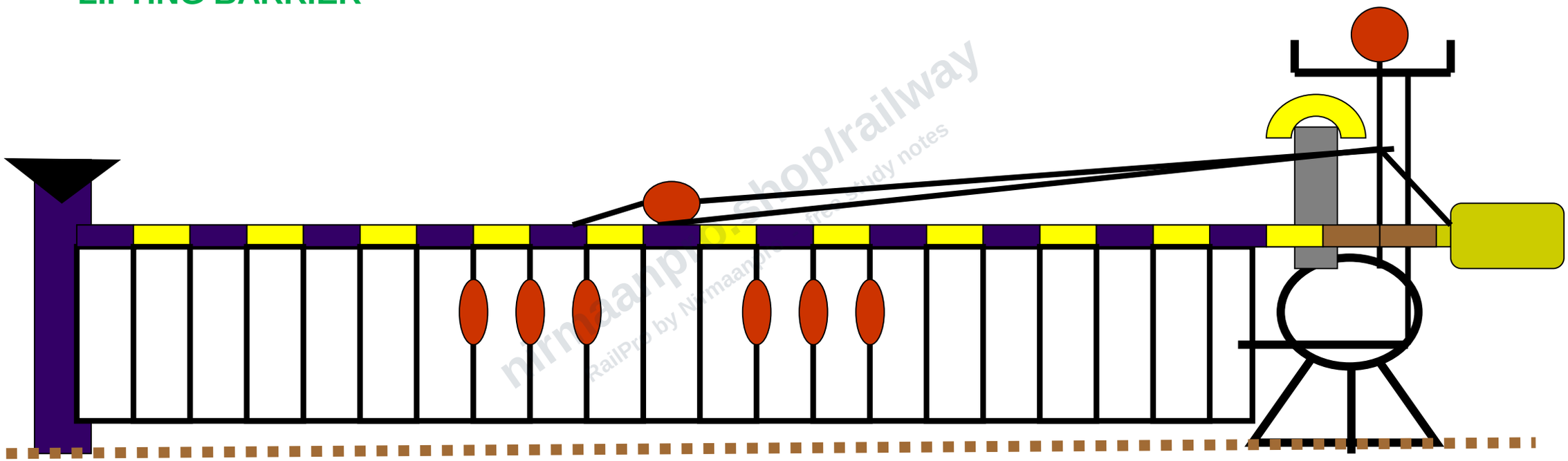


- After every round of Census, LC gates qualifying for Interlocking as per above criteria (TVU>25000), should be proposed for interlocking through preliminary works programme(PWP/LB).

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LOCKING ARRANGEMENTS AT LEVEL CROSSING

LIFTING BARRIER



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LOCKING ARRANGEMENTS AT LEVEL CROSSING

LIFTING BARRIER



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Flap gate



Flap gate

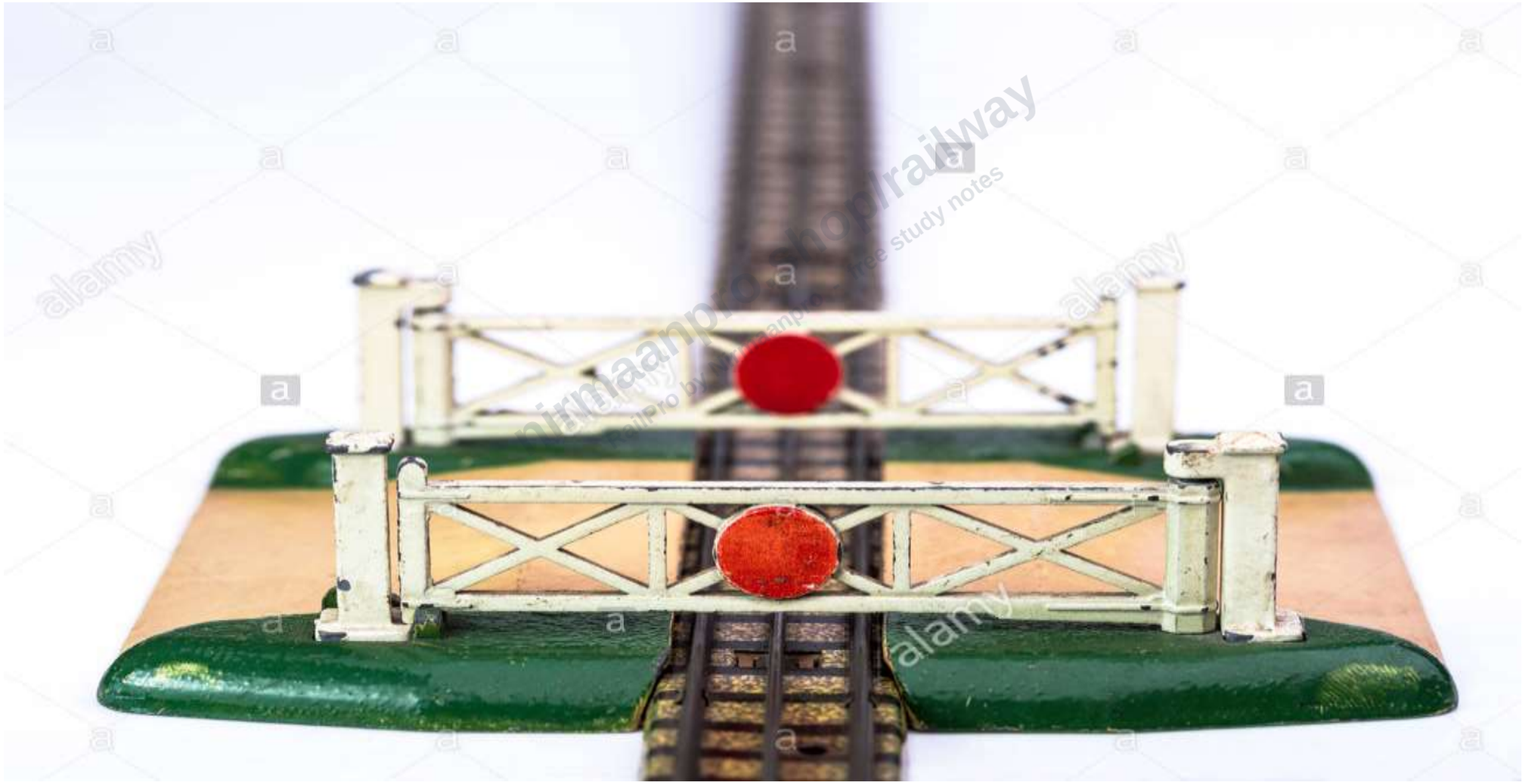


Flap gate



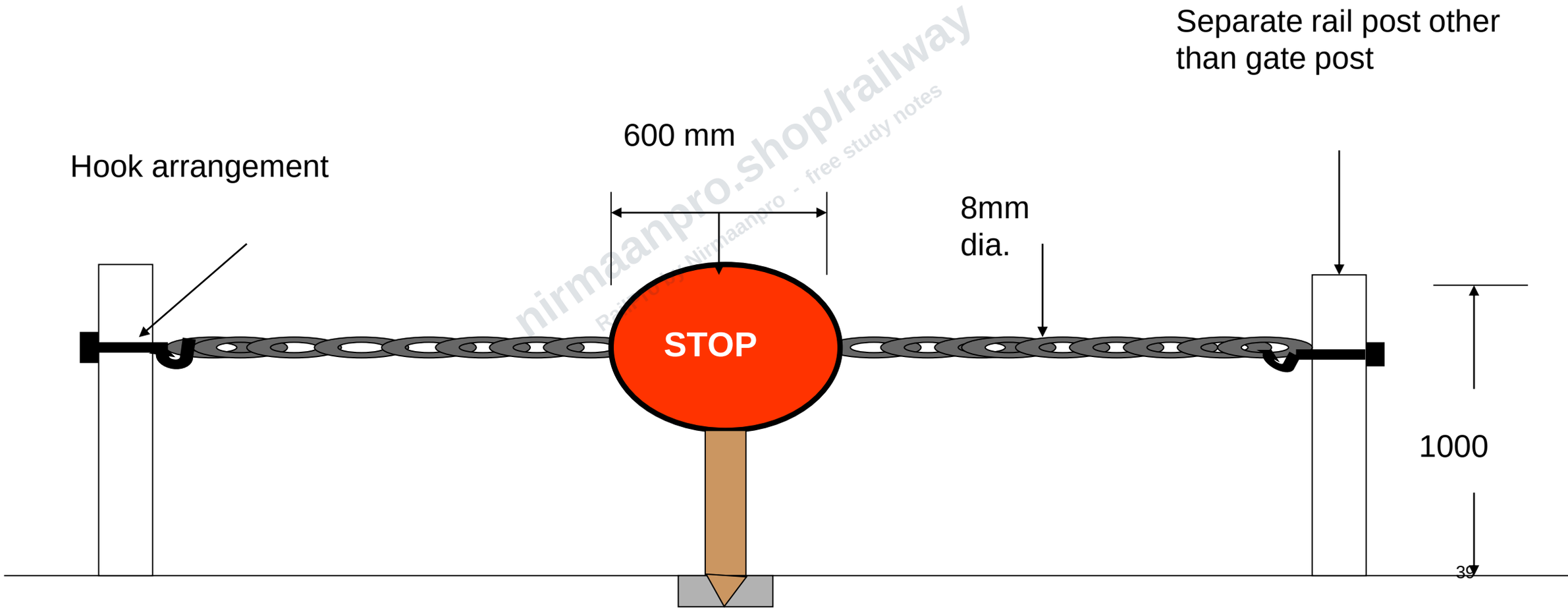
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Flap gate



LOCKING ARRANGEMENTS AT LEVEL CROSSING

Long chain



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LOCKING ARRANGEMENTS AT LEVEL CROSSING

SLIDING BOOM




THANKS

Level Crossings

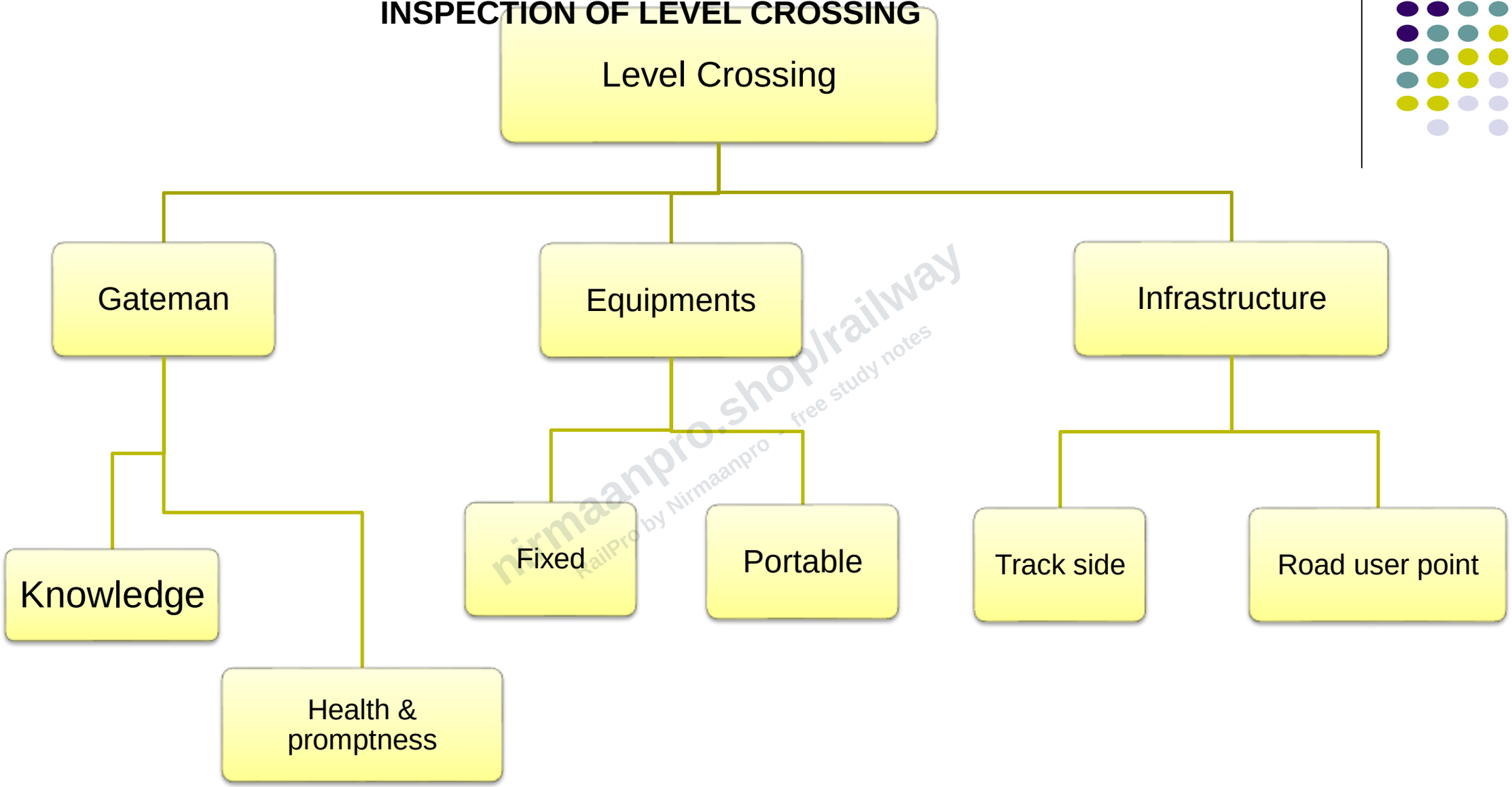
2.15.3_Equipment at LC

Periods 1



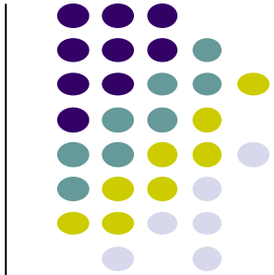
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INSPECTION OF LEVEL CROSSING



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Equipment on Level Crossing (Fixed)



- **Long chains** with stop disc at center - Check condition of chain, boards & locking system.

- **Diagram indicating** method of protection

- **Distinct indication** at 600/400 & 1200/800 m for fixing of detonators.(BG/MG)

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Equipments on Level Crossing

(Safety Equipments)

- Tri color HS lamps (Bright reflectors) - 2
- HS flags (Red) -2
- HS flag (Green) -1
- Banner flag -2 (C.S.No.135)
- Staff - 2(for fixing red lamp/flag)
- Detonators – 10 (C.S.No.135)
- Warning signals—1 for SL / 3 for DL/Ghats/ABS (C.S.No.136)
- Gate lamps – 2

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Contd. …(Other equipments)

- Powrah -1
- Tool list -1
- Pick-axe -1
- Rammer - 1
- Bucket -1
- Spare small chains and padlocks —2
  (for locking in emergency)
- Wall clock at all manned level Crossings.
- Sufficient supply of, k-oil, wicks, matches etc at gate lodges.

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Cont..

- Tin case for Flags - 1
- Canister for Muster Sheet – 1(Only for Engineering gates as per **C.S No.139**)
- Can for Oil – 1
- Tommy Bar – 1
- Water Pot or Bucket – 1
- Mortar pan – 1
- 2 long spare chains with **STOP** mark disc attachment at Centre , in case gate/barrier gets damaged.

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Contd. …(Register & Books)

- Inspection register
- Complaint book for road users
- LC working instructions (In local language)
- Safety rule book—1 (in Hindi or Regional language)
- Duty Roster
- Diagram indicating the method of protection to be adopted , in case of obstruction in the level crossing.

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Contd. …

- Height Gauges on Electrified section
  Distance -minimum 8 meters from Gate post.
  CE can permit up to 8 meters from centre of nearest track.

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Banner flag

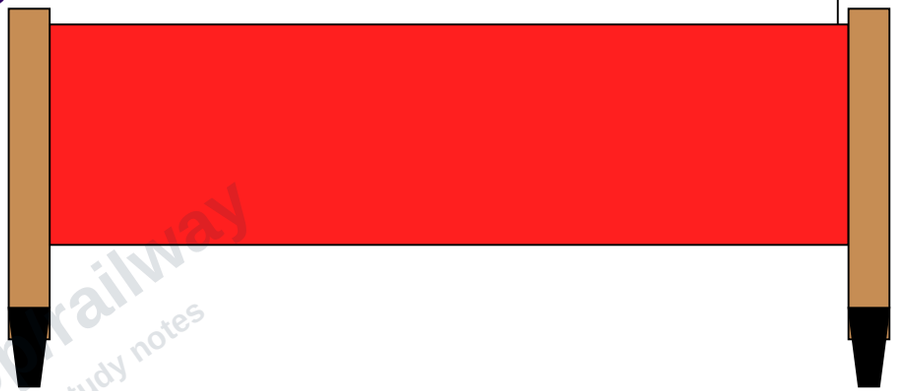


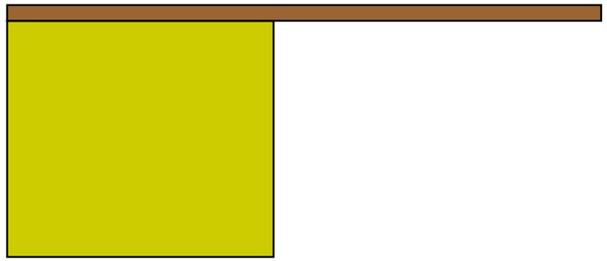
Automatic Banner flag

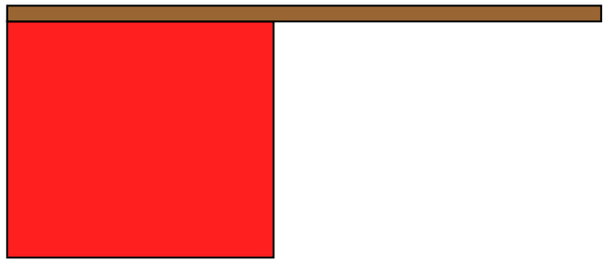


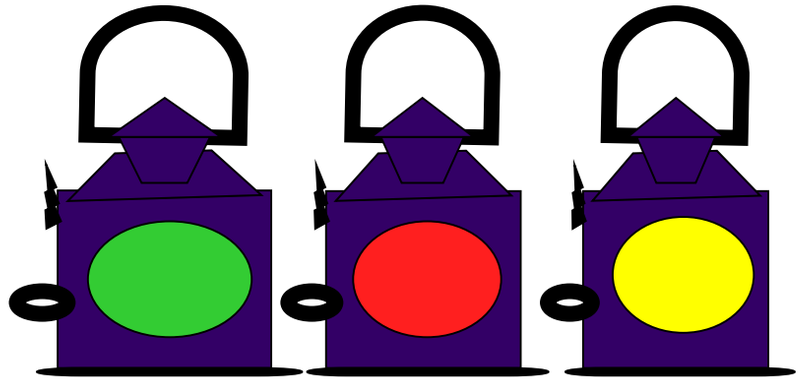
SAFETY EQUIPMENTS





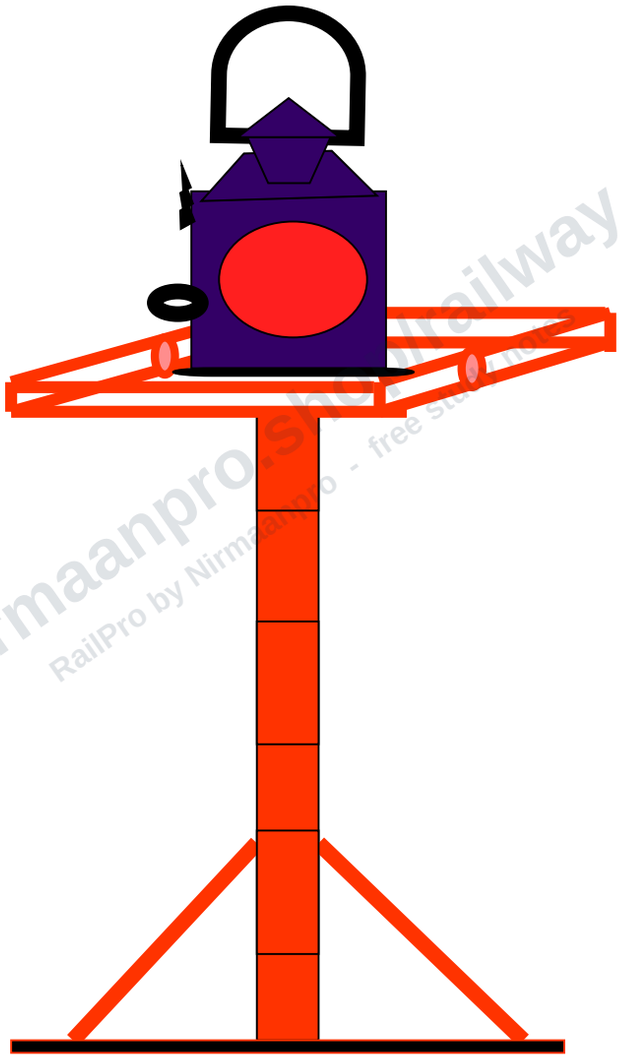




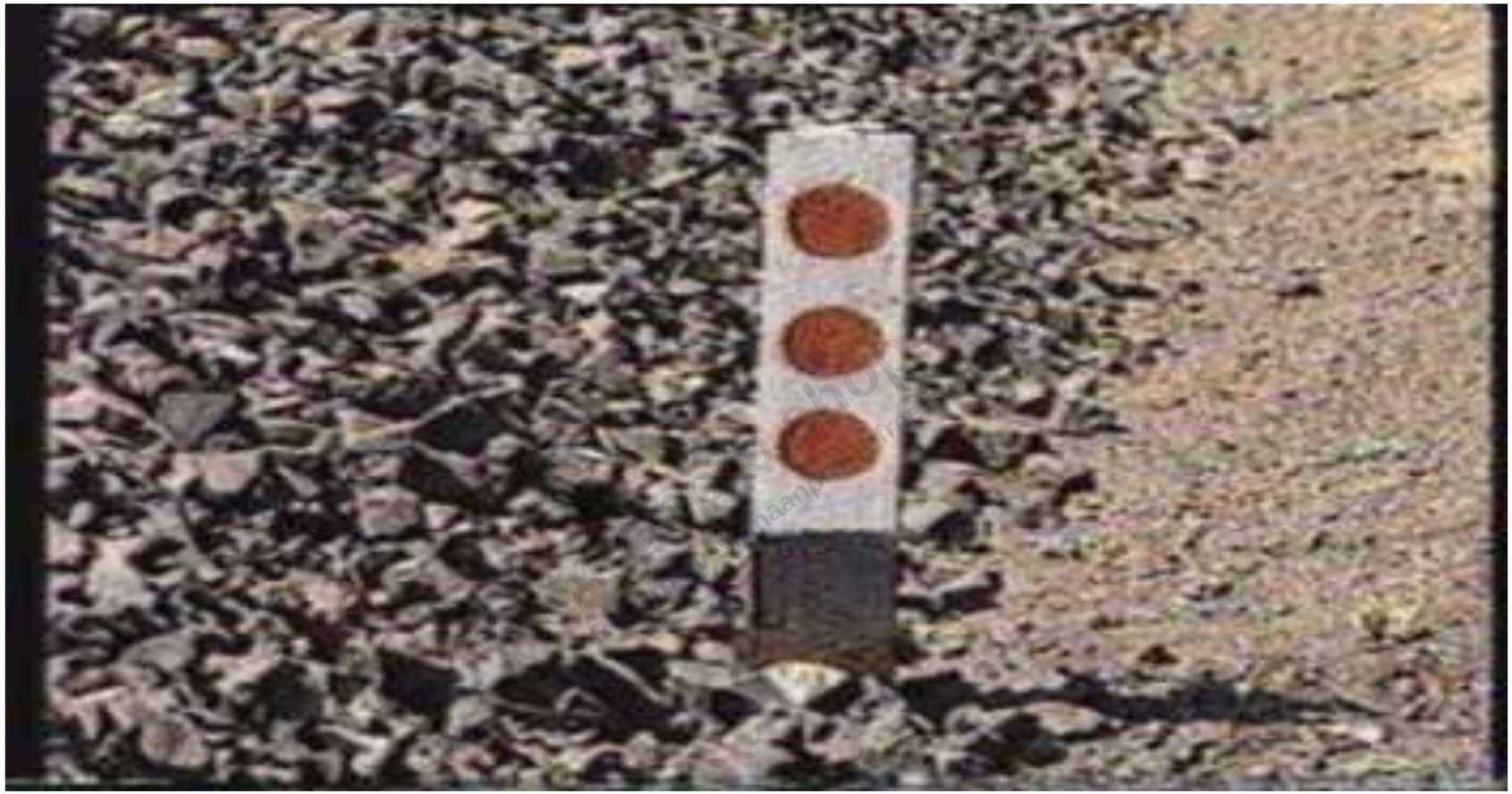


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WOODEN STAFF

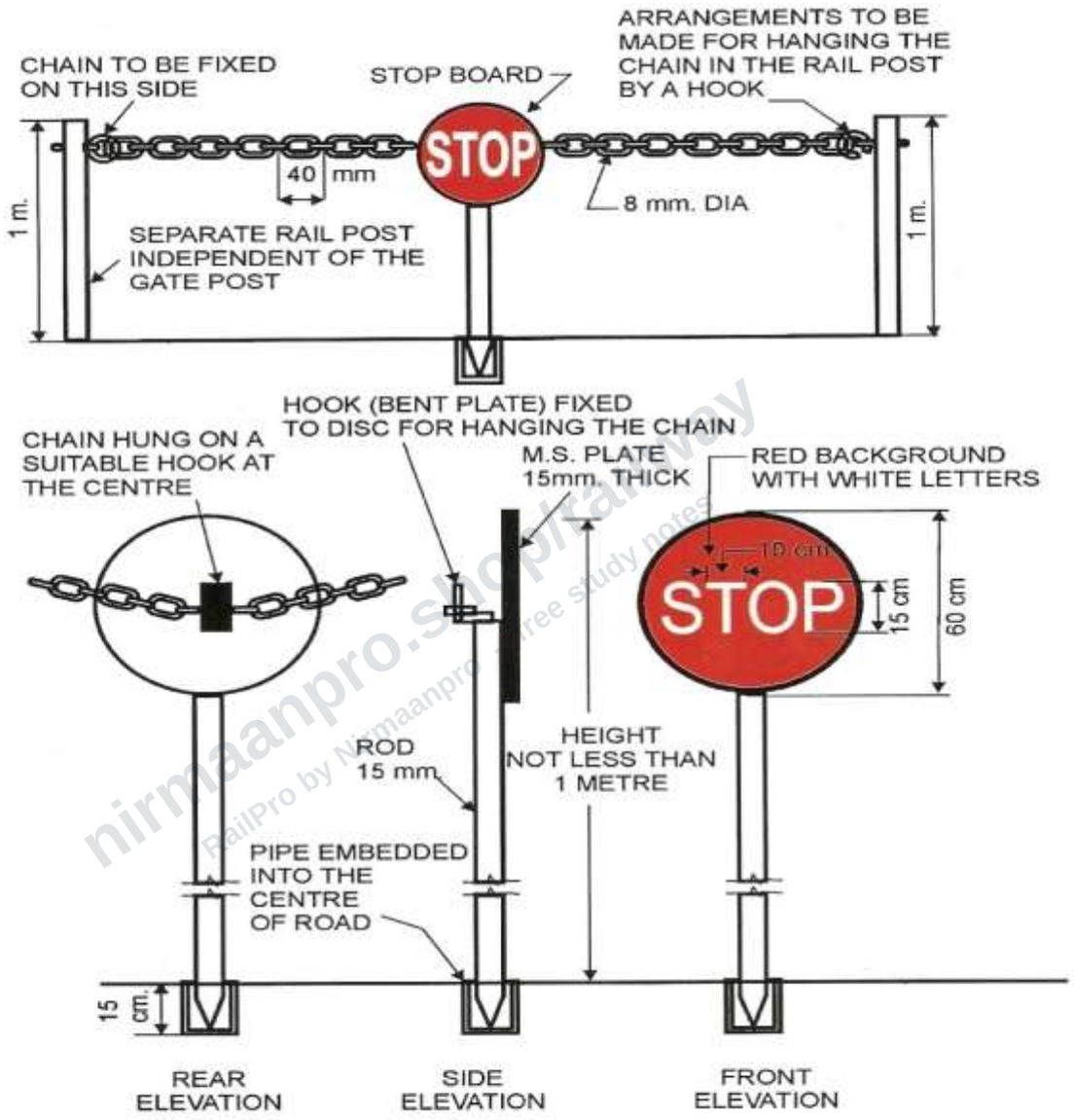


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DETAILS OF STOP DISC TO BE PROVIDED ALONG WITH SAFETY CHAIN AT MANNED LEVEL CROSSINGS

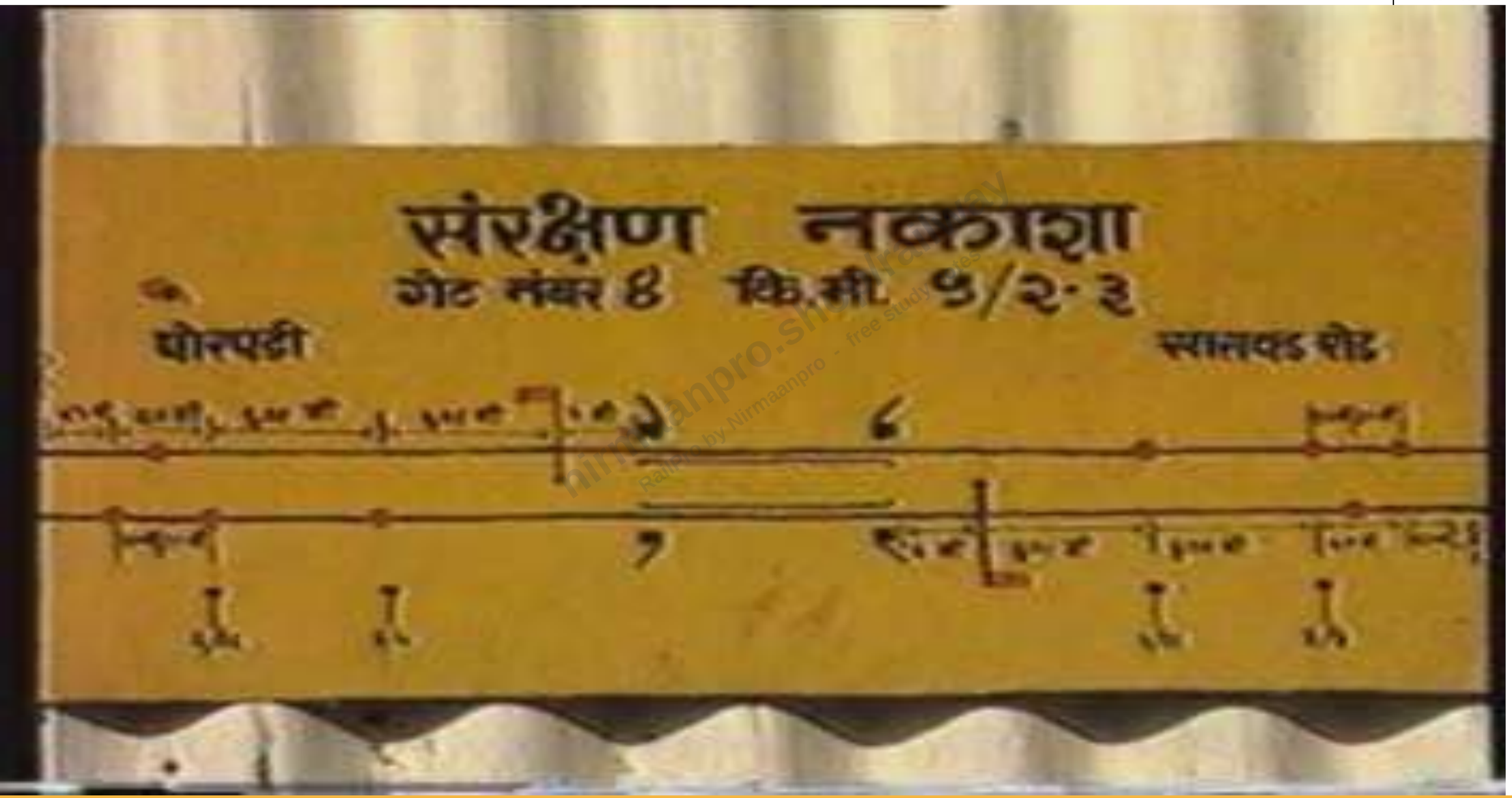
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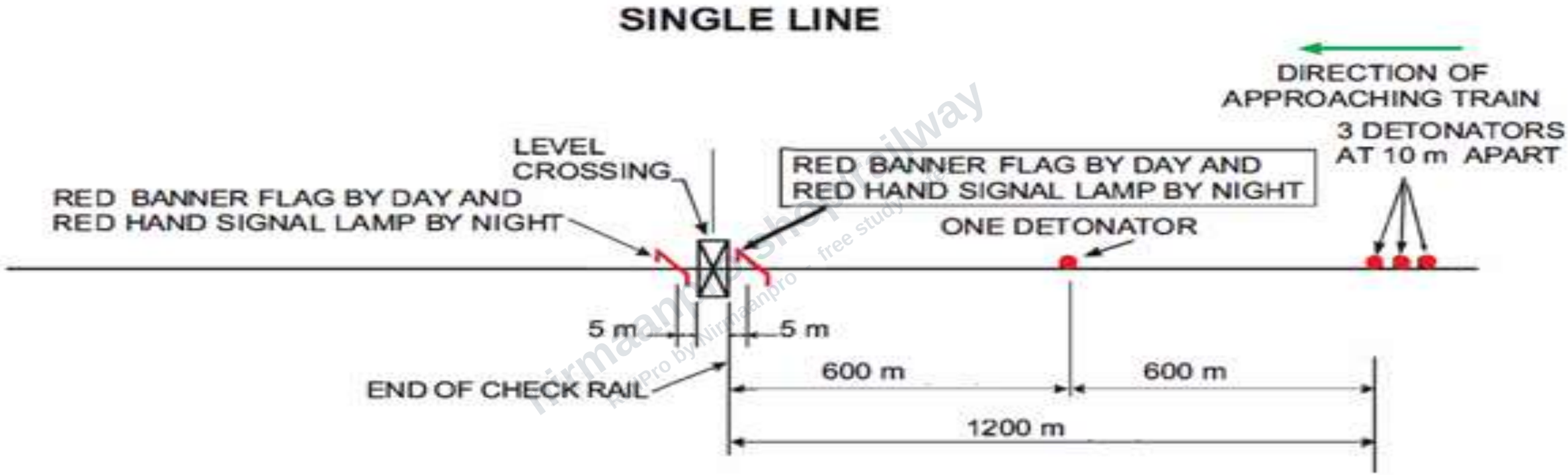


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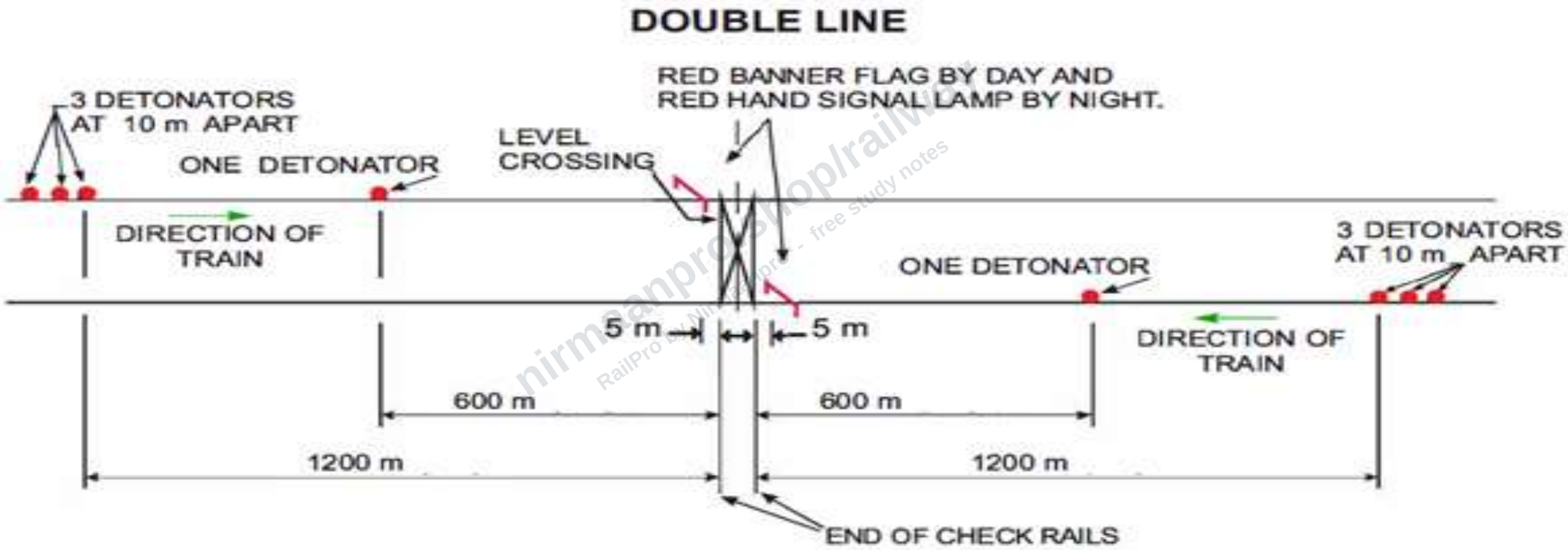
PROTECTION DIAGRAM



Note-

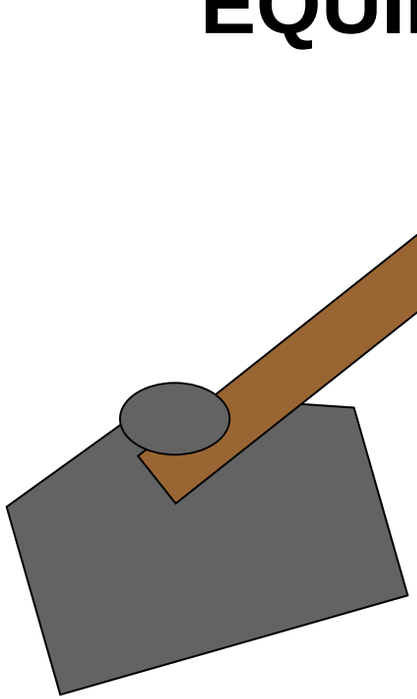
PROTECTION FOR THE DIRECTION OPPOSITE TO THAT OF APPROACHING TRAIN TO BE REPEATED ON THE OTHER SIDE ALSO.

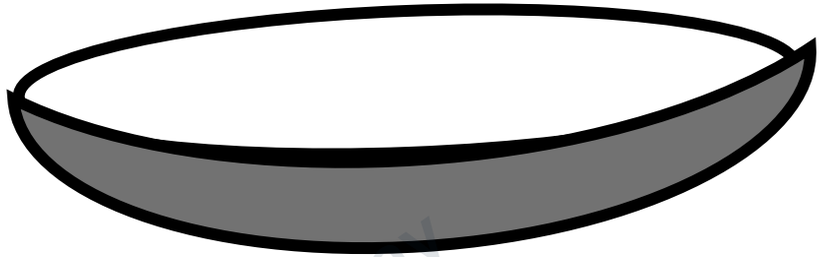
PROTECTION DIAGRAM

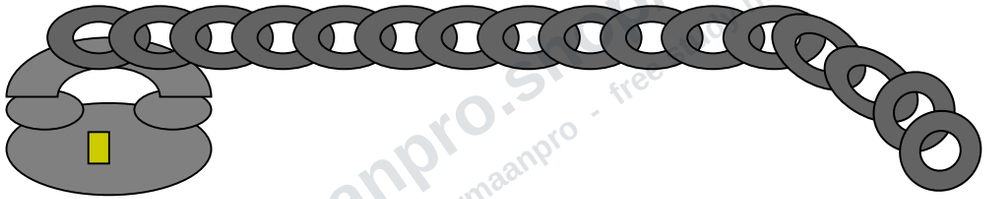


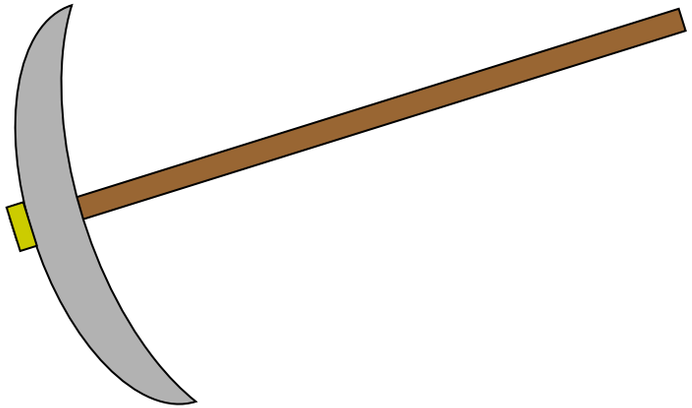
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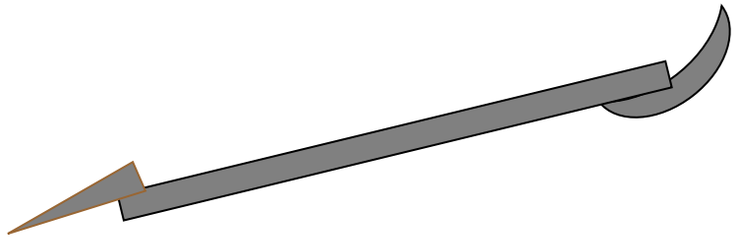
EQUIPMENTS AT LEVEL CROSSINGS

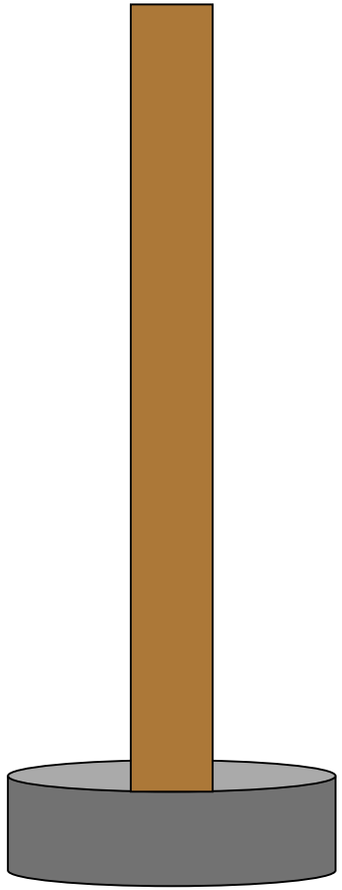




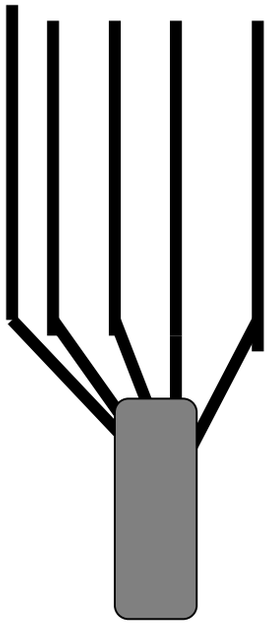


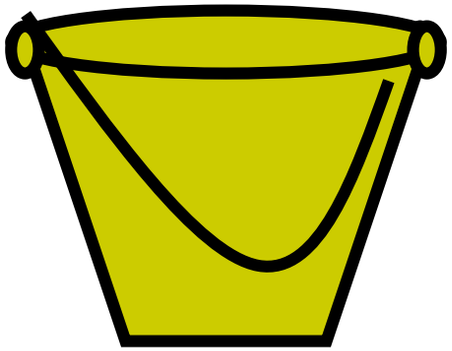




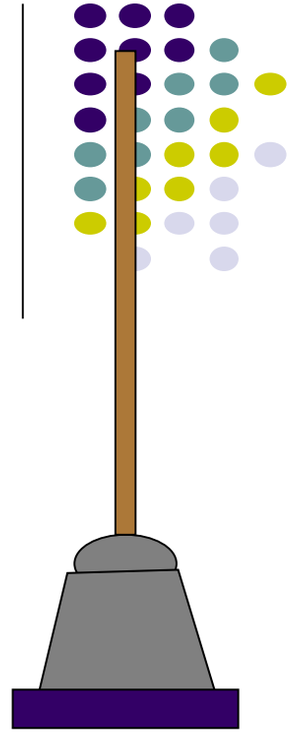


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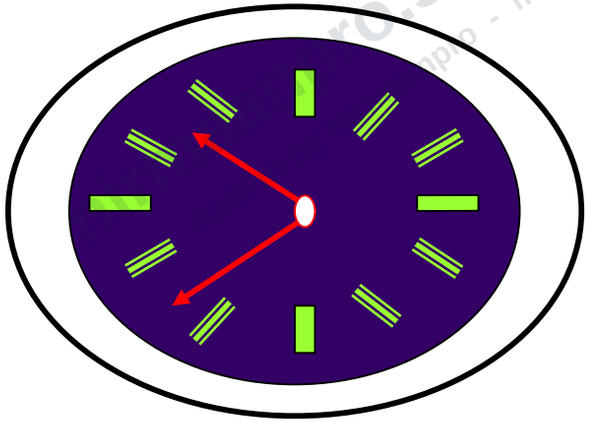






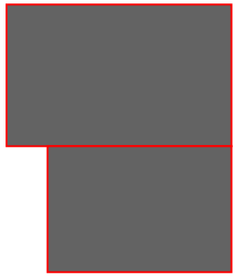


TIME BOOK





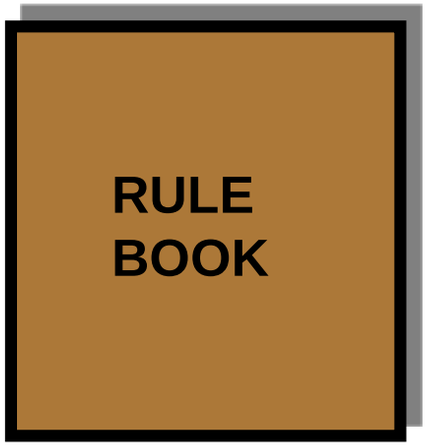
HS FLAG TIN CASE

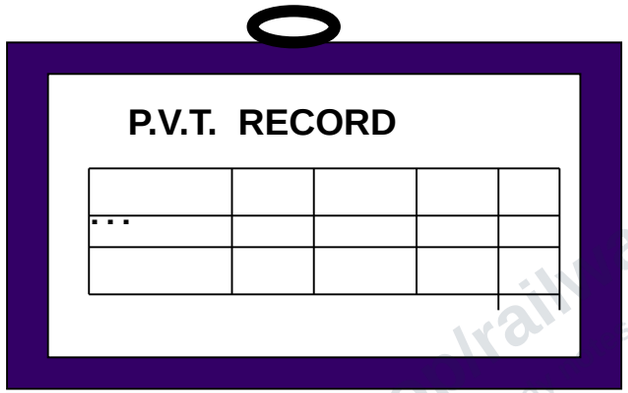


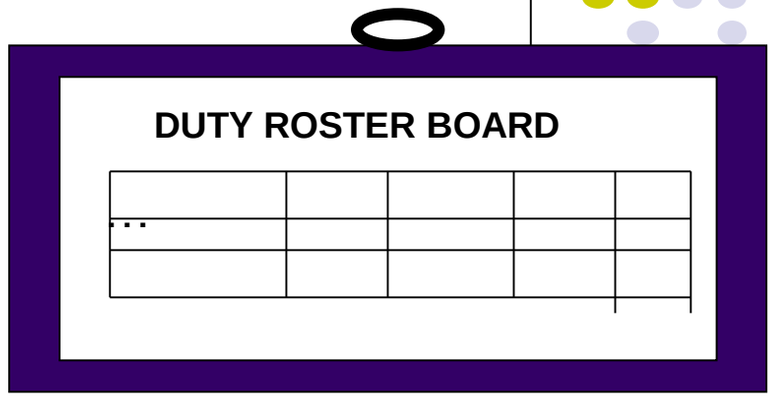
CLEARENCE GAUGE

64

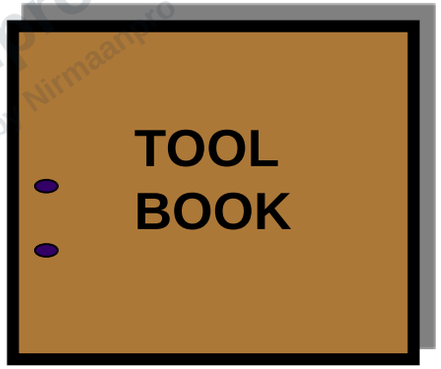
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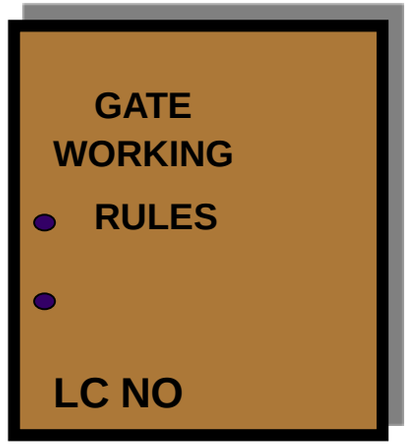












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THANKS

Level Crossings

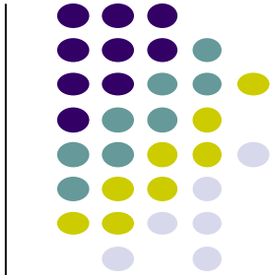
2.15.4_Features of track at and on approaches of level crossings, overhauling of LC, Maintenance of road surface and approach, track, Check rails-types, Visibility at LC.

Periods 1



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Provision of Wicket Gate for Foot Passengers



- Spl Class – To be provided , Except where FOB provided
- 'A' Class – To be provided , Except where FOB provided
- 'B' Class – 'To be provided , Except where FOB provided
- 'C' Class – To be provided on Need Basis after assessing the requirement by committee constituted by Railway.

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Infrastructure (Road user side)

Item	Specification
Road sign Boards	As per IRC
Stop Boards (In English, Hindi and Regional Language)	To be provided only on U/manned LCs at 5 m from center line of the nearest track, within Railway Boundary.
Speed Breaker (CS No.128 dated 05.03.12)	1.One speed breaker to be provided on either approach of LC at a distance of **about 20 M from gate post of LC covering full width of road including berms**.
	2. This may require construction of speed breaker by railway, out side the railway boundary
	3. For road with central median/ one way road, speed breaker to be **provided on entry side of the road only. For safety reasons ,paint markings should be provided and their maintenance ensured.**

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Stop Board



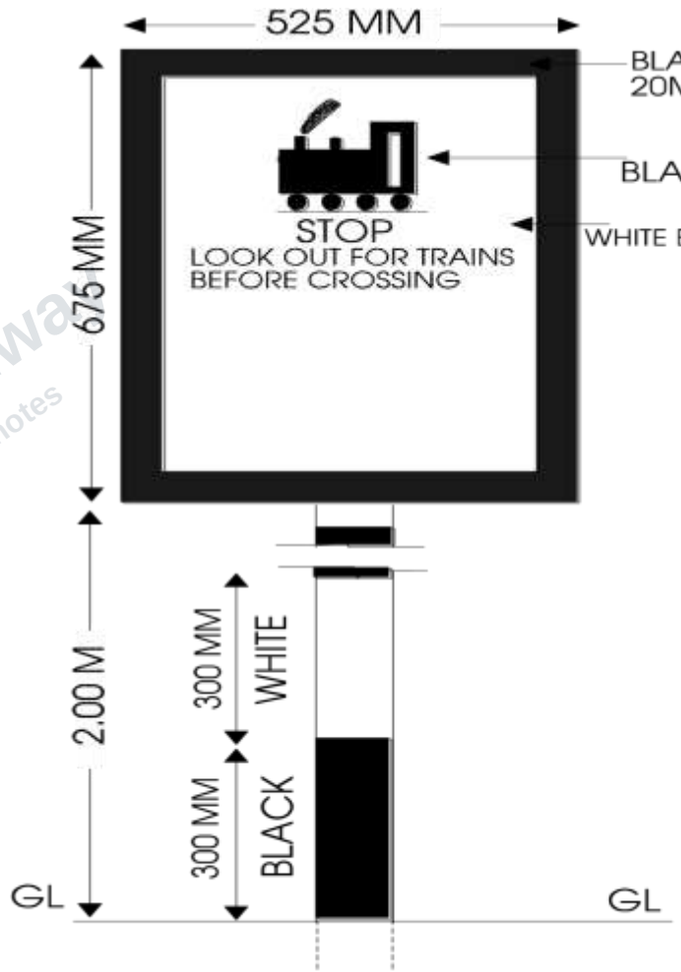


Figure : Stop Board

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Stop Board



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Infrastructure (Road user side)

Item	Specification
Speed Breaker	Speed breaker boards are provided at the following distance from speed breaker 1.National/State Highways-120m 2.Major District Roads -90m 3.Other District Roads -60m 4.Rural Roads-40m

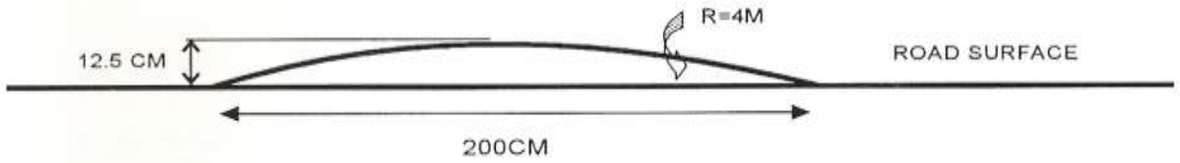
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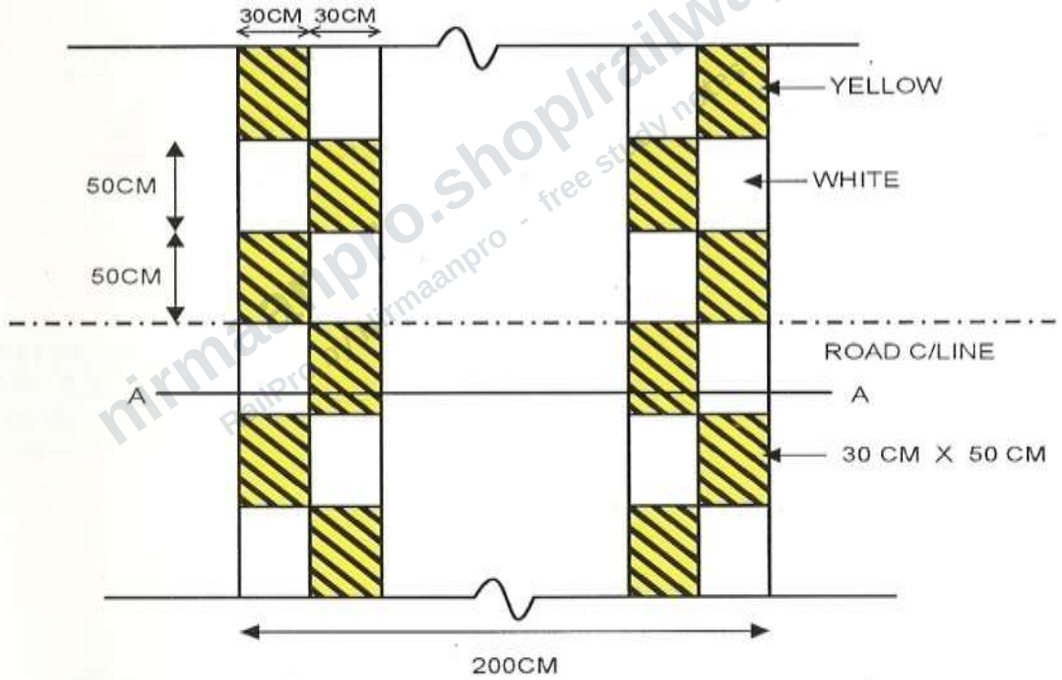
Item	Specifications
Speed Breaker	**Provision of rumble strip on approaches of Level crossings as per standard Design is responsibility of Road Authorities/State Govt**. They should be pursued to ensure provision of it as per standard design over **total width of road i.e. edge of the berm to edge of berm with proper road warning signs as per standard design.** **However it is incumbent upon railways** to provide speed breakers as per standard design on both manned as well unmanned level crossings irrespective of approach roads are metalled / Unmetalled, **as a temporary safety** measure, till such time these are replaced with rumble strips of proper design by the road authorities.

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SPEED BREAKER DESIGN



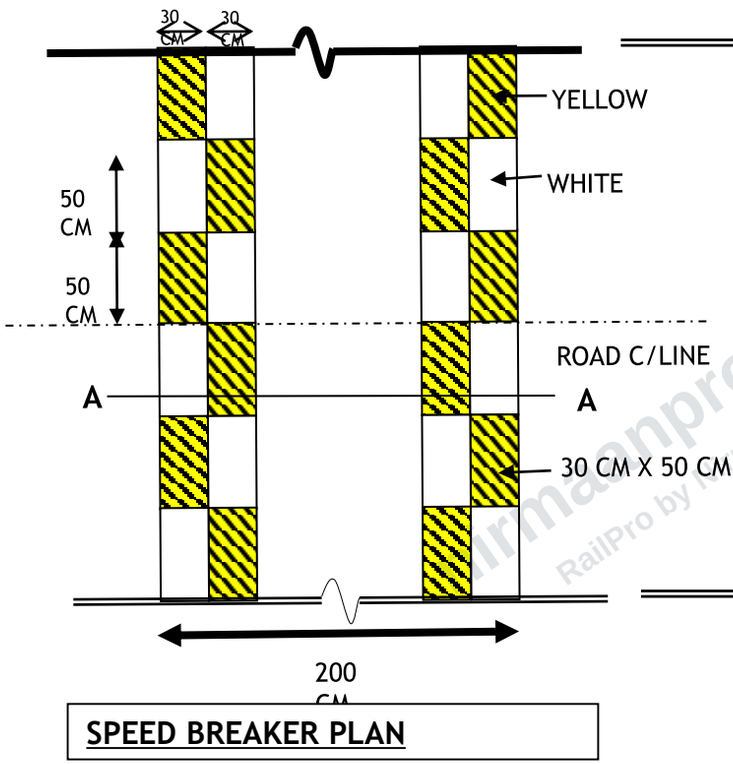
SPEED BREAKER - SECTION - 'AA'



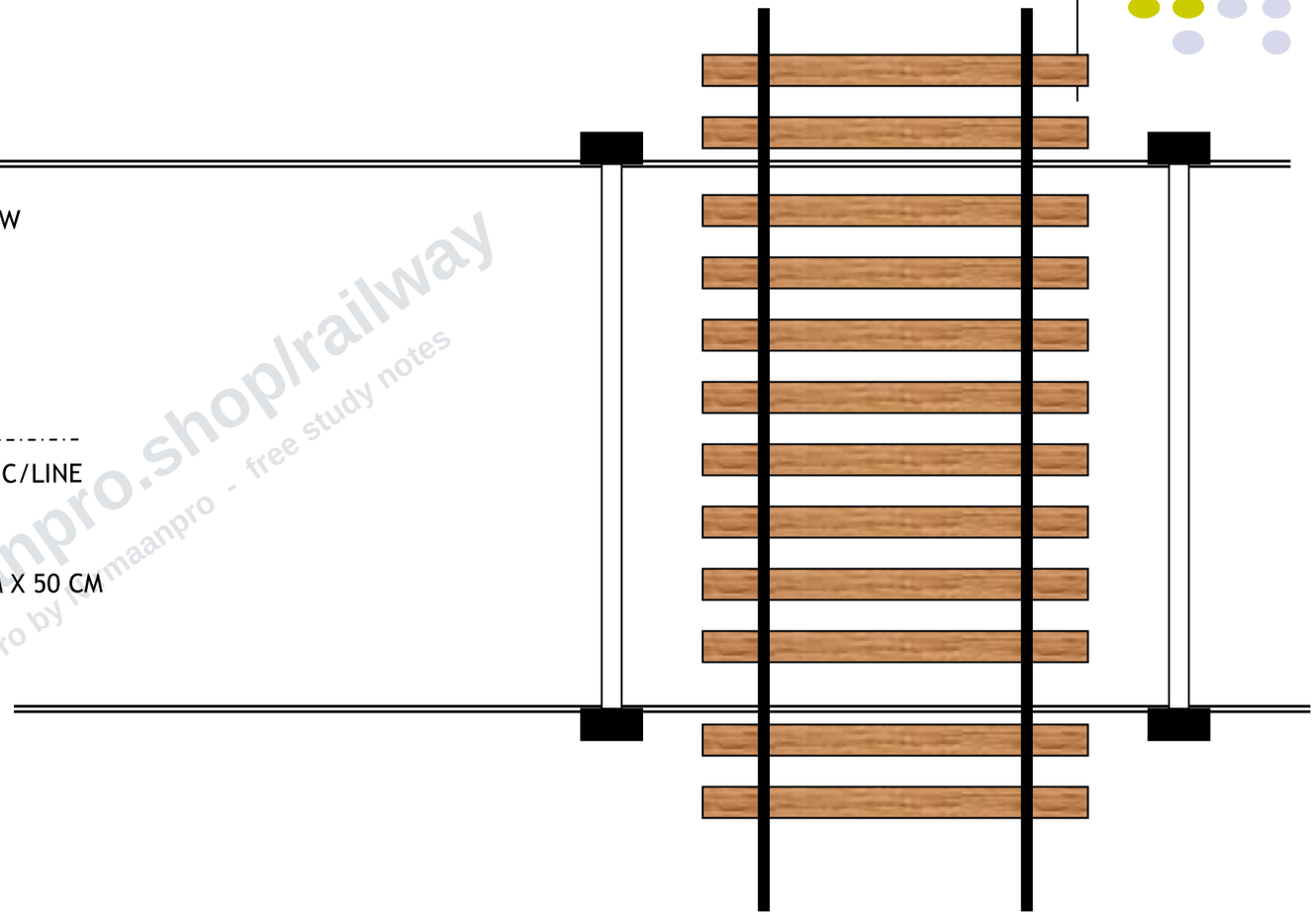
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NOTE - THE HUMP SHOULD EXTEND TO THE FULL ROADWAY WIDTH APPROPRIATE BASE COURSE MATERIAL SHOULD BE EXTENDED OVER THE SHOULDERS FOR PLACING THE HUMPS OVER THESE.

Speed breaker



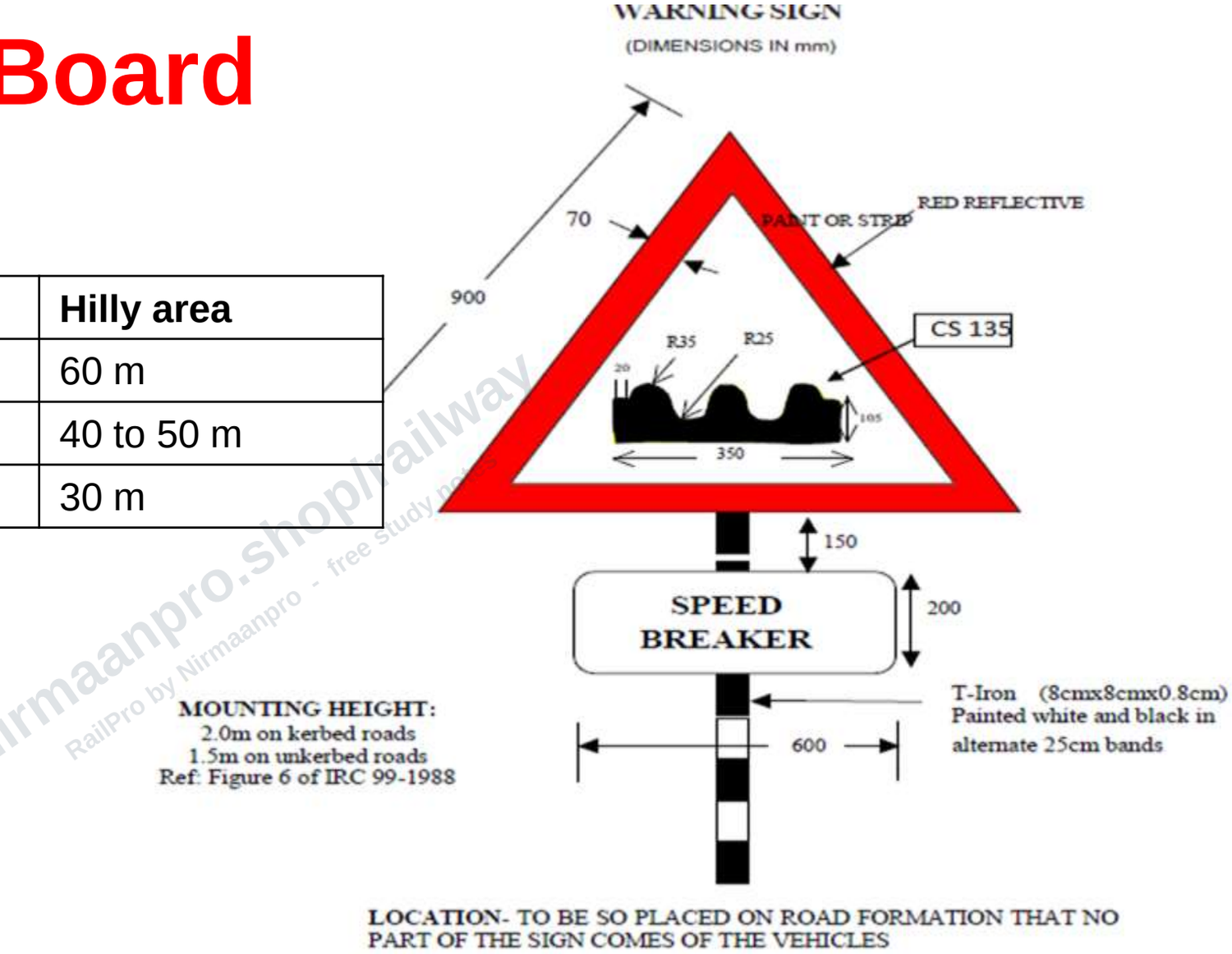
SPEED BREAKER PLAN



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Speed Breaker Board

Class of road	Plain area	Hilly area
Class I	120 m	60 m
Class II	60 to 90 m	40 to 50 m
Class III	40 m	30 m



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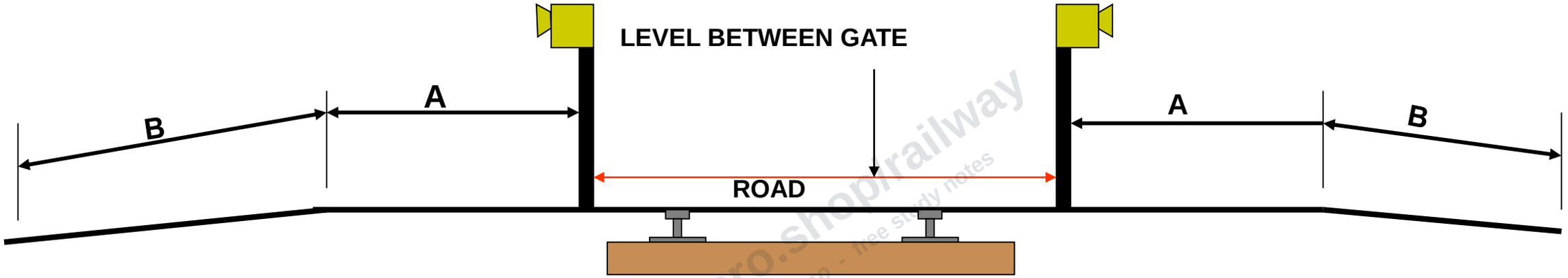
Level length & Gradient

	Class I	Class II	Class III	Class IV
Between Gates	Level	Level	Level	Level
Outside gates Level upto	15 m beyond	8 m beyond	8 m beyond	-
Not steeper than	1 in 40 beyond	1 in 30 beyond	1 in 20 beyond	1 in 15 beyond

- Vertical curves should be provided at Change of Grades within Railway Boundary according to IRC , beyond Level portion.
- Sketch

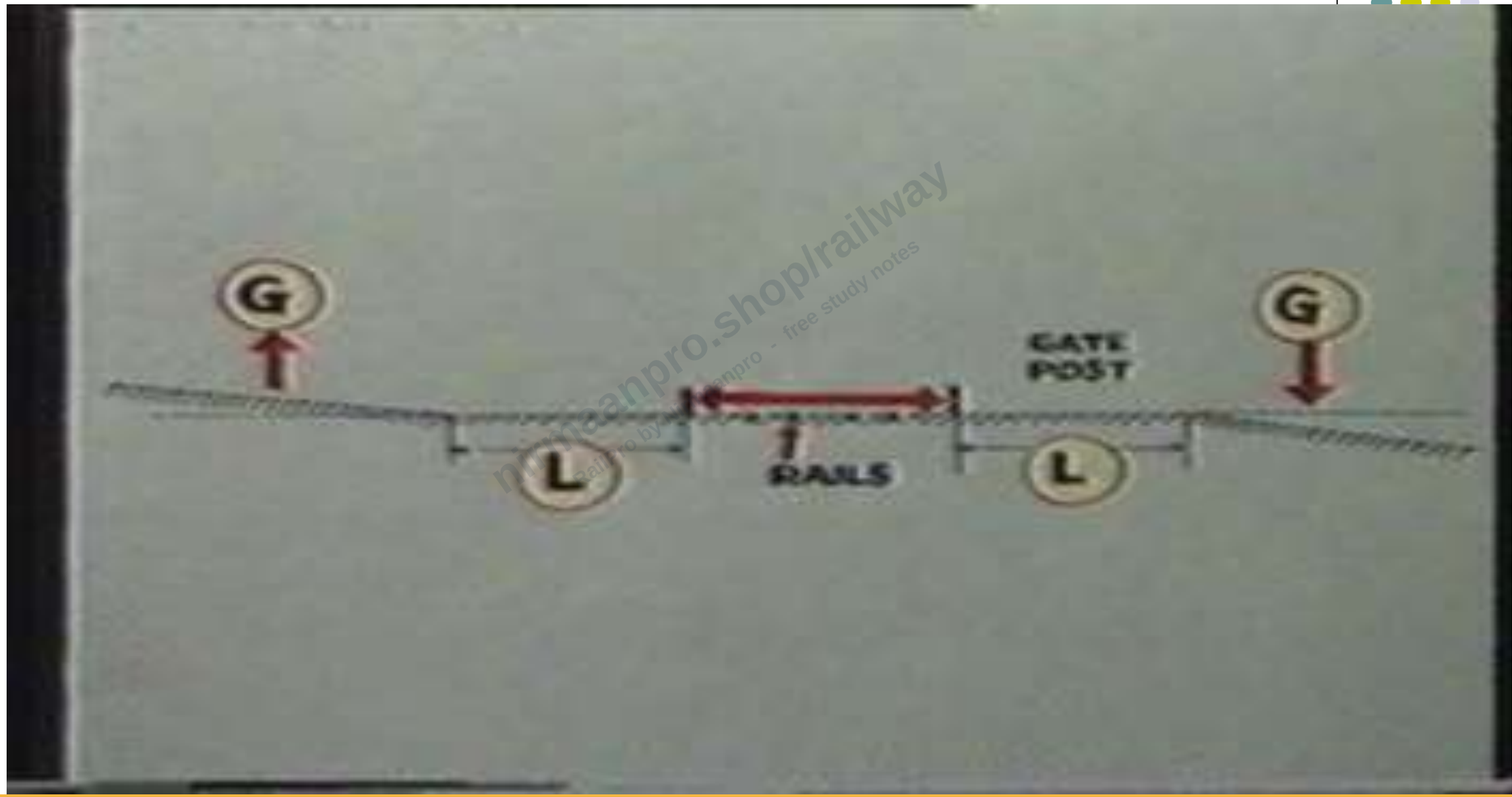
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LEVEL LENGTH AND GRADIENT



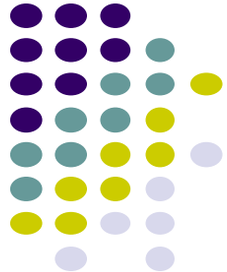
CLASS OF ROAD	LEVEL LENGTH- A	GRADIENT - B
CLASS I	15 M	NOT STEEPER THAN 1IN 40
CLASS II	8 M	NOT STEEPER THAN 1IN 30
CLASS III	8 M	NOT STEEPER THAN 1IN 20
CLASS IV	-----	NOT STEEPER THAN 1IN 15

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Minimum radius of center line of road on curved approaches

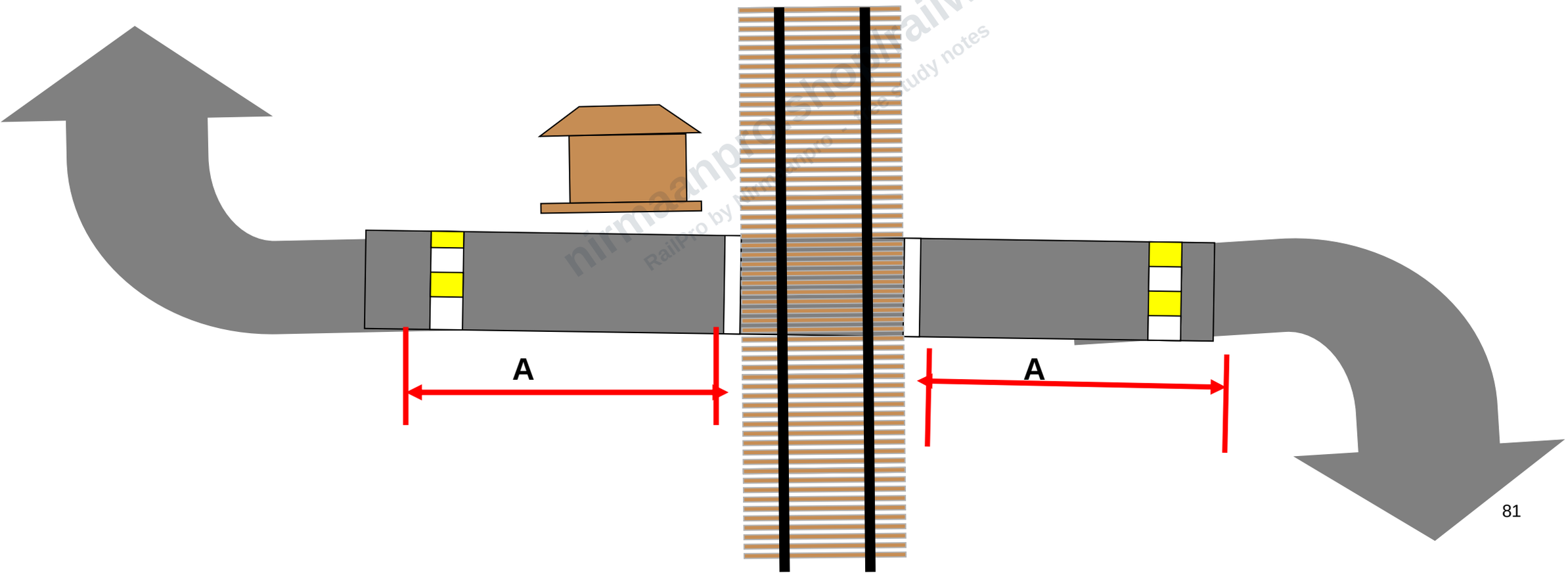


- In case of LC`s situated on N/H & S/H; Plain or rolling country---250 M Hilly country---90 M
- Minimum & desirable straight length of road outside the gate; Desirable –class I-30 m, class II -22.5m class III-15 m
  Minimum—class I-15 m, class II- 9 m class III-4.5 m

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DESIRABLE & MINIMUM & STRAIGHT LENGTH OF ROAD OUT SIDE GATE .

CLASS I ROAD	30M	15 M
CLASS II ROAD	22.5 M	9 M
CLASS III ROAD	15 M	4.5 M



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Minimum & Desirable Straight Length of Road Outside the Gate;

Details	Class I	Class II	Class III
Desirable	30 m	22.5 m	15 m
Minimum	15 m	9 m	4.5 m

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Minimum Sight Distance of Level crossing Gate from Road in the vicinity of Level Crossing gate

Details	Class I	Class II	Class III
Plain or Rolling terrain	120 m	60 to 90 m	40 m
Hill country	60 m	40 to 50 m	30 m

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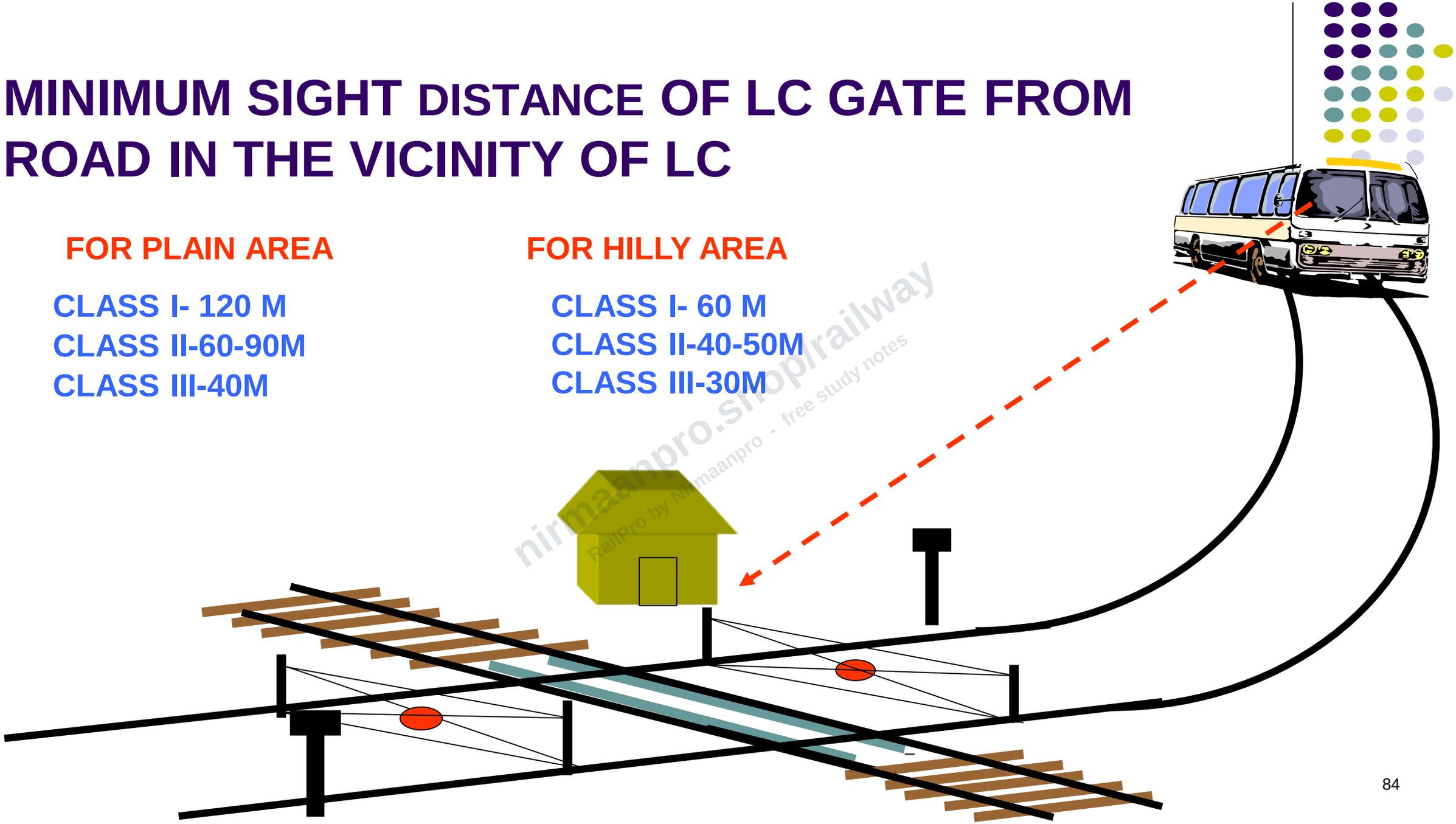
MINIMUM SIGHT DISTANCE OF LC GATE FROM ROAD IN THE VICINITY OF LC

FOR PLAIN AREA

CLASS I- 120 M
CLASS II-60-90M
CLASS III-40M

FOR HILLY AREA

CLASS I- 60 M
CLASS II-40-50M
CLASS III-30M



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Warning to Road Traffic of Proximity of level crossing

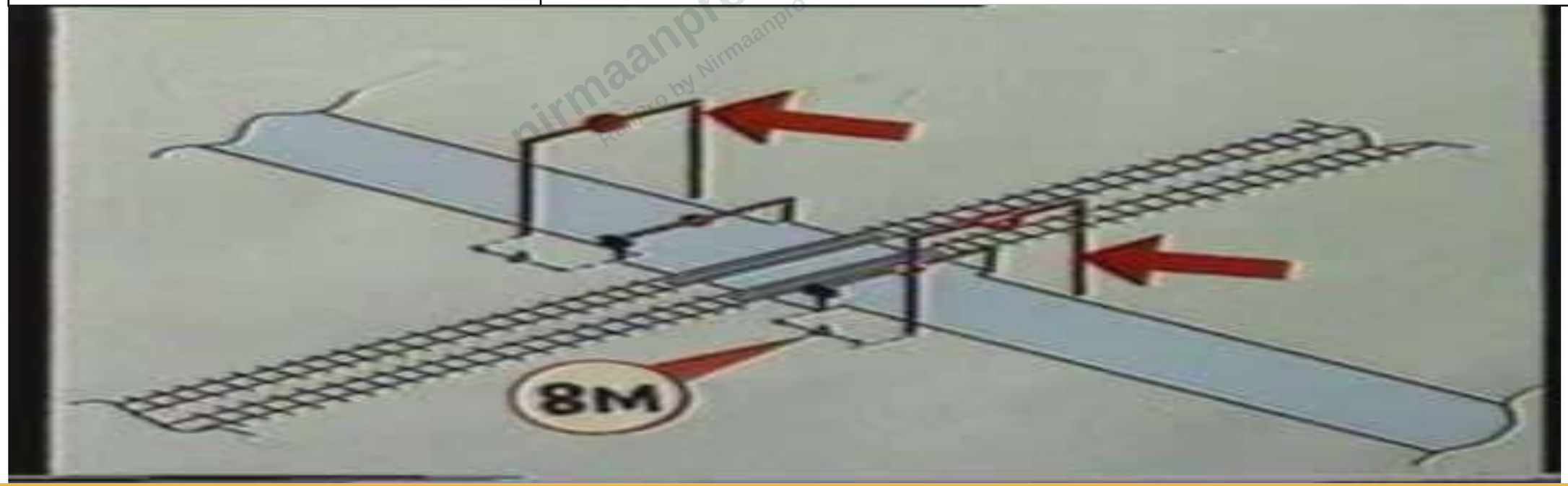
Details	Class I	Class II	Class III
* **Plain Country**	120 m	60 to 90 m	40 m
* **Hill country**	60 m	40 to 50 m	30 m

* The distance of Road sign Posts from Level crossings

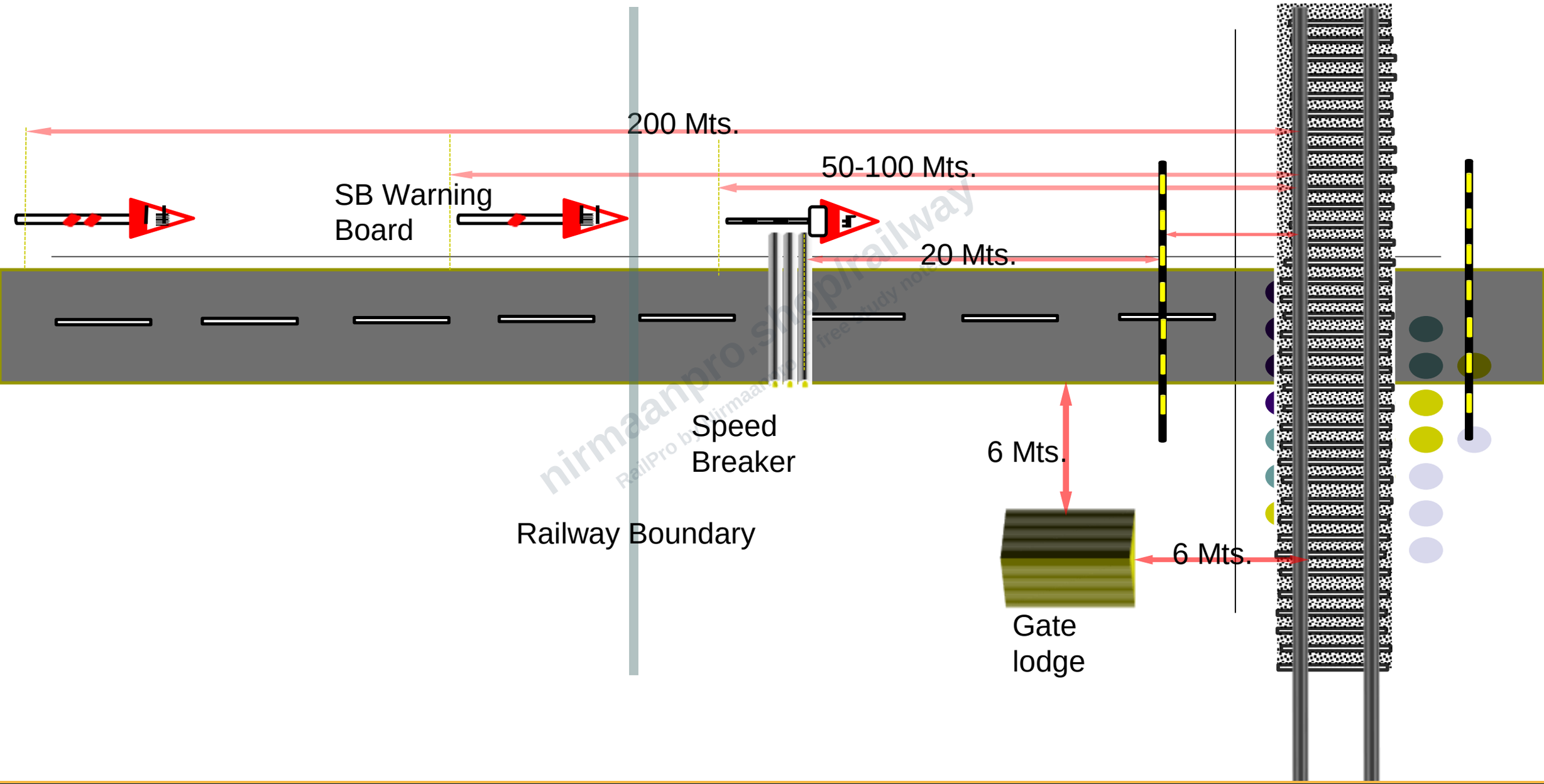
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Infrastructure (Road User Side)

Item	Specification
Height Gauge	1.To be provided on electrified section at **8 meters** from Gate post. Maximum height above road surface-4.67m
	2. CE can permit **up to 8 meters from centre of nearest track**



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Track Structure on LC's

- At LC's U category sleepers (durable) should preferably be used.
- All sleeper should be provided with suitable bearing plate.
- Rail joint should be avoided in check rail & running rail within the LC and 3 meters on either side.
- LC should not fall within the breathing length.
- In case of SWR, FP joint should be avoided on the LC and within 6m from the end of LC.

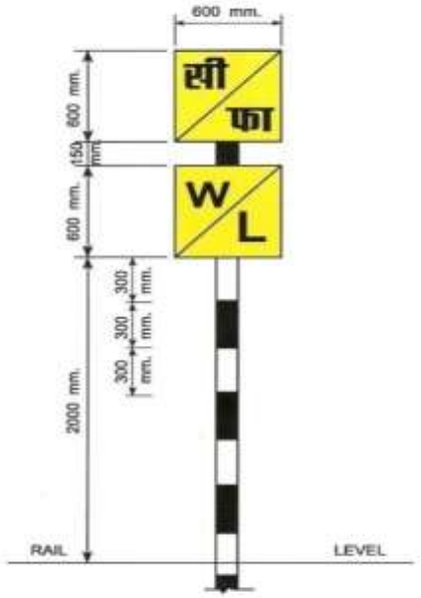
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Infrastructure (Track side)

Item	Specifications
Check rails	i. Length must be 2m more than **gate width**
	ii. Clearances range between Check rail and Running rail (51-57mm)
	iii. Clear depth Minimum (38mm)
	iv. Flange way must be clean
Gate Lodge	6 m from centre line of nearest track
	6 m from edge of the road metalling

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Contd. ….

Item	Specification
Fencing	All four side , **Minimum 15 m** from gate post parallel to track
Whistle Board	1. On approaches to all **unmanned C class LC`s**
 DETAILS OF WHISTLE BOARD ON THE APPROACH OF A LEVEL CROSSING	2. Manned LC`s where view **is not clear on either side for a distance of 600 M**
	3. Manned LCs having **normal position open to road traffic without interlocking & protection by signals.**
	4. whistle boards should be Bilingual
	5. **Distance – 600 m** along the track from gate to enjoin the Driver of approaching trains to give audible warning to road users. Whistle continuously from location of board to Level Crossing.

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Infrastructure (Track side)

Items	Specifications
Condition of track on Level crossing	Gauge & Cross levels should be within service tolerances
Fish plated Joint	i. In case of free Rails – There should not be any joint on LC and within 3M from edge of the road ii. In case of SWR track – There should not be any joint within 6M from edge of the road
Condition of Rails, Sleepers & fittings.	During Over hauling of LC these should be checked and replaced If found defective at least once a year and for PSC sleepers with each cycle of machine Packing and in No case more than 2 yrs.
Condition of road surface	Should be uniform and level

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Cont..

Items	Specifications
Painting of gates and Discs	Done at Regular Intervals
Manuscript register with PWI	Register should show Date of opening, condition of sleepers with their age and time, Date and type of each sleeper changed and other requisite particulars.
Upkeep of Whistle board and STOP boards	PWI shall be responsible for Upkeep and maintenance of these boards provided on the approaches to Level Crossings.
Removal of Check rails	Shall be removed for Tamping operation, OH, Distressing of LWR or Track renewals. Should be re-fixed as quickly as possible and preferably before leaving site.

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Cont..

Items	Specifications
Removal of Check rails (cont..)	**If cannot be re-fixed ,SR of 30 kmph imposed apart from diversion of Road traffic.** If diversion not possible. Temporary arrangements for passage of Road traffic to be done. **Check rails should necessarily be provided by close of next day.** Till that time stationary watchman to be posted to ensure safety.
Obstruction of View	All trees, bushes or undergrowth that interferes or tends to interfere with view from the Railway or Roadway when approaching level crossing should be cut down and comply provisions of Para 222 of IRPWM.

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Over Hauling of LC

- Level crossings laid with PSC sleepers should be overhauled with each cycle of machine packing or more frequently as warranted by condition and in no case shall opening be delayed by more than two years. In all cases, rails and fastenings in contact with the road shall be provided with galvanized fitting.

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Over Hauling of LC

- Alternatively, non-galvanized fittings should be thoroughly cleaned with wire brush and a coat of coal tar/anti-corrosive paint applied. Flange way clearances, cross level, gauge and alignment should be checked and corrected as necessary, and the track packed thoroughly before reopening the level crossing for road traffic.

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Over Hauling of LC

- Check rails of level crossing are required to be removed for tamping operations, overhauling of level crossings, destressing of LWR or track renewals etc. Check rails should be re-fixed as quickly as possible and preferably before leaving site.
- Should a situation arise where check rails cannot be re-fixed for any reason and trains have to be passed, a speed restriction of 30 Kmph should be imposed

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Check rail

- **Minimum length of check rail**
  - **For a square crossing**
  - **2 m more than width of gate.**

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Check rail

- **For a skew crossing**
- **The length of the check rail must be increased in accordance with the formula**

$$X = \frac{L}{\sin A}$$

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where
X = required length,
L = Minimum length measured at right angles to the centre line of the road,
A = Angle between the centre line of the Road and Railway.

Visibility requirements for Unmanned LC

With single or double lines track, for **New U/M LC`s, visibility requirement for road users along the track shall be 600M**. **Where this is not feasible**, distance reduced suitably with approval of CE, provided max. permissible speed is less than 100 KMPH &/or there is only single track to be crossed on Level Crossing. Visibility of trains for Road Users at Unmanned LC may be assessed from a **distance of 5 m from the centre of the track.**

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Positioning of Gate Lodge

- Gate lodge is to be located on outside of curve for better visibility.
- Minimum distance of face of goomty to track should be 6 m.

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Level Crossings

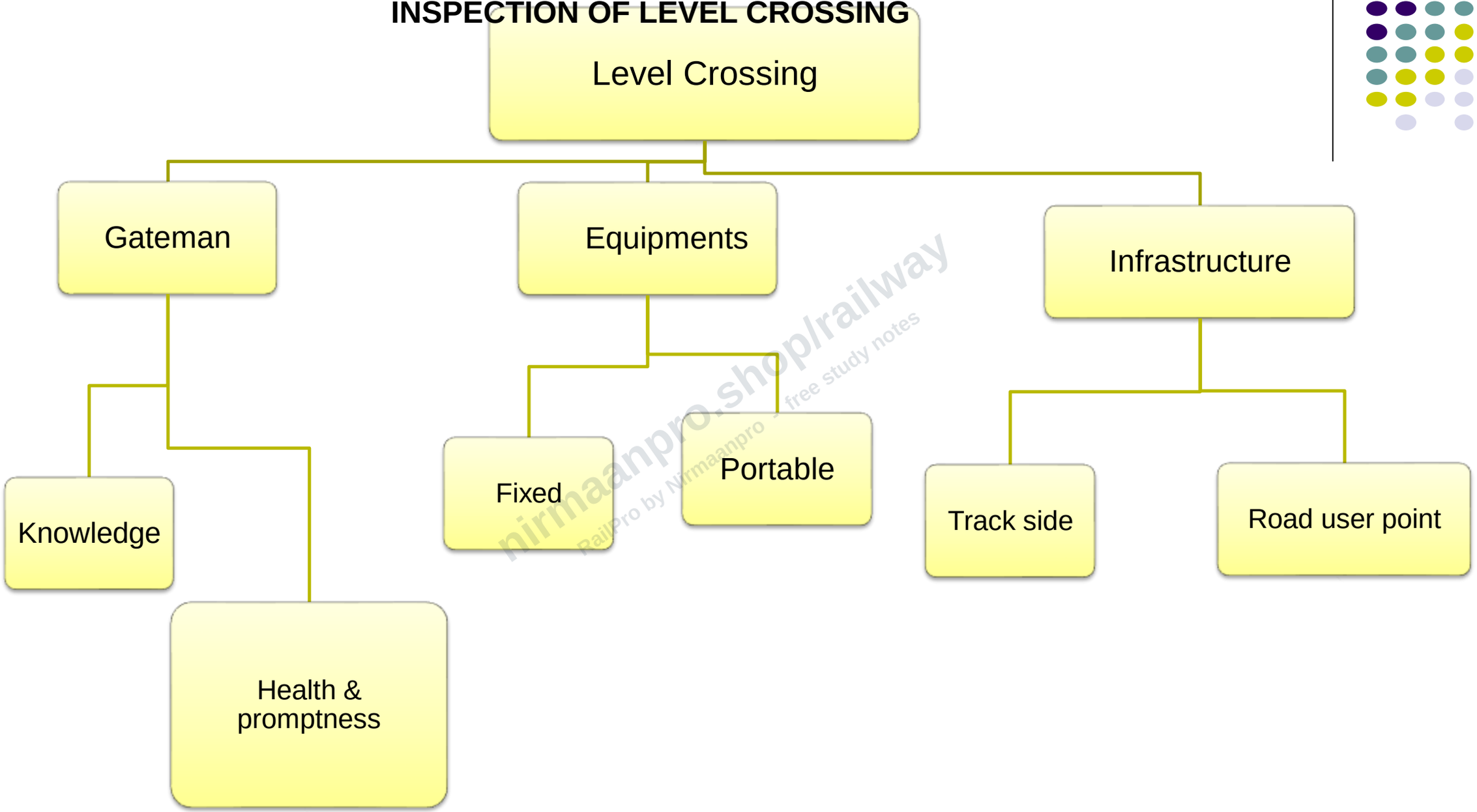
2.15.5_Checking of equipment and knowledge of rules of gatemen, competency, medical, Refresher Statutory provisions of Railway Act on LC. GWR, Protection diagram, Slide boom operation, Height gauge

Periods 1



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INSPECTION OF LEVEL CROSSING



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Checking equipment and examination of Gateman in rules–

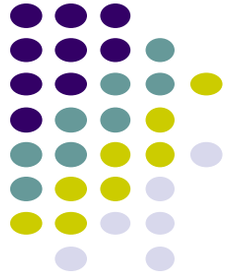
By JE/SSE/P.Way

(i) The equipment with the Gateman shall be checked by JE/SSE/P.Way **once in a month by rotation.**

(ii) Surprise day/night inspection of level crossing should be carried out to ensure presence and alertness of Gateman.

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Checking equipment and examination of Gateman in rules–



JE/SSE/PWAY-

(iii) The JE/SSE/P.Way shall ensure that the Gatemen have correct knowledge of rules by examining them periodically during his routine inspection and on appointment, promotion or transfer. He should not only educate them in rules, but also conduct **practical demonstration** of protection of level crossing in case of emergency.

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Checking equipment and examination of Gateman in rules–

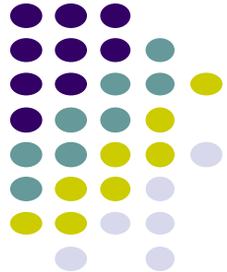
JE/SSE/PWAY-

iv) He should maintain a manuscript register of repairs for all LC gates on his section. This Register shows details viz. date of opening, condition of sleepers & age, details of change of sleeper etc.

v) He will check that on duty GK is as per roster.

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Checking equipment and examination of Gateman in rules–

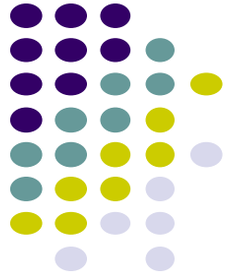


By Assistant Divisional Engineer–

The Assistant Divisional Engineer should inspect the equipment at every manned level crossing on the sub-division **once in six months**, and examine the Gateman in rules during his inspection.

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The Assistant Divisional Engineer should scrutinize the manuscript register of level crossings maintained by the SSE/P.Way (In-charge) and inspect as many level crossings as possible, when they are completely opened out during the year.

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Items to be checked at LC's



- Condition of gate lodge, drinking & toilet water facility, electricity
- Road surface & Speed breaker(about 20m from gate post)
- Various road sign boards Caution board, warning board, speed breaker board
- Height gauge (minimum 8m from Gate post) maximum height 4.67m above road surface(height of contact wire from rail level-5.50 m)

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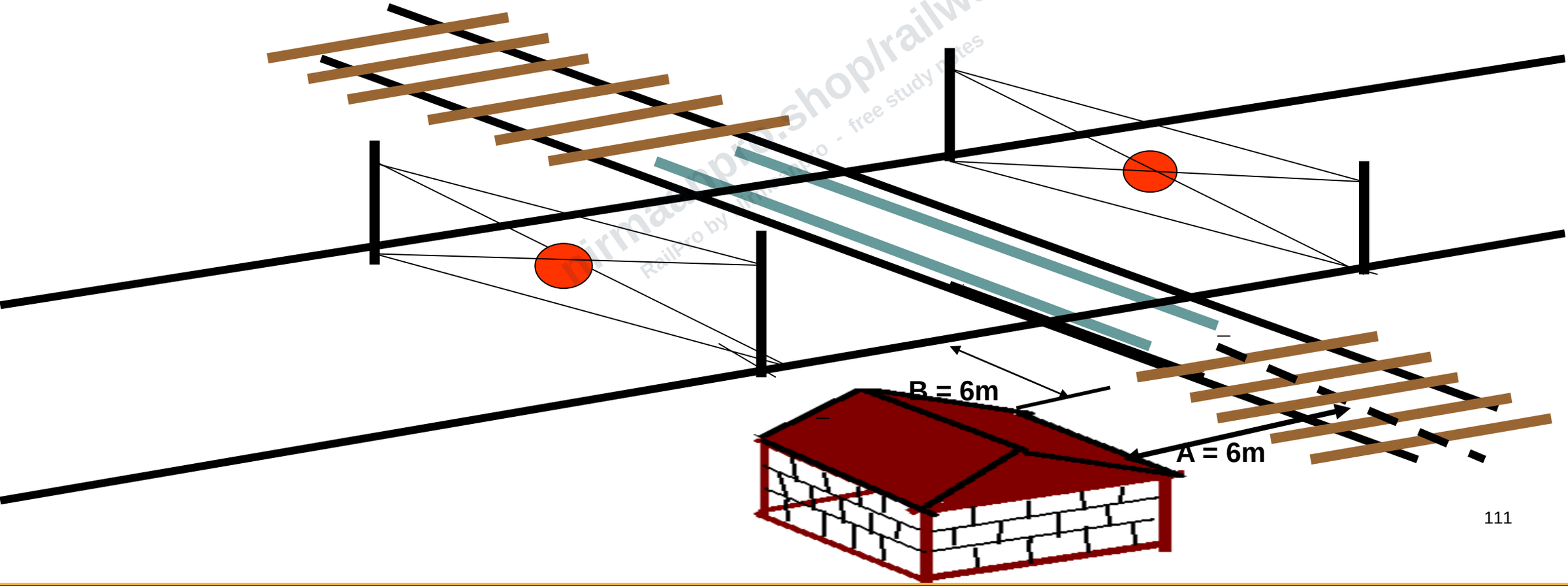
Location of gate lodges

- Should be located at a place from where a clear view of approaching trains & road vehicles.All future extensions
- Allowance for future extensions possible.
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- LC at or near cutting should be avoided as far as possible.

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MINIMUM DISTANCE OF GATE LODGE FROM

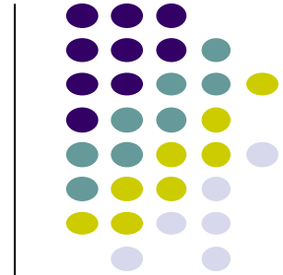
[A] CENTRE LINE OF NEAREST TRACK
[B] FROM EDGE OF ROAD METALLING



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111

Items to be checked at LC’s



- Road surface level upto Ht. gauge
- Protection diagram, OH date, TVU details to be painted on the Gate lodge
- Arrangement for fixing of banner flag at &Tri colour HS lamp (5m from end of check rail)

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Items to be checked at LC’s



- Check rail clearance, condition of track at LC & approach
- Copy of GWR, duty roster, details of competency, refresher, PME, private No. sheet, Train entry register, public complaint register, LC inspection book, equipment failure register (telephone, gate boom, wall clock etc).

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Items to be checked at LC’s



- LC No. Bd, W/L Bd, detonator Bd at 1200m/600m, tie bar fencing 15 (min)
- Equipment as per IRPWM para 910.
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- LC gates which remain closed during night, should have a board prominently displaying this fact.

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Items to be checked at LC’s

- Statutory warning Board
- Planning of plantation at LC gate
- Feasibility for closure of LC by LHS/diversion/RUB/Light weight ROB/ ROB etc.

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Inspection of Level Crossings

JE/SSE/PWAY-

- **Will check competency, medical & refresher details of GK.**
- **Validity of comp certificate-5 years**
- **Refresher – Every 5 years**
- **Medical Examination**

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Age	Medical Examination
<45	Every 4 yrs
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Examination of Gateman .

- **Scrutinize Medical certificate** (A-3 category)
  - When last examined?
  - When next due?
  - With or without Glasses?
- **Scrutinize Competency Certificate**
  - Date of issue & issuing authority
  - Validity
- **Whether he is working as per duty roster?**

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Inspection of Level Crossings

- **In all Level Crossings** provided with telephone connections literate gateman capable of exchanging private numbers, should be posted.
- **The Hours of duty for Gateman**

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Inspection of Level Crossings

- **Full particulars** regarding PME and Vision test of each gateman shall be maintained at gatelodge.
- **While handing over** and taking over charge, the gateman and relievers should jointly check all equipment and test all gears to see that they are in order.
- **Every gateman** shall be fully conversant with the use of Hand signals,detonators,fusees and protection rules.

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Provision of IR Act 1989 for LC

- Section- 146- Obstructing Rly Servant in his duties –
  - If any person willfully obstructs or prevent any Railway Servant in the discharge of his duties, he shall be punishable with imprisonment for a term which may extend to six months or with fine which may extend to one thousand rupees or both.

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Provision of IR Act 1989 for LC



- Section- 160- Opening or Breaking any LC Gate –
  - 1. If any person other than a Railway Servant or a person authorized in this behalf, opens any gate or Chain or Barrier set up on either side of a Level Crossing which is closed to road traffic, he shall be punishable with imprisonment for a term which may extend to three years.

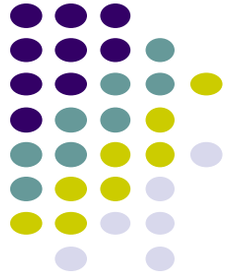
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Provision of IR Act 1989 for LC

- Section- 160- Opening or Breaking any LC Gate –
  - 2. If any person breaks any gate or Chain or Barrier set up on either side of a Level Crossing which is closed to road traffic, he shall be punishable with imprisonment for a term which may extend to five years.

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Provisions of Various Acts for Road Users of Level Crossings



- Railway Act 1989 and Motor Vehicle act 1988

Contains many Important provisions.

* Railway board provisions for Unmanned level crossings.

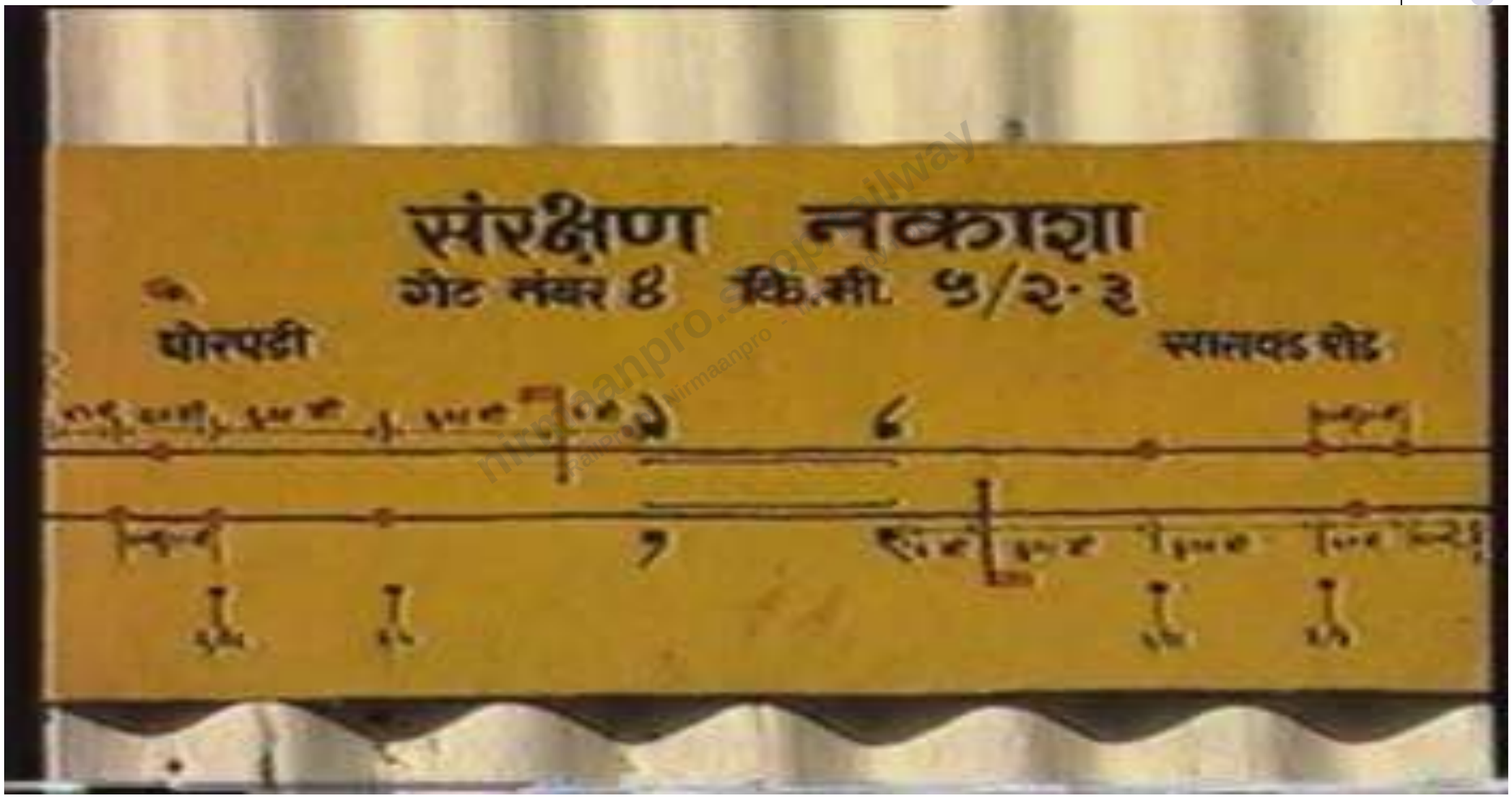
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GATE WORKING RULES (GWR)

The gate working instructions in English, local language and Hindi (wherever required) for manned gate including the signaling diagram for interlocked gate shall be incorporated in Station working Rules. A copy of gate working rules, for both interlocked and non-interlocked gates, shall also be kept at gate lodge.

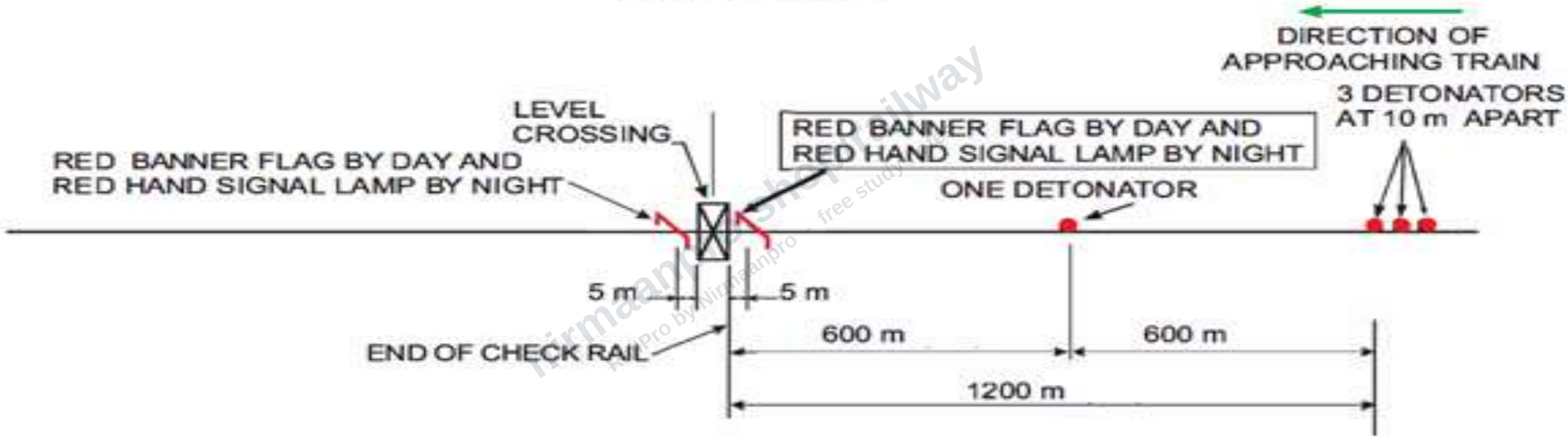
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PROTECTION DIAGRAM



PROTECTION DIAGRAM

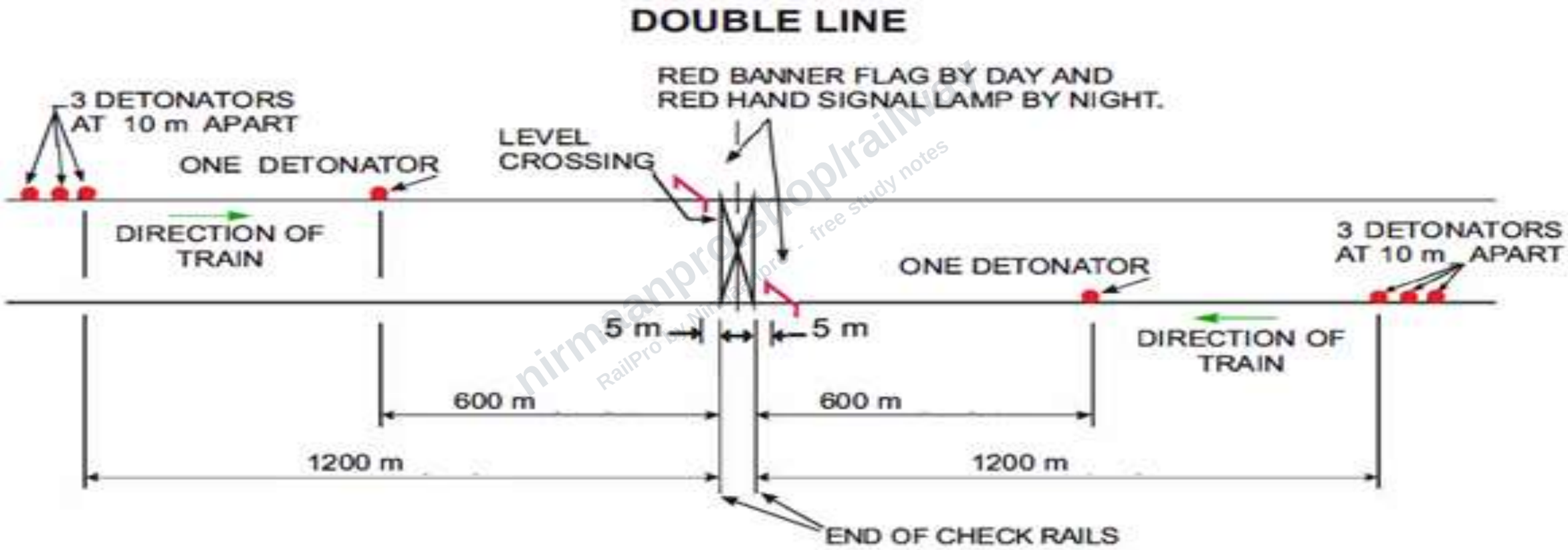
SINGLE LINE



Note-

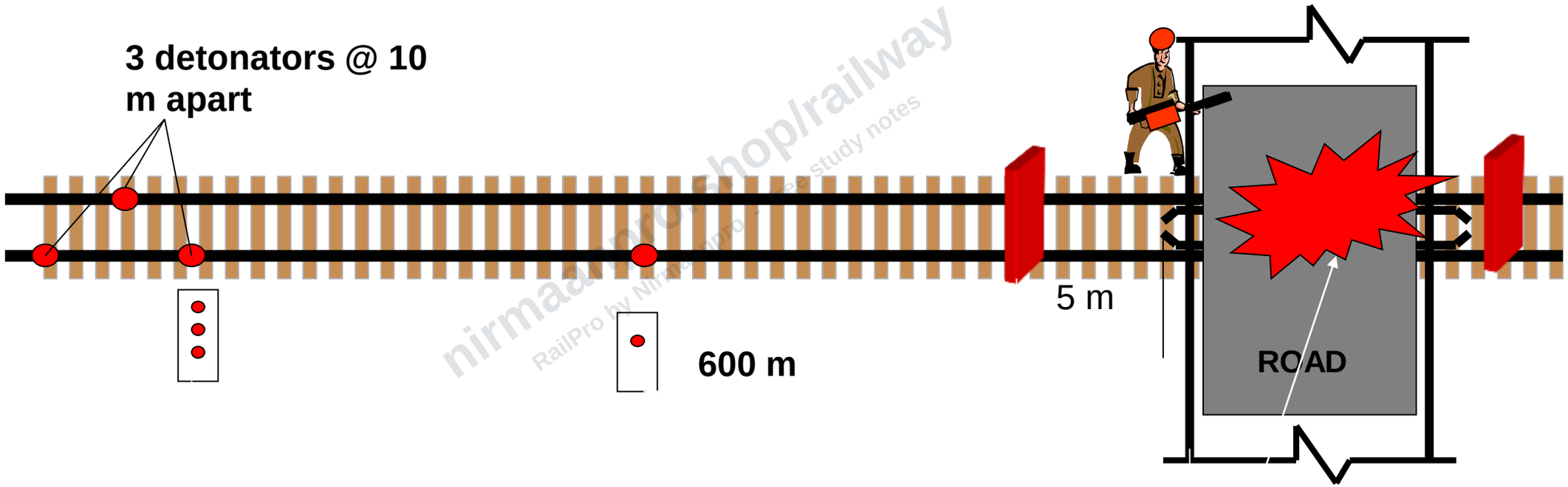
PROTECTION FOR THE DIRECTION OPPOSITE TO THAT OF APPROACHING TRAIN TO BE REPEATED ON THE OTHER SIDE ALSO.

PROTECTION DIAGRAM



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PROTECTION OF LEVEL CROSSING



OBSTRUCTION AT LC

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Emergency sliding booms

Notch for locking of emergency sliding boom in locking box by key lock plunger

Stop Board

Fig. 1: Emergency Sliding Boom



Fig.2: Locking Post at far end of LC gate hut



Fig.3: Locking Post at near end of LC gate hut

EMERGENCY SLIDING BOOM:

- Emergency Sliding Boom is provided in addition to Electric Lifting Barrier at Level Crossing gates for passage of trains on proper signal when Electric lifting barrier is defective or damaged due to hitting of any road vehicle or failed due to any other reason and barriers can not be closed properly.

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Operation of Sliding Boom:

- Two Emergency Sliding Booms are installed on either side of the track. Emergency Sliding Booms are operated and locked by means of man power to close and lock the LC gate for passage of trains on proper signal when Electric lifting barrier is defective due to any reason and gate can not be closed and locked against road traffic.

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Operation of Sliding Boom:

- Emergency Sliding Booms are operated and locked as per the following.
- First one sliding boom situated at far end of the LC Gate hut is operated first by man power and forward end of the boom is inserted in the hole provided on the locking post fitted on the other side of the road.

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Operation of Sliding Boom:

- Key of ‘E’ type lock (painted in yellow colour) attached to the boom with iron chain is inserted in the lock fitted on the locking post and turned. This lock is unlocked and make the other ‘E’ type lock key (painted in red colour) free for turning and locking the boom in locking post.

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Operation of Sliding Boom:

- Now this boom installed at far end of LC Gate hut is locked by turning this key(painted in red colour) in the locking post fitted at other end of the road.

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Operation of Sliding Boom:

- Now Key (painted in red colour) is released from this locking post grounded at Far end of the LC Gate hut and this key is inserted in the other locking post grounded at near end of the LC Gate hut and turned to unlock the lock fitted on the locking post.

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Operation of Sliding Boom:

- Now 2nd Sliding Boom is operated by man power and key(painted in yellow colour) attached with the boom with iron chain is inserted in the ’E’ type lock fitted on the 2nd locking post at near end of the LC Gate hut and turned to unlock the lock.

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Operation of Sliding Boom:

- Space is available to insert the forward end of the boom in the hole of the locking post. Now forward portion of the boom is inserted in the hole provided on locking post.
- Now 3rd key (painted in green colour) can be operated to lock the boom in the locking post and released after locking the boom in the locking post.

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Operation of Sliding Boom:

- Signal can be given by this 3rd key (painted in green colour) for passage of trains on signal or in case of level crossing gate is interlocked with the station, slot for giving signal can be given to ASM with the help of this key.

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Slide boom


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Slide boom


Centre for Advanced Maintenance Technology
Maharajpur, Gwalior - 474005
Presents
Video Film on Operation
of Emergency Sliding Boom
RDSO
Indian Railways
Centre for Advanced Maintenance Technology

Height Gauges



Height Gauges

- Adequate arrangements shall be made to erect standard height gauges on either side of the overhead equipment or other equipment at every level crossing so as to ensure that all vehicles and moving structures passing under the height gauge also pass under the overhead equipment or other equipment with adequate clearance.

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Height Gauges

- The adequate clearance

  Maximum height above road surface- 4.78m

- Height Gauges should be located at a minimum distance of 8 meter from gate posts. In exceptional circumstances where site conditions do not permit, PCE can give exemption in these standards subject to a minimum of 8 meter distance from the centre line of the track. Road surface up to this point may be at the same level as the road surface inside the gate posts.

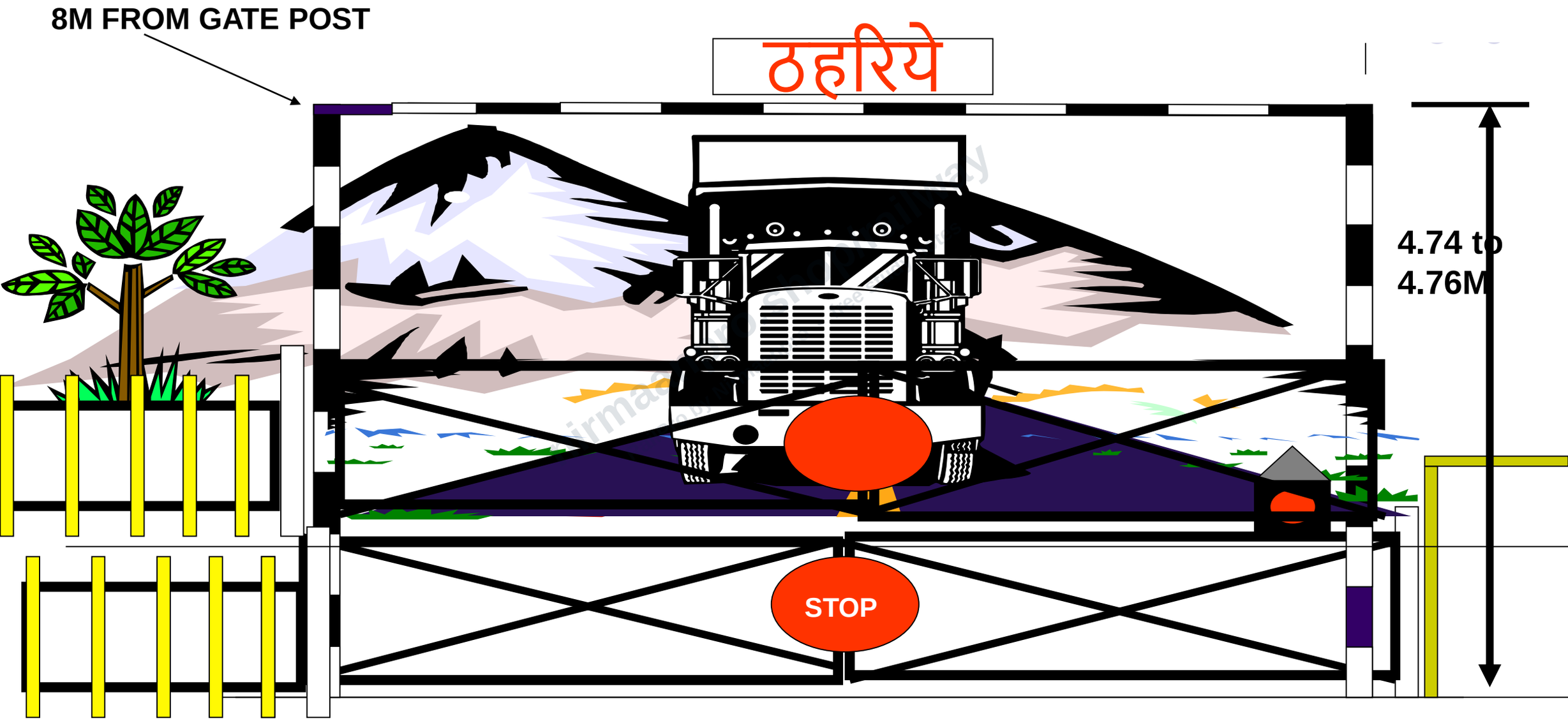
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Height Gauges

- Vehicles and moving structures, which cannot pass under the height gauge without striking or touching it, shall not be permitted to pass the overhead equipment or other equipment except in accordance with special instructions.

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Height Gauges




THANKS

Level Crossings

2.15.6_Tutorial on Census at L- xing

Periods 1



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5	LEVEL CROSSINGS	30
5.1	Level crossings: Classification, types.	2
5.2	Normal Position of Gates, Locking arrangement.	2
5.3	Equipment at LC	1
5.4	Features of track at and on approaches of level crossings, overhauling of LC, Maintenance of road surface and approach, track, Check rails-types, Visibility at LC.	4
5.5	Checking of equipment and knowledge of rules of gatemen, competency, medical, Refresher Statutory provisions of Railway Act on LC. GWR, Protection diagram, Slide boom operation, Height gauge.	3
5.6	Tutorial on Census at L- xing.	1
5.7	Inspection of L-xing, Duties of gatekeeper in case of fire, Hot axle, train parting, hanging part, flat tyre.	2
5.8	Speed breakers, Road sign Boards, Provision of new LC,Manning, De- manning, interlocking and replacement with ROB, closure, shifting and replacement with limited height subways/ RUBs , Elimination of LC.	5
5.9	Field visit to nearest LC gate and Calculation of census.	8
5.10	Technical Film/Video clip/Photographs pertaining to LC gate, safe operation & precautions.	2

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Census of LC (ACS No.100)

- **Periodical census of all LC`s (Manned/Unmanned) -** Once in 3 years
- LC`s Census taken for One week.

  (7 Days) to work out **TVU per day (Train units X Road vehicle units).**

  * **Train, Motor vehicles, Bullock Carts & Tongas considered as One Unit.**

  * **Cycle-Rickshaw /Auto Rickshaws considered as Half Unit.**

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Census of LC

- motorcycles/two wheelers are considered as ¼ units in the TVU

- ***Census to be carried out by Multi-disciplinary team consisting of representative of CE,S&T and Traffic.***

- ***TVU census may also be planned using CCTV camera by outsourcing this activity.***

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Census of LC

- *The mechanism shall be set up by DRM to ensure that representatives are present for the census by laying down advance time table for carrying out census of LC gates.*

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EXAMPLE

TVUs = (Train Units × Road Vehicle Units)

TYPE OF ROAD VEHICLE					
DAY	MOTORIZED FOUR WHEELER (1 Unit)	BULLOCK/CAMEL CART/TONGAS (1 Unit)	AUTO/CYCLE RICKSHAW (0.50 Unit)	MOTORIZED TWO WHEELER (0.25 Unit)	TRAIN (1Unit)
1	700	40	350	600	50
2	680	20	380	580	55
3	584	25	420	620	60
4	675	20	380	520	52
5	800	15	400	620	58
6	780	20	390	520	54
7	900	15	400	560	59
Total	5119	155	2720 ÷ 2 =1360	4020 ÷ 4 = 1005	388

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Total TVUs = {(5119+155+1360+1005) ÷7} x {388÷7}
= 1091.28x55.42 = 60479 Unit.



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Level Crossings

2.15.7_Inspection of L-xing, Duties of gatekeeper in case of fire, Hot axle, train parting, hanging part, flat tyre.

Periods 1



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Checking equipment and examination of Gateman in rules–

By JE/SSE/P.Way

(i) The equipment with the Gateman shall be checked by JE/SSE/P.Way **once in a month by rotation.**

(ii) Surprise day/night inspection of level crossing should be carried out to ensure presence and alertness of Gateman.

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Checking equipment and examination of Gateman in rules–



JE/SSE/PWAY-

(iii) The JE/SSE/P.Way shall ensure that the Gatemen have correct knowledge of rules by examining them periodically during his routine inspection and on appointment, promotion or transfer. He should not only educate them in rules, but also conduct **practical demonstration** of protection of level crossing in case of emergency.

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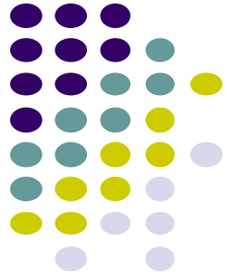
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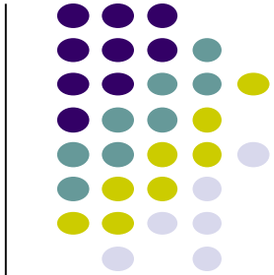


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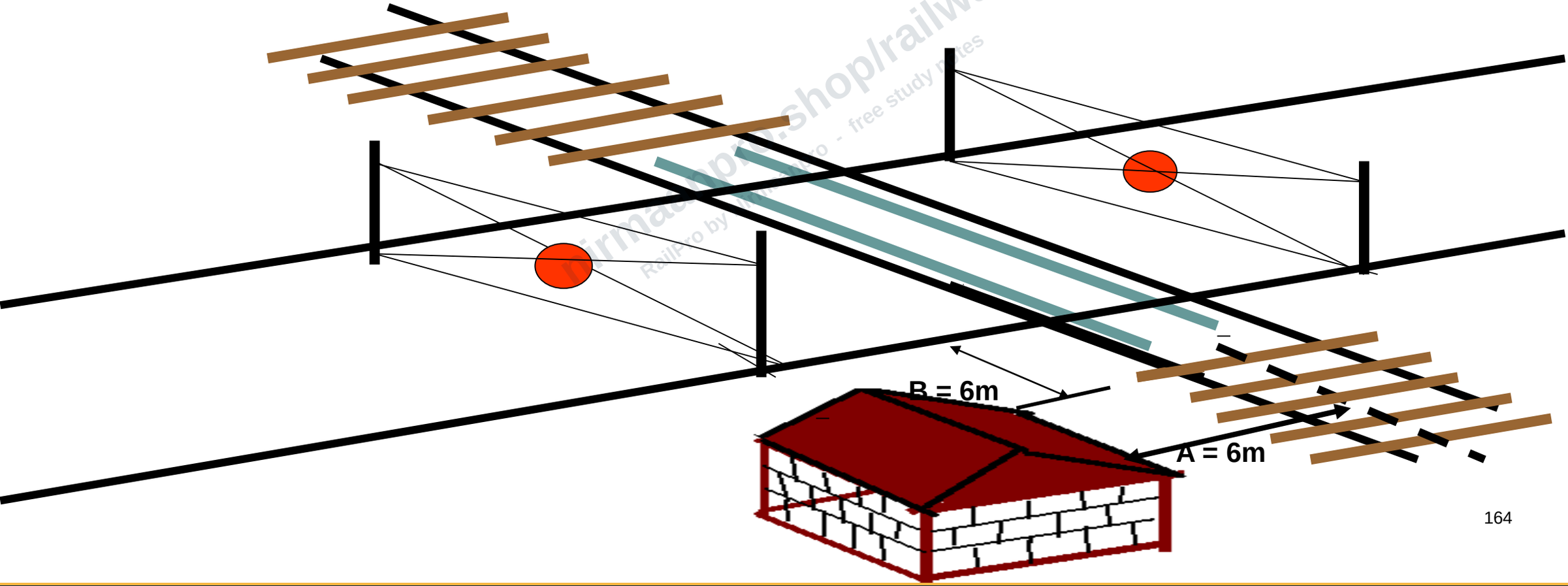
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MINIMUM DISTANCE OF GATE LODGE FROM

[A] CENTRE LINE OF NEAREST TRACK
[B] FROM EDGE OF ROAD METALLING



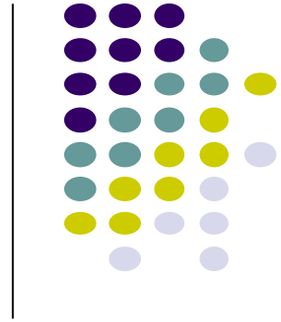
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Items to be checked at LC’s

- Road surface level upto Ht. gauge
- Protection diagram, OH date, TVU details to be painted on the Gate lodge
- Arrangement for fixing of banner flag at &Tri colour HS lamp (5m from end of check rail)

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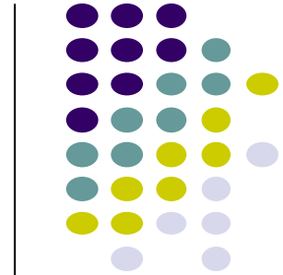
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  - When last examined?
  - When next due?
  - With or without Glasses?
- **Scrutinize Competency Certificate**
  - Date of issue & issuing authority
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- **Whether he is working as per duty roster?**

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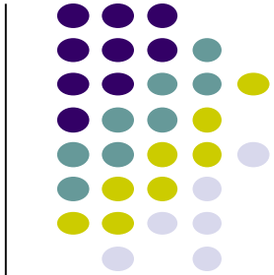
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Inspection of Level Crossings

- **Full particulars** regarding PME and Vision test of each gateman shall be maintained at gatelodge.
- **While handing over** and taking over charge, the gateman and relievers should jointly check all equipment and test all gears to see that they are in order.
- **Every gateman** shall be fully conversant with the use of Hand signals,detonators,fusees and protection rules.

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Appointment of gate keeper



- SSE to ensure that competent men selected to work as gate keepers should have been declared fit in A3 category. Literate gateman posted, capable of exchanging private numbers, on gates provided with telephone connections.
- Duty roster be available on gate & all gate keepers to strictly follow roster

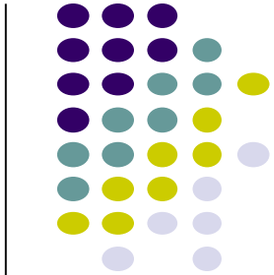
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Appointment of gate keeper

- Full particulars regarding periodic medical examination & test available on gate.
- While handing over/taking over duties, they should check all equipments & test all gears & signals.
- Gateman to be fully conversant with use of hand signals, detonators,fog signals & protection rules.

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Appointment of gate keeper



- The selected gatemen will be given initial and periodical training in DTC
- Competency certificate to be issued to Gate keeper by SSE/P.Way(In-charge)/Divisional Training centre
- Valid for 5 years.
- Medical fit in A-3

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Duties of Gateman.

- **Alertness** –

  Alert and be prepared to take immediate action should Danger be apprehend.

The keys shall be on his person.

- **Position , during passage of trains** –

  Stand facing the track, on gate lodge side of approaching trains. Observe all passing trains and be prepared to take action for safety of trains.

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Duties of Gateman.



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Duties of Gateman.

Action in Emergency –

- In case of any obstruction at the Level Crossing, the gateman should maintain the gate signal , if any, in ***ON*** position and if unable to remove, protect the line and should take immediate action to inform Mate, JE/SSE(P.Way) and nearest Station Master through messenger or any other means.

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Duties of Gateman.

Action in Emergency –

- He shall watch all passing trains and keep sharp look out for any unusual like hanging parts,flat tyre,hot axle box(Any symptoms of Hot axle (like de-colorization of bearing, heavy grease oozing, breakage of axle box cover plate, end plate etc.), hanging chains, hanging battery, any vehicle/wagon/train/ battery box on fire, shifted load, falling material like brake blocks, brake beams, safety bracket, vacuum cylinder or any other situation endangering safe running of trains.

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Duties of Gateman.

Action in Emergency –

- If anything unusual is noticed during the passage of the train or other mishap likely to foul or obstruct the railway line, gateman shall show a Stop hand signal to stop the train. In case it is not possible to stop the train by the exhibition of a Stop hand signal, he shall advise the station to stop and examine the train.

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Duties of Gateman.

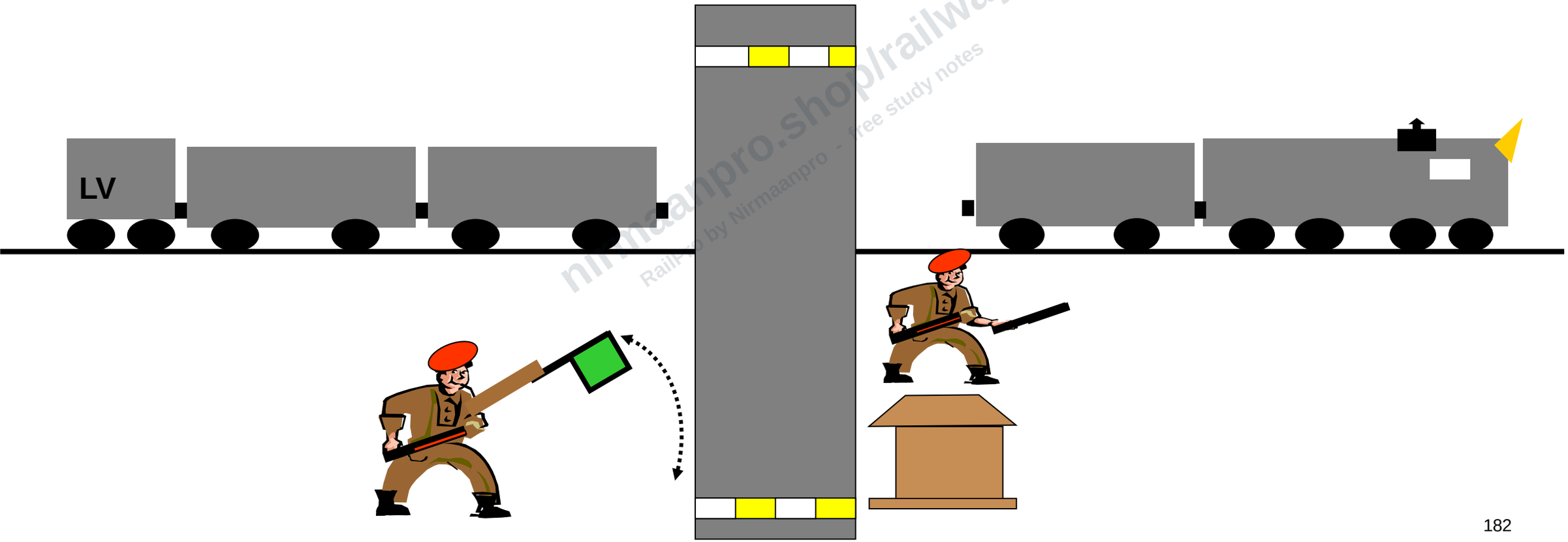
- **Action during parting of train** –

  On noticing, that the train has parted, he shall **not show a stop hand signal** to the driver , but shall try to attract the attention of the driver and the Guard by shouting, gesticulating or other means.

- **He shall ensure** that Gate lamps and lamps of all gate signals are lighted and kept burning continuously from sunset to sunrise.

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ACTION TAKEN IN CASE OF TRAIN PARTING



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Duties of Gateman.

- **No gateman** shall leave his gate unless other gateman has taken charge of it. If required in emergency , he should close and lock the gate for road traffic.
- **The gateman** should see that the channel for the flange of the wheel is kept clear.
- **The gateman** should keep the road surface well watered and rammed.

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Duties of Gateman.



Duties of Gateman.

- **If any gate or barrier** gets damaged/out of order at Level crossing, he should use spare chain and Disc for closing against road traffic and inform Station Manager, Gangmate, PWI.
- **When the gate signal is defective** , the gateman should close and lock the gates on sighting the train and hand signal or pilot the train past defective signal and advice Driver about the defective signal to next Station Manager.

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Duties of Gateman.

- **The gateman** should ensure that the equipment supplied to the gate is in good order and ready for immediate use.
- **Every gateman** shall as far as possible prevent trespassing by person or cattle.

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Duties of Gateman.

Action in Emergency





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Level Crossings

2.15.8_Speed breakers, Road sign Boards, Provision of new LC, Manning, De-manning, interlocking and replacement with ROB, closure, shifting and replacement with limited height subways/ RUBs , Elimination of LC

Periods_1



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Speed Breaker

Item	Specification
Speed Breaker (CS No.128 dated 05.03.12)	1.One speed breaker to be provided on either approach of LC at a distance of **about 20 M from gate post of LC covering full width of road including berms**.
	2. This may require construction of speed breaker by railway, out side the railway boundary
	3. For road with central median/ one way road, speed breaker to be **provided on entry side of the road only. For safety reasons ,paint markings should be provided and their maintenance ensured.**

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Speed Breaker

Item	Specification
Speed Breaker	Speed breaker boards are provided at the following distance from speed breaker 1.National/State Highways-120m 2.Major District Roads -90m 3.Other District Roads -60m 4.Rural Roads-40m

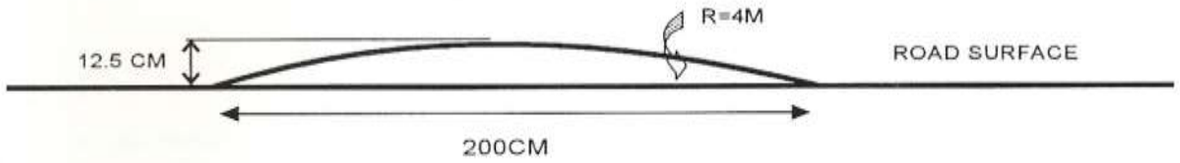
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Speed Breaker

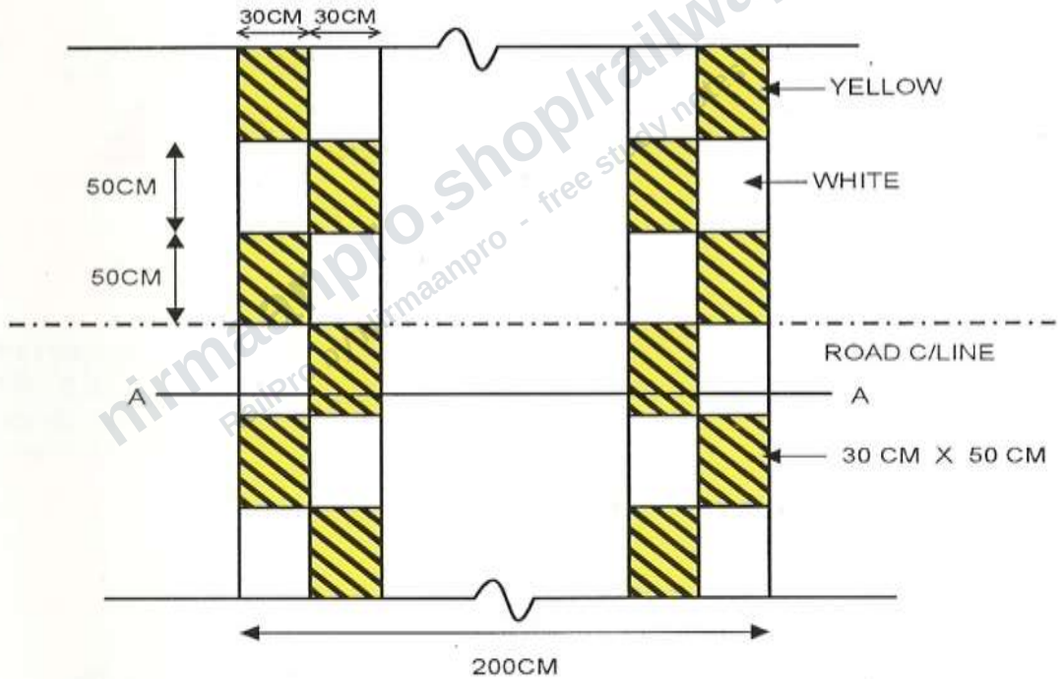
Item	Specifications
Speed Breaker	**Provision of rumble strip on approaches of Level crossings as per standard Design is responsibility of Road Authorities/State Govt**. They should be pursued to ensure provision of it as per standard design over **total width of road i.e. edge of the berm to edge of berm with proper road warning signs as per standard design.** **However it is incumbent upon railways** to provide speed breakers as per standard design on both manned as well unmanned level crossings irrespective of approach roads are metalled /Unmetalled, **as a temporary safety** measure, till such time these are replaced with rumble strips of proper design by the road authorities.

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SPEED BREAKER DESIGN



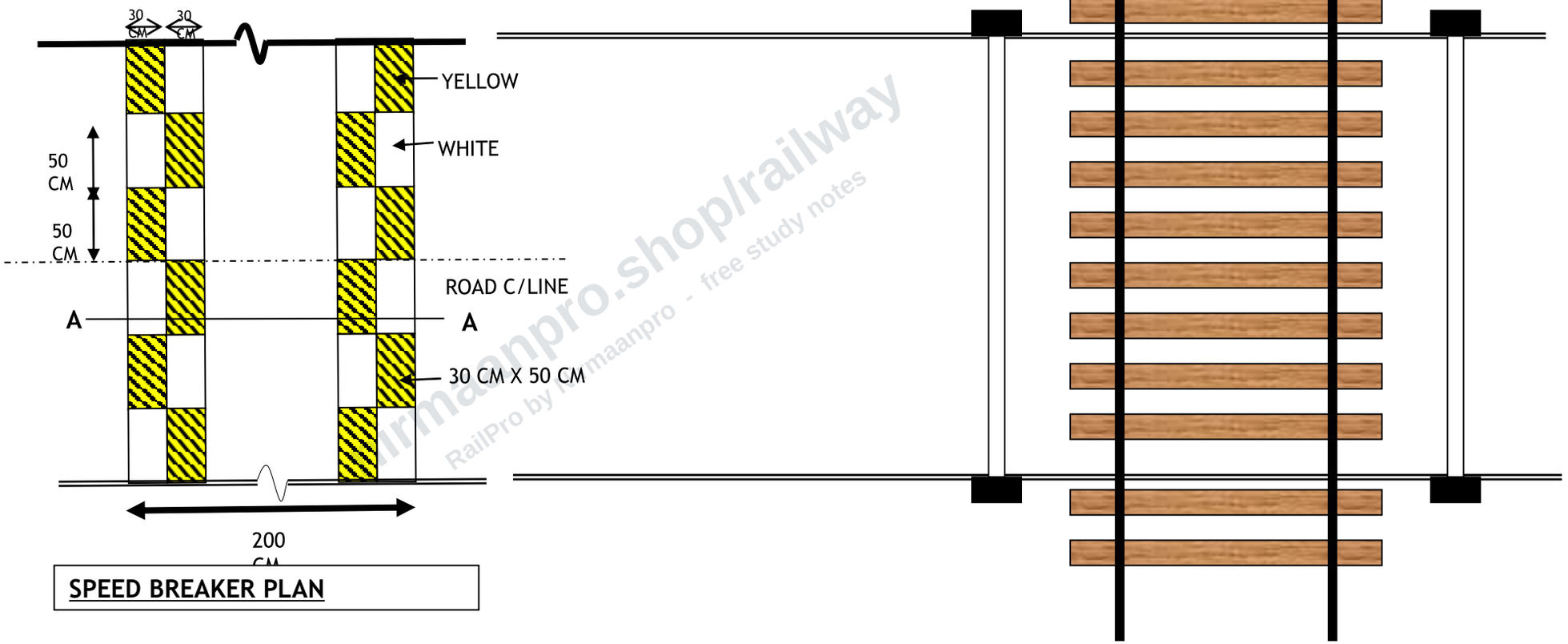
SPEED BREAKER - SECTION - 'AA'



NOTE - THE HUMP SHOULD EXTEND TO THE FULL ROADWAY WIDTH APPROPRIATE BASE COURSE MATERIAL SHOULD BE EXTENDED OVER THE SHOULDERS FOR PLACING THE HUMPS OVER THESE.

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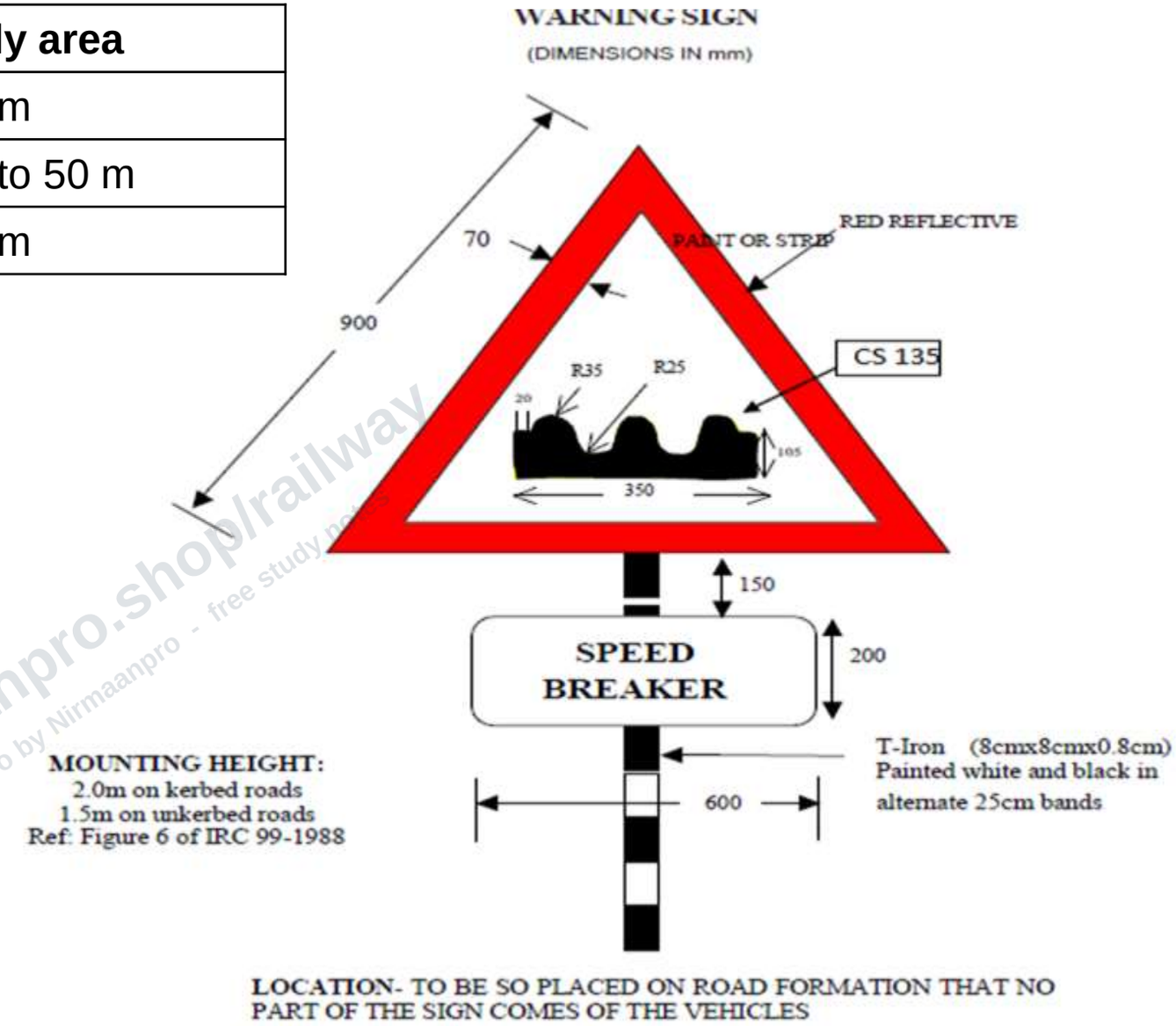
Speed breaker



SPEED BREAKER PLAN

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Class of road	Plain area	Hilly area
Class I	120 m	60 m
Class II	60 to 90 m	40 to 50 m
Class III	40 m	30 m

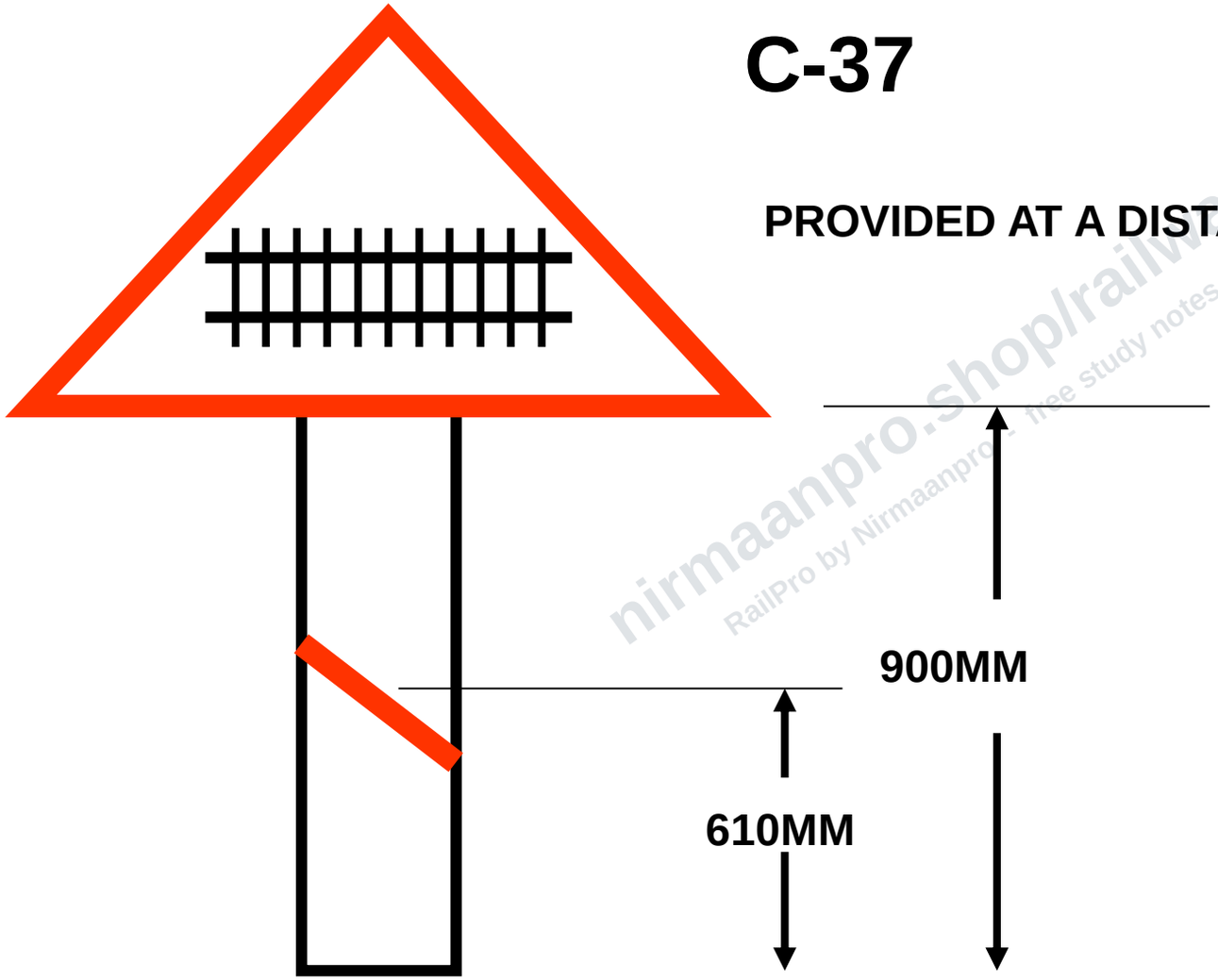


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ROAD SIGN BOARDS FOR MANNED LEVEL XING

C-37

PROVIDED AT A DISTANCE OF 50- 100 M FROM GATE.

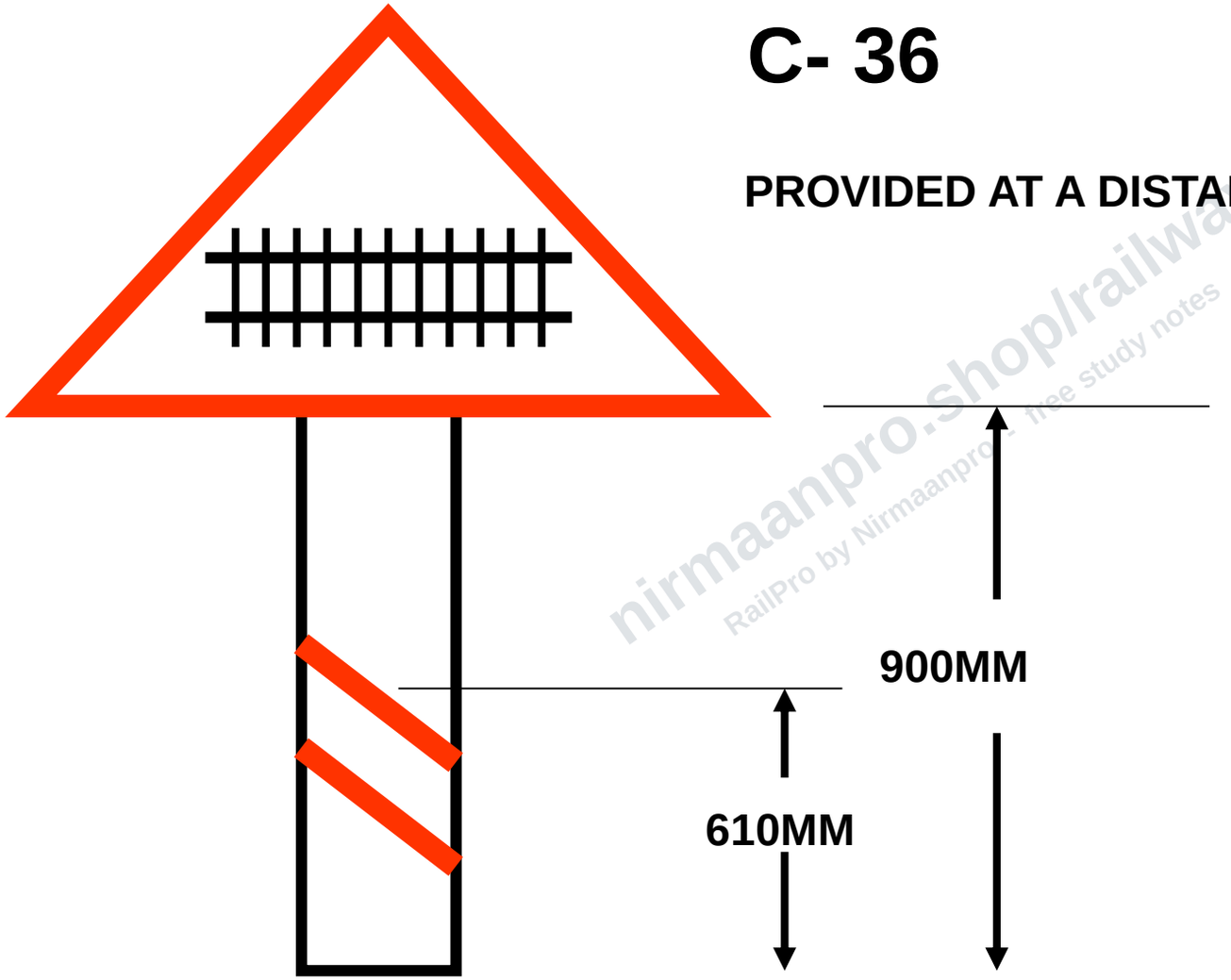


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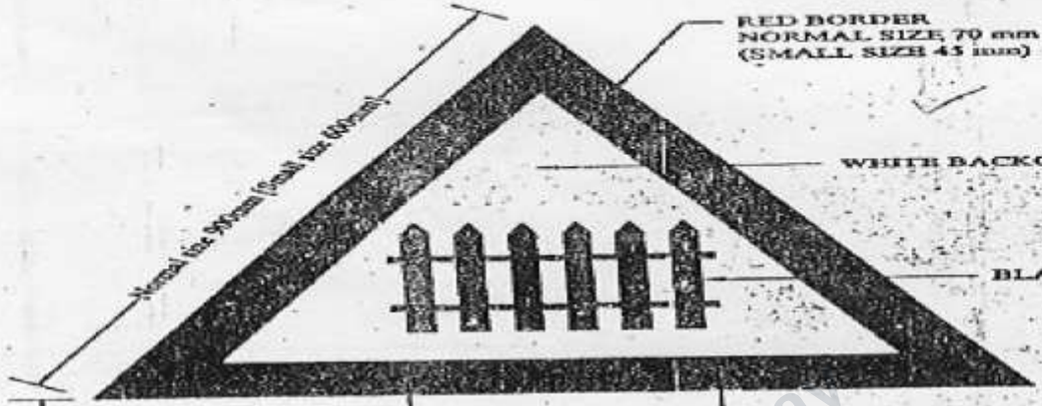
ROAD SIGN BOARDS FOR MANNED LEVEL XING

C- 36

PROVIDED AT A DISTANCE OF 200 M FROM GATE.



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Based on Drg. No.C-37 of MV Act, 1939.

SOUTHERN RAILWAY

SKETCH SHOWING THE SECOND SIGN BOARD FOR ROAD USER AT 50-100m FROM THE LEVEL CROSSING [MANNED]

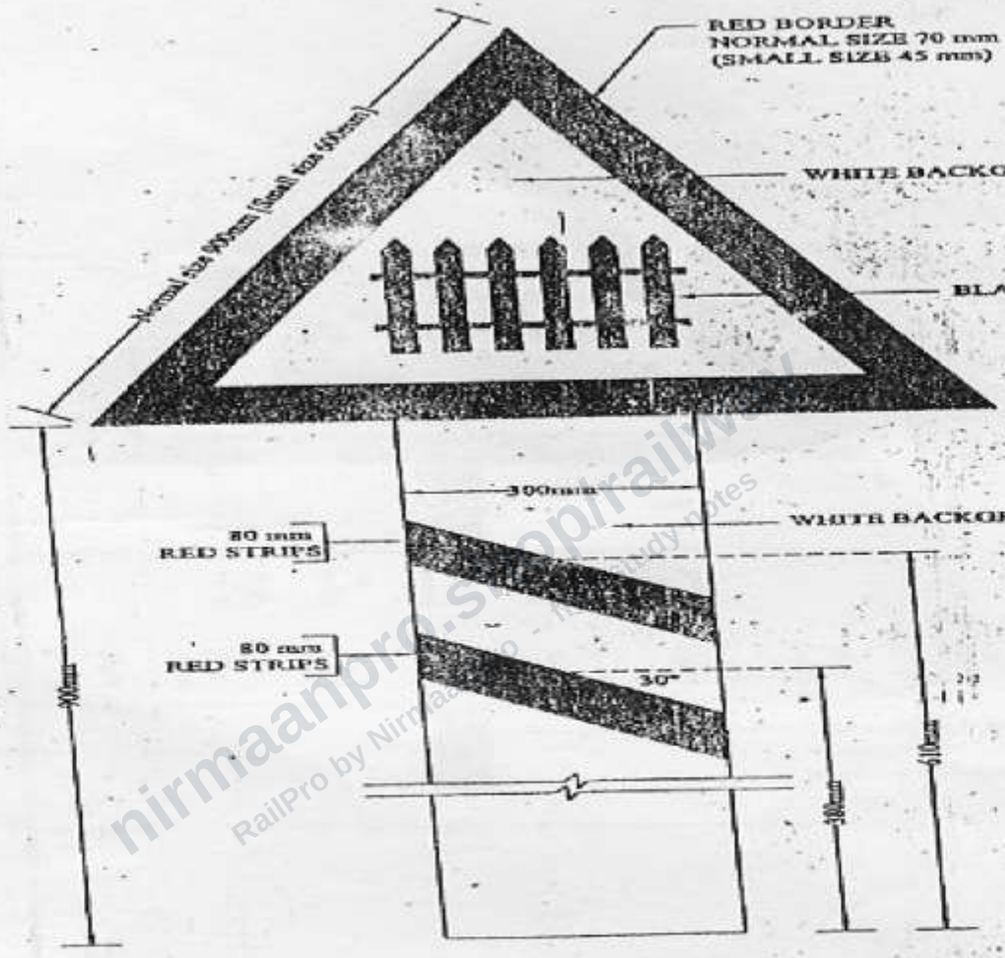
NOT TO SCALE

Drg. No. CE / LC / SK-4

AXEN/P&D

CAD: R. SUDHARSAN
CKD: S. PARTHASARATHY
CAD No. SIGN BOARD M2

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Based on Drg. No.C-36 of MV Act, 1939.

SOUTHERN RAILWAY

SKETCH SHOWING THE FIRST SIGN BOARD FOR ROAD USER AT 200m FROM THE LEVEL CROSSING [MANNED]

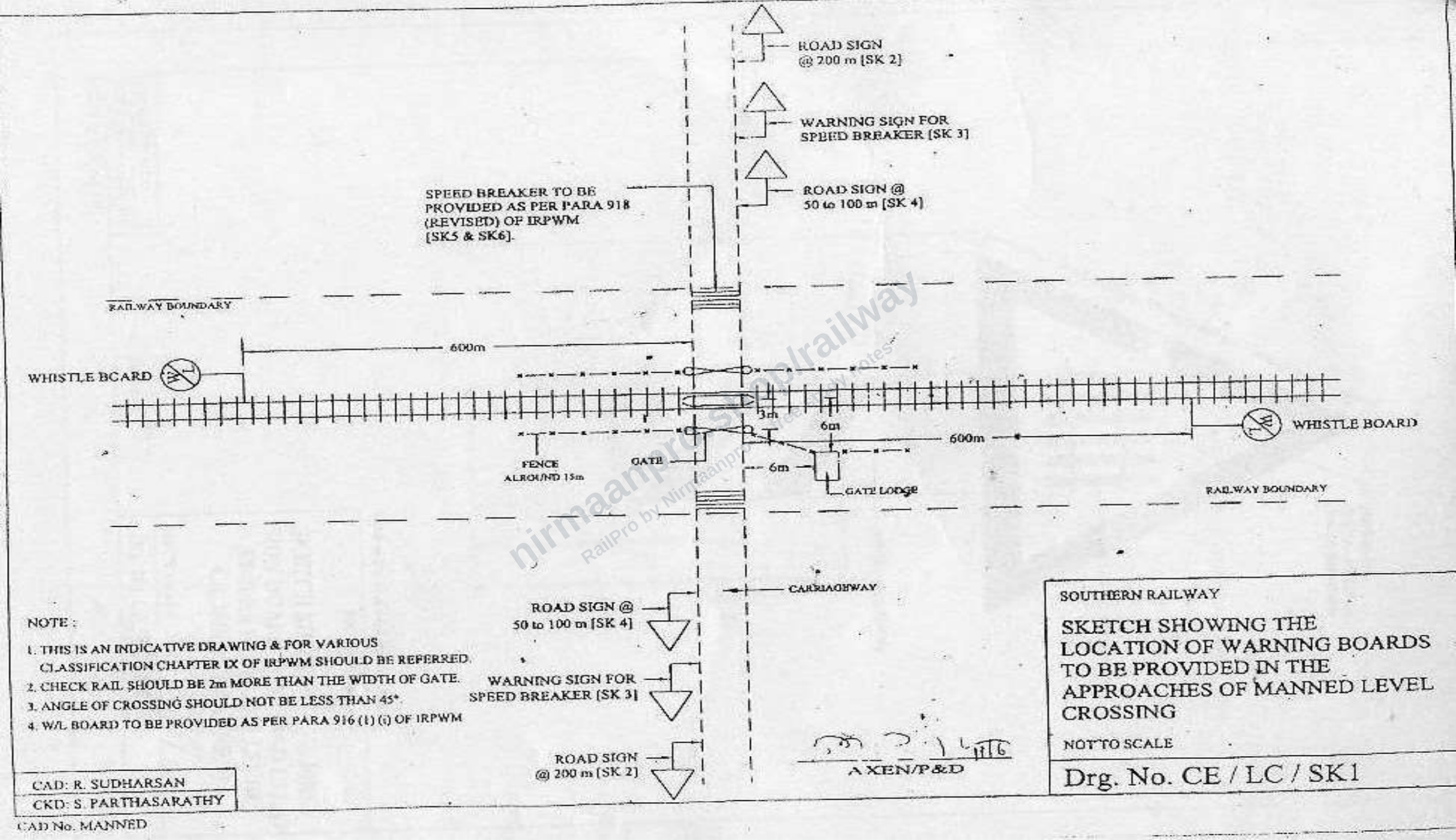
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Drg. No. CE / LC / SK-2

CAD: R. SUDHARSAN
CKD: S. PARTHASARATHY

AXENPAD

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NOTE :

1. THIS IS AN INDICATIVE DRAWING & FOR VARIOUS CLASSIFICATION CHAPTER IX OF IRPWM SHOULD BE REFERRED.
2. CHECK RAIL SHOULD BE 2m MORE THAN THE WIDTH OF GATE.
3. ANGLE OF CROSSING SHOULD NOT BE LESS THAN 45°.
4. W/L BOARD TO BE PROVIDED AS PER PARA 916 (1) (i) OF IRPWM

AXEN/P&D

SOUTHERN RAILWAY

SKETCH SHOWING THE LOCATION OF WARNING BOARDS TO BE PROVIDED IN THE APPROACHES OF MANNED LEVEL CROSSING

NOT TO SCALE

Drg. No. CE / LC / SK1

CAD: R. SUDHARSAN
CKD: S. PARTHASARATHY

CAD No. MANNED

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Provision of New LC

- ON NH, SH & their bypasses and important city roads only grade separators are to be provided. Relaxation of this clause will require Board's prior approval.
- In case of other important roads, it is preferable to provide grade separators. However, depending upon the traffic density, manned LC can also be considered.
- If provision of new LC is inescapable, only manned LC will be provided. (not applicable in private siding)

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Interlocking of LC Gates

- After every round of Census, LC gates qualifying for Interlocking as per above criteria (TVU>25000), should be proposed for interlocking through preliminary works programme(PWP/LB).

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Manning of Unmanned LC

- Based on traffic density and visibility etc, U/M LCs have been categorized in three categories for Manning.

Category	TVU	Visibility	
Category I	Above 3000	-	
Category II	Above 2500	Restricted to 800 M	
Category III	-	-	All U/M LCs which do not fall in cat. I & II and which can not be eliminated as per extent policy

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Manning of Unmanned LC

- All U/M LC on Rajdhani/Shatabdi Routes where MPS is 120KMPH or more, should be manned on priority.
- Manning of U/M LC's should be the last resort. Effort should be made to close them by construction of LHS/Diversion/ RUB/ROB etc.
- In any block section not more than 6-7 manned LC's are permitted (for the convenience of on duty ASM.

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Elimination of the LC

- **A detail survey of existing manned & U/M LCs should be done with a view to eliminate them.**
- **Feasibility of elimination of LC's may be examined through –**
  - **Construction of sub way with adequate drainage arrangement.**
  - **Construction of road along railway boundary to divert the road traffic to nearest LC / bridge**

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Elimination of the LC

- **The roads for closure of LC gates can be diverted through existing water way bridges if the water way remaining after treating one span as closed is sufficient to cater to the requirement of design discharge.**

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Elimination of the LC

- **Construction of ROB / RUB**
- **Construction of light weight ROB**
- **Construction of ROB on deep cutting**
- **Closure of low TVU gates**
- **During execution of Gauge conversion & doubling works, etc.**
  - Railways can De-man an existing L-Xing gate in case TVU falls below 80% of the value of the crieteria laid down for Manning.

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Criteria for replacement of existing LCs with ROB/RUB

- Census(TVU) should be **One lakh** per day for replacement with ROB/RUB on Cost Sharing Basis.
- Relaxation can be given –

a) Suburban section having high frequency of train.

b) Near station where detention to road traffic is very high.

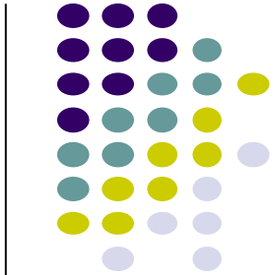
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New policy under formulation

- **Railway board is considering to waive off the criteria of minimum TVU of 1 lakh for eligibility of LC on cost sharing.**
- **Railway may take up the work of ROB on cost sharing basis in lieu of any LC if such proposal is received from state Government.**

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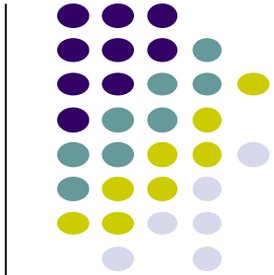
Elimination of LC by ROB/RUB



- Preference should be given to LC on trunk route vis-à-vis LC's on branch lines.
- In case ROB/RUB in lieu of busy LC gate in municipal areas where light vehicular traffic is considerable, additional light overbridge with ramp for light vehicle may be included in the proposal.
- Closure of LC should be ensured before commissioning of new ROB.

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Elimination of LC by ROB/RUB



- Wherever, LC could not be closed after construction of ROB, Railway board should be immediately informed through proer channel.
- For framing the proposal of ROB/RUB on cost sharing basis, following are to be ensured
  - prior consent of state govt for sharing the cost
  - Collectore permission for closure of LC gate after commissioning of ROB/RUB

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Construction of LHS/RUB

LHS	RUB
In lieu of existing LC gate	In lieu of LC gate or facilitation work for sponsoring agency
Constructed at Railway Cost (DRM Power-2.5 Cr)	Constructed on cost sharing/Deposit term basis
Height 3.6m to 5.o m	Height generally 5m or more

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Precautions in LHS/RUB

- Rly should provide water-logging free subway by making watertight RCC box and adequate drainage arrangement.
- Carriage way and vertical clearance should be designed to cater all types of vehicles plying through the LC.

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LHS/RUB/ROB

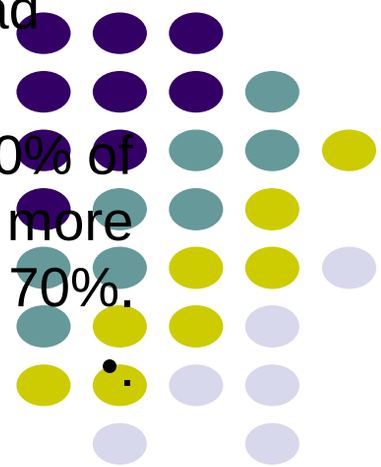


Basic Concepts

1. SAFETY:

- Level crossings the weakest link, most unsafe element and source of accidents on Railway track from safety point of view.
- Due to increase in train speed and non observance of rules by road users, these are more critical.

On Indian Railway, Level crossings contribute approximately 40% of consequential train accidents. In terms of casualties, they contribute more than 70%.



- 3

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GENERAL ; SAFETY contd..

- Most of the accidents take place on unmanned level crossings.
- Therefore unmanned level crossings are most vulnerable
- Accidents at unmanned level crossings primarily occur due to negligence of road users.
- Manned level crossing gates are also prone to accident due to human error on the part of Railway staff as well as forcible opening/crossing by road users.

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GENERAL

- OPERATION:
- Potentially unsafe locations, congestion points for road-rail users and operationally bottlenecks for Railways, causing loss of line capacity by about 5%.
- Due to large nos. of fatal accidents at unmanned level crossings, Railway has restricted provision of the unmanned level crossing, and currently, provision of U/M level crossings is almost banned.

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GENARAL

- It results in stoppage of road vehicle for hours.
- O&M cost is also very high.
- On the whole, a manned gate does not satisfy Indian Railways goal.
- Hence, increasing need is being felt to eliminate these Level crossings, especially the unmanned ones.

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Thus….

- IN NO CASE A LC IS TO BE ADDED IN NEW PROJECTS.
- EFFORTS ARE TO BE MADE TO ELIMINATE EVEN EXISTING ONES
- IT SHOULD BE KEY CONCERN TO ALL, BE STATE GOVT OR CENTRAL GOVT OR ANY OTHER ORGANIZATION to eliminate UM LC.

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Instructions from Rly Board

1. Construction of ROB/RUB in replacement of busy LCs- Provision of ramps/subways near the site of LC for the use of light vehicular traffic. Board's letter no. 90/CE-I/BRO/157 - dated 24.09.1991

2. Reduction in number of level crossings. Member Engineering, Railway Board's Letter No. 95/CE-I/LX/10 dt.15.02.1995.

3. Item No. 4 Indian Railway Vision- 2020 (2009-10)

4. Item No. 35 & 36 of Railway Budget Speech'10-11

5. Item No. 41 Railway Budget Speech'2011-12

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- 6. Revised criteria of manning. AMCE, Railway Board's letter No. unmanned level crossings 2006/CE-I/LX/WP/Pt. dated 30.08.2011.
- 7. Delegation of power to sanction. Board's letter no. F(X) 2008/PW/7 works under PH 30 dated 10.03.2010
- 8. Delegation of power to sanction. EDCE/B&S-II Railway Board, letter for works under PH 30 in year 2011.

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- 9 Dispensation of CRS sanction for RUB through cut & cover method EDCE/B&S-II Railway Board, vide letter. ter no. 2011/CE-III/Subway/CRS-1 dated 21.11.2011
- 10. Provision of Light over bridge and FOB at LC gates for use by light Vehicular traffic and pedestrians. Rly Bd letter no. 2008/CE-I/Misc./2/RUB/(Pt) dated 12.01.2010
- 11. FOB/RUB addition not a Material modification. Board's letter no. 2010/CE-I/Estt.3 (BRO) dated 06.09.2011

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- 12. Construction of RUB through funds provided under MPLADS MPLADS. Board's letter No. 2006/CE-I/BRO/82/ (policy) dated 27.02.2007.
- 13. Construction of RUB through funds provided under NREGA. AMCE/ railway Board letter no.2007/ CE-I/BRO/3 (NREGA) dated 23.08.2011.
- 14. Joint Circular for Mega Traffic Block of six hours on weekends for Integrated Maintenance work. Board's letter no. 2010/CE-I/Estt.3 (BRO) dated 06.09.2011.
- 15. Diversion of Road upto 1 km through railway land . Chairman, Railway Board D.O. 2007/ Safety (A&R)/3/13 dated 07.11.2006

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- 16. Diversion Road through one of spans of railway bridge Member Engineering, Railway Board's Letter No. 95/CE-I/LX/10 dt. 15.02.1995.
- 17. Level crossings on new line projects. Adviser Projects, Rly Board's Letter No. 2011/W-I/Gen/Circulars dt. 04.02.2011.

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- 18. Elimination of LC from New line, GC and Doubling projects. Adviser Projects, Rly Board's Letter No. 2011/W-I/Gen/Circulars dt. 21.06.11.
- 19. Central Road Fund (CRF) ACT-2000.
- 20. Sanction of Part Estimate of Bridge Proper. Board's letter no. 2011/CE-III/ROB/ Estt/3 dated 23.09.2011.
- 21. Sanction of ROB Share of the cost of ROB works as per the Board's letter no. 2011/CE-I/Estt/9/Railway ROB dated 20.09.2011

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- 22. Applicable charges and schemes of construction of grade separators. Board's letter no. 2010/CE-I/Misc./NH/ 4/Pt.IV dated 30.11.2011.
- 23. Works Programme 2012-13: Proposals under PHs - 29 & 30 New Board's letter no. 2011-B-103 dated 19.10.2011.
- 24. Master Plan for manning/elimination of unmanned LC. AMCE, Railway Board's letterNo.2008/ CE-I/LX/Target 2011-12 dt 17.10.11.

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Recent letters from Board

Letter no.	subject	Date of issue
2014/CE-iii/BR/bridge policy	Constructiob of RUB preferably by relieving span. By box pushing with the approval of PCE/CAO	29.5.15
2015/CE-IV/ROB/76	Appl of GAD of ROB/RUB step by step procedure.	4.3.15
2015/CE-IV/Misc/86	No piles in ROB foundation .	10.9.15
2006/CE-IV/Misc/2(rub)/pt2	Clarification regarding height of RUB to be 5.0 m, maintenance of drainage and lighting by state Govt.	21/26.11. 15
2015/CE-IV/ROB/Misc/49	Type of foundation in ROB being constructed by MORTH/NHAI as per design by them. In other cases with the approval of PCE/CAO.	22.3.16

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PROVISION OF LHS/RUB (CONTD..)

- RUBs to be provided at NH & SH as per IRC standard with Vertical clearance of 5.0 / 5.5 M.

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LHS/RUB



Closure by Providing Subway/RUB along with FOB with Ramp

• In order to minimize the problem due to water-logging during rainy season, for the convenience of pedestrian and 2-wheelers, FOB with ramp along with Subway/RUB can be provided.

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RUB/LHS with side ramps



PROVISION OF LHS/RUB (CONTD)…

- FOR DOUBLING/TRIPLING/GAUGE CONVERSION:
  - A). BY BOX PUSHING METHOD
  - B) BY CUT AND COVER METHOD

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BOX PUSHING METHOD



BOX PUSHING METHOD…



LHS BY CUT AND COVER METHOD

STEPS TO BE FOLLOWED:

1. Site selection/survey
2. Arrangement of men and machinery
3. Pre block works-
    (i)- approach road
    (ii) casting of base slab and boxes
    (iii) placing them in reqd location
    (iv) track preparation

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LHS BY CUT AND COVER METHOD(CONTD..)

4. During block work-

   (i)-dismantling of track, (ii)-cutting the formation

   (iii)-placing base slabs and boxes

   (iv) reconnecting the track and allowing the traffic

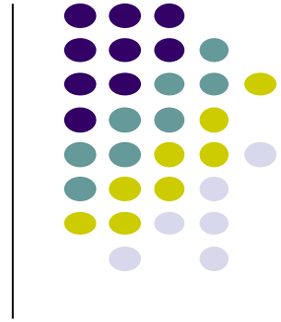
5. Post block works:

   (i) Retaining wall, approach road and drainage

   (ii) Height gauge and commissioning for road users

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2. Closure by Providing ROB



•ROBs can be planned in place of level crossings on cost sharing basis if it qualifies the TVU criteria, Else on deposit term.

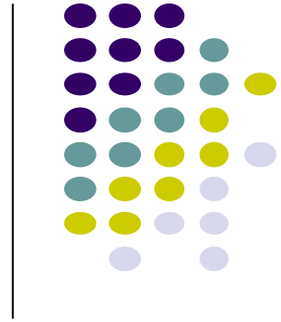
- ROB can have PSC girder, Composite girder or Bow string girders.

•Composite Girders are normally used for spans more than 24m.

•For longer spans, Bow string girders are better.

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3. Closure by Providing Diversion Roads



- Many LCs can be closed by providing Diversion Roads in lieu thereof, in consultation with the State Govt.
- In order to facilitate construction of DR, policies have been issued to take the same through Railway land, even up to one kilometer long, to divert road traffic to nearby level crossings or Grade Separator and to pass the Diversion Road through one of spans of Railway Bridge, if technically feasible and safe

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4. PLAIN CLOSURE –



•Low TVU unmanned LCs having no road on either side can be closed directly.

- Now, no CRS sanction is required.
- DM’s consent for closure is required .

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Construction of LHS/RUB

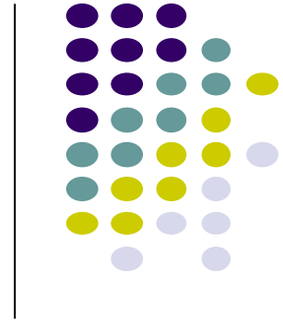


Small Subway

- Whenever any level crossing is not being planned for closure due to any technical reason, a small subway of 2.5m vertical clearance x 4m carriage way can be provided to ease out the pressure from level crossing, so that pedestrians, 2/3 wheelers, LMV can cross.

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Use of PSC girders in ROB



- For ROB's, use of In-situ casting of PSC girders of span>24.4m is prohibited, in view of avoiding long duration speed restriction and traffic block.
- Use of pre-cast PSC/prefabricated composite steel/bow-string girder for any span length(depending upon the site condition and requirement) is permitted.

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JE Bridge – Induction – Phase – I – 2.16 (Periods-2)

I. Classification of lines

II. Latest Policy Circular No 6

III. Speed certificate

IV. Opening of Line for Public carriage

V. Commission of Railway Safety
(Brief history, organization, functions/duties)

II. Extracts from P- Way manual

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CLASSIFICATION OF LINES

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CLASSIFICATION OF LINES

(Ref: Correction Slip No. 109 to IRPWM dt. 15.02.08)

IRPWM Para 202(1) - BG lines have been classified into 6 groups A to E based on future maximum permissible speed

- **Group A – Speeds upto 160 kmph**
- **Group B – Speeds upto 130 kmph**
- **Group C – Suburban section of Mumbai, Delhi, Chennai and Kolkata**
- **Group D Spl – Speed upto 110 kmph & Annual GMT 20 GMT or more**
- **Group D – Speed upto 110 kmph and Annual GMT less than 20**
- **Group E – All other sections and branch lines with speed upto 100 kmph.**

Gr A, B, C and (D & D Spl) routes have been identified

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Latest Policy Circular no 6 dated 31-10-2018

1. **Railway Board** is the Final Authority to introduce a new locomotive or rolling stock under section 27 of "The Railway Act, 1989"

2. Use of **Rolling Stock** already sanctioned by Board or running on any sections of Railway – **GM approval** as per procedure for opening for Public Carriage of passengers Rules 2000 as amended from time to time.

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Latest Policy Circular no 6 dated 31-10-2018

3. Determination of Speed of New Design of a locomotive or Rolling Stock –

Determination of provisional speed

New design of Loco / Coaching Stock	Existing Design of Loco / Coaching Stock
Certified by ED / Standards (Motive power)/ RDSO in Consultation with other ED Track/Br/Structures	
80 KMPH – BG Passenger 65 KMPH – BG Goods 60 KMPH – MG Passenger 45 KMPH – BG Goods 35 KMPH – NG	105 KMPH – BG Passenger 75 KMPH – BG Goods 75 KMPH – MG Passenger 50 KMPH – BG Goods 40 KMPH – NG Can be further Increased if no adverse report

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Latest Policy Circular no 6 dated 31-10-2018

Determination of Final Maximum speed

- **Detailed Oscillation trials on test stretches, increments from provisional speed with GM sanction after obtaining CRS permission (for passenger running lines) based on Joint safety certificate**
- **The GM sanction valid – 2 years, after which requires revalidation**
- **Based on Oscillation trial results, Speed Certificates – Provisional and Final for New Design of Loco / Coach shall be issued by Board (proposal forwarded by RDSO).**

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Latest Policy Circular no 6 dated 31-10-2018

Introduction of Passenger Train on Specific route

- **With Board's approval, Passenger trains shall be introduced in a section subject to the Sectional speed (GR 4.08).**
- **Subject to speeds up to 105 KMPH on BG and 75 KMPH on MG**
- **GM approval for first type of Passenger train with 24, (+) coaches**

For speeds above 105 KMPH and upto 110 KMPH on BG

- **All above shall be ensured – Then PCE can introduce passenger train at this speed.**
- **PCE shall ensure that track is being maintained as per standards specified in C&M 1 Vol. 1.**

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Latest Policy Circular no 6 dated 31-10-2018

For speeds above 110 KMPH and upto 120 KMPH on BG

- All earlier for lesser speeds shall be ensured.
- Zonal Railway shall carry out Route Proving Run to record vertical and transverse accelerations with personal approval of PCE, who shall ensure that track is being maintained as per standards specified in C&M 1 Vol. 1.
- Joint safety Certificate shall be signed by PCE, PCME, PCOM, PCSTE, PCEE
- Results should be satisfactory
- CRS shall be kept advised of the programme along with all documents above.
- **PCE can permit first train at above 110 KMPH and upto 120 KMPH on BG**

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Latest Policy Circular no 6 dated 31-10-2018

For speeds above 120 KMPH and upto 130 KMPH on BG

- RDSO shall carry out Confirmatory Oscillograph Car run (COCR) **with personal approval of GM.**
- Joint safety Certificate shall be signed by PCE, PCME, PCOM, PCSTE, PCEE
- PCE shall ensure that track is being maintained as per standards specified in C&M 1 Vol. 1.
- CRS shall be kept advised of the programme along with all documents above.
- If Results of COCR are satisfactory, RDSO shall issue speed certificate.
- **GMs approval for first train run is required.**

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Latest Policy Circular no 6 dated 31-10-2018

For speeds above 130 KMPH on BG and above 75 KMPH on MG

- RDSO shall carry out Confirmatory Oscillograph Car run (COCR) with prior approval of CRS.
- Joint safety Certificate shall be signed by PCE, PCME, PCOM, PCSTE, PCEE
- PCE shall ensure that track is being maintained as per standards specified in C&M 1 Vol. 1.
- CRS shall be kept advised of the programme along with all documents above
- Zonal Railway shall carry out COCR to record vertical and transverse accelerations. If Results are satisfactory, RDSO shall issue speed certificate.
- GMs shall approach Board through CRS and CCRS for approval for first train run is required.

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SPEED CERTIFICATE

A speed certificate consists of the following information / documents

- Nomenclature of the rolling stock
- Axle load
- Maximum Permissible speed in loaded/Empty conditions (in case of wagons)
- Tractive efforts/Braking forces
- Drawings – plan, section, elevation and profiles, moving dimensions
- Details of Track, Bridges, S&T, OHE on which permitted,
- Operating requirement like requirement of locos etc.,,
- loading conditions, safety precautions during loading, running toward the staff, public

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JOINT SAFETY CERTIFICATE

- Based on the provisional/final speed certificate, the Mech/Elect Engineer makes a requisition to process for sanction of CA for the introduction of the rolling stock
- HQ BR office, coordinates for processing the sanction. The speed certificate to be studied thoroughly to ascertain the departments involved and to comply various conditions prescribed in the speed certificate.
- Speed certificate sent to CTE to get the track certificate duly signed by DyCE/Track and countersigned by CTE. The track certificate consists of speed recommended for each sections of the Zonal Railway based on the conditions of speed certificate
- Similarly Bridge certificate is to be obtained from DyCE/Br/HQ duly countersigned by CBE which consists of any Speed Restriction on account of bridges based on the bridge requirements prescribed in the speed certificate.
- The Emergency braking distance for the rolling stock is to be obtained from Mechanical/Electrical department. The EBD is normally restricted to 1 km to avoid second distant signal and thus speed is restricted in certain cases to obtain EBD within 1 km.

JOINT SAFETY CERTIFICATE

- JSC is jointly signed by PHODs of Civil, Mech, Elect, S&T & Operating about compliance of the conditions in the speed certificate for the rolling stock.
- The JSC should consist of
  - The nomenclature of the Rolling stock, Drawing No
  - Reference to speed certificate & amendments
  - Proposed speed and Max permissible speed in the speed certificate
  - Sections proposed for operations, Details of the speed restrictions
  - Special restrictions, if any
  - Compliance to the conditions of speed certificate (optional)
- Circulated with a copy of speed certificate to all the departments to specify the compliance or concur the compliance proposed by the dept to each conditions of the speed certificate
- If any condition is not complied in any section, then the Rolling stock can not be operated in that section.
- Once the draft JSC is vetted by all technical departments, a fair JSC is prepared and put up to all PHODs for signature

COACH, LOCO, WAGON SANCTIONED BY CENTRAL GOVT. CAN BE RUN OVER I.R

110 KMPH

- New Stock
- RDSO speed certificate for consist or generic certificate for speed
- Joint safety Certificate
- GM sanction
- For any other train , only GM sanctioned is required

120 KMPH

- RDSO speed certificate for consist or generic certificate for speed and higher speed
- Route Proving Run conducted by CTE,CPTM, CEDE & CRSE
- Joint safety Certificate
- GM sanction
- For similar consists of other trains only GM sanctioned is required

UP TO 130 KMPH

- RDSO speed certificate for specific section for COCR
- JSC for COCR
- GM sanction for conducting COCR
- COCR conducted by RDSO
- RDSO speed certificate for regular operation for consists
- Joint safety Certificate
- GM sanction
- For similar consists of trains GM sanction is required.

UP TO 160 KMPH

- RDSO speed certificate for specific section COCR
- JSC for COCR
- CRS sanction for conducting COCR
- COCR conducted by RDSO
- RDSO speed certificate for regular operation of stock
- Joint safety Certificate
- GM approach to Central Govt. through CRS/CCRS for sanction of Cent. Govt.
- Central Govt. Approval
- For similar consists of other trains CRS sanction required without COCR

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दक्षिण रेलवे / SOUTHERN RAILWAY

रेलपथ प्रमाण पत्र / Track Certificate

I do hereby Certify that the track on various BG sections of Southern Railway, as mentioned in Annexure – A to Joint Safety Certificate No. 959 BG, the weakest portion of which is shown against the relevant sections is to the required strength can safely take WDM3D class of BG locomotives (Single or Double headed) to drawing No.53.01.01 (alt.b) and suspension arrangement as per drawing No.53.04.01 (alt-5) on various BG sections of Southern Railway up to a maximum axle load of 19.5 ± 2% t at a maximum speed of 105 kmph against the maximum speed of 120 kmph as certified by RDSO's speed certificate in their letter No. SD.WDM3D.11 dated: 04.09.2006, subject to the local speed restrictions noted below:

गति प्रतिबंध/ **Speed Restrictions :**

Sl. No.	From Km	To Km.	Section	Speed (kmph)	Reason
1	349.000	350.200	NCJ-TEN	60	M+4 density
2	As per Annexure- A				
3	As per the latest Working Time Table of Chennai, Salem, Palakkad, Thiruvananthapuram, Tiruchchirappalli and Madurai Divisions.				
4	Any other Restrictions now in force and those which may be imposed from time to time.				

01.08.2013

(R.P. NIRALA)
उप मुख्य इंजीनियर / रेलपथ
Dy.Chief Engineer/ TMS

Countersigned:

(K.K. Sharma)
मुख्य रेलपथ इंजीनियर
Chief Track Engineer

Annexure - A to Joint Safety Certificate No.959 BG

Sl. No	Section	Line	Kilometre From	Kilometre To	Weakest portion of track	UTS	Rail wear (%)	Sleeper Density	Ballast Cushion (mm) Total	Ballast Cushion (mm) Clean	Max. permissible Speed in kmph
1	Chennai Central – Arakkonam Jn.	Dn Fast	0.000	68.480	52 kg	90	3	M+7	250	100	105
		Up Fast	0.000	68.480	52 kg	90	3	M+7	250	100	105
2	Chennai Central - Pattabiram	Dn Slow	0.000	24.930	52 kg	72	3	M+7	250	100	105
		Up Slow	0.000	24.930	52 kg	72	3	M+7	250	100	105
3	Pattabiram - Thiruvallur	3rd line	24.93	41.65	52 kg	90	3	M+7	300	200	105
		4th Line	24.93	38.55	52 kg	90	3	M+7	300	250	105
		4th Line	38.55	39.35	52 kg	90	3	M+7	300	300	100
		4th Line	39.35	41.65	52 kg	90	3	M+7	300	300	105
4	Thiruvallur – Arakkonam Jn.	3rd line	41.650	68.480	60 kg	90	Nil	M+8	300	300	70
5	Tiruvalangadu - Arakkonam Jn.	4th Line	58.120	68.480	60 kg	90	Nil	M+8	300	300	90
6	Villivakkam - Annanagar	SI	0.000	3.090	52 kg	90	Nil	M+8	250	250	50
7	Arakkonam Jn. - Thalangal	Dn	68.480	94.280	52 kg	90	3	M+7	300	150	105
		Up	68.480	94.280	52 kg	90	3	M+7	250	150	105
8	Thalangal - Walajahroad	Dn	94.280	98.900	52 kg	90	3	M+7	300	250	105
		Dn	98.900	104.200	52 kg	90	3	M+7	300	300	105
		Up	94.280	104.200	52 kg	90	3	M+7	300	300	105
9	WalajahRoad - Jolarpettai Jn.	Dn	104.200	213.020	52 kg	90	3	M+7	300	250	105
		Up	104.200	213.020	52 kg	90	3	M+7	250	250	105
10	Arakkonam Jn. - Renigunta Jn. (including Melpakkam bypass)	Dn	68.480	133.600	52 kg	72	6	M+7	250	150	105
		Up	68.480	133.600	52 kg	90	6	M+7	250	150	105
11	Basin Bridge Jn. - Gudur Jn.	Dn	2.220	134.300	52 kg	90	3	M+7	300	200	105
		Up	2.220	134.300	52 kg	90	3	M+7	300	200	105
12	Korukkupet- Vyasarpadi	Dn	0.000	2.000	52 kg	90	4	M+7	250	100	60
		Up	0.000	2.000	52 kg	90	4	M+7	250	100	60
13	Vyasarpadi- Washermanpet	Dn	0.000	2.580	60 kg	90	1	M+7	200	150	75
		Up	0.000	2.580	60 kg	90	1	M+7	200	150	75
14	Korukkupet – Washermanpet	Dn	0.000	1.580	52 kg	90	4	M+7	200	150	60
		Up	0.000	1.580	52 kg	90	4	M+7	200	150	60
15	Basin Bridge Jn.- Washermanpet	Dn	2.220	4.140	52 kg	90	4	M+7	250	150	65
		Up	2.220	4.140	52 kg	90	4	M+7	250	150	65
16	Washermanpet- Royapuram	Dn	4.140	5.650	60 kg	90	Nil	M+7	250	150	75
		Up	4.140	5.650	60 kg	90	Nil	M+7	200	150	75
17	Royapuram - Chennai Beach	Dn	5.650	6.880	60 kg	90	4	M+7	250	150	25
		Up	5.650	6.880	52 kg	90	4	M+7	250	150	25
18	Pattabiram East siding – E.Depot	SI	0.000	6.030	52 kg	72	5	M+4	200	75	50

Countersigned
21/9/13
(K.K.SHARMA)
Chief Track Engineer

(R.P.NIRALA) 20.9.13
Dy.Chief Engineer/ TMS

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दक्षिण रेलवे
Southern Railway

पुल प्रमाण पत्र
BRIDGE CERTIFICATE

Certified that the bridges on various BG sections of Southern Railway, as mentioned in the Joint Safety Certificate No. 959 BG date 09.07.2013, the strength of superstructure being MBG/RBG standards as per Bridge Rules 1964 corrected upto and inclusive of correction slip No.42 dated 20.10.2009 are safe to carry WDM3D class of BG locomotives (Single or Double headed) to Drawing No. 53.01.01 (alt.b) and suspension arrgement as per Drawing No. 53.04.01 (alt-5) on various BG sections of Southern Railway at a maximum speed of 105 kmph, against the maximum speed of 120 kmph as certified by RDSO's speed certificate in their letter No. SD.WDM3D.11 dated 04.09.2006 respectively subject to the following Restrictions and Conditions.

Restrictions:

(i) As per Latest Working Time Table of Chennai, Salem, Palghat, Tiruchchirappalli, Madurai and Thiruvananthapuram Divisions.

(ii) Any other Restrictions now in force and those which may be imposed from time to time.

2. Substructure of all the bridges are in satisfactory condition and safe to carry the above rolling stock at the speed proposed, conforming to the provisions of the IRS substructure code revised in 1985 corrected upto correction slip No 29 dated 28.07.2009, except those that are weak and distressed which will be kept under observation with adequate speed restrictions on the same as follows:

Restrictions:

(i) As per Latest Working Time Table of Chennai, Salem, Palghat, Tiruchchirappalli, Madurai and Thiruvananthapuram Divisions.

(ii) Any other Restrictions now in force and those which may be imposed from time to time.

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(S.Ashok kumar) 10/7/13
उप मुख्य इंजीनियर / पुल
Dy.Chief Engineer / Bridges

Countersigned
5/E 12/7/13
(Lalloo Singh)
मुख्य पुल इंजीनियर
Chief Bridge Engineer

Gist of

Opening for Public Carriage of Passengers - Rules, 2000

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Opening for Public Carriage of Passengers - Rules, 2000

Rule 3. Reference to the CRS - ensure that the railway line or a portion thereof to be opened for public carriage of passengers is complete in all respects as per the Indian Railways Standard Codes and Manuals of Practice and all the administrative formalities are complete and that the working of the railway is regulated by the Indian Railways(Open Lines) General Rules, 1976.

Before applying to the CRS, Railway Board permission shall be obtained by an application by the GM, The application shall contain: -

(a)Tabulated details; **(b)Index Plan and Section of railway;**
(c)Drawings of works; **(d)List of questions and answers;**
(e)Certificates;**
(f)List of infringements of Maximum and Minimum Dimensions;
(g)Working orders to be enforced at each station; and Administrative note giving the salient features of the project.

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ANNEXURES and FORMS

(a)Curve abstract as specified in Form I;

(b)Gradient abstract as specified in Form II;

(c)Bridge abstract as specified in Form III;

(d)Important bridges particulars of waterway and construction as specified in Form IV;

(e)Ballast and Permanent Way as specified in Form V;

(f)Stations and station sites as specified in Form VI;

(g)Station accommodation as specified in Form VII;

(h)Station machinery as specified in Form VIII;

(i)Level crossing abstract as specified in Form IX;

(j)Brief particulars of traction installations as specified in Form X;

(k)Power supply installation abstract as specified in Form XI;

(l) Traction maintenance depot abstract as specified in Form XII

(m)Restricted Over Head Equipment clearances abstract as specified in Form XIII;

(n)Electrical crossing over railway track abstract as specified in Form XIV.

1. Index Plan and Section sheet shall be prepared as laid down in paragraphs 443 to 451 of the Indian Railways Code for the Engineering Department as reproduced in Schedule.
2. Completion drawings of bridges, with drawings showing each type of girders used and giving the loading standard for which each is designed, and (if called for by the Commissioner), details of the calculations of their strength;
3. Completion drawings of tunnels, if any;
4. Diagrammatic plans of station yards showing the gradients, the layout of tracks and particulars of turn out, block working and of any signals and interlocking installed;
5. Implantation of diagrams of Over Head Equipment masts, if applicable.

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**(e)Certificates;

(i) maximum and minimum dimensions;
(ii) strength of bridges;
(iii) number of engines on one span ;
(iv) brake and communications;
(v) accommodation in coaches to cater for different categories of passengers ;
(vi) system of working;
(vii) electric traction equipment (only if applicable); and
(viii) types of rolling stock proposed along with list of restrictions.

Further, the Station working rules / Traction working rules proposed shall also be annexed

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GM Shall accompany CRS alongwith all officers concerned.

AEN shall be responsible for making arrangements for testing of Bridges.

CRS inspection including bridges, buildings, SOD, working rules etc., is completed and report submitted to Railway Board.

Board shall sanction the opening of the Railway line for carriage of Passengers subject to compliance of observations of CRS.

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CRS - BRIEF HISTORY.

- To exercise effective control over the construction & operation of the first railways in India, which were entrusted to private companies, consulting engineers were appointed under the govt. of India.

- Later, when the govt. undertook the construction of Railways, the consulting engineers were designated as government Inspectors.

- In 1883, Their position was statutorily recognized. Later on, the Rly. Inspectorate was placed under the Rly. Board which was established in 1905.

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CRS - BRIEF HISTORY.

- In 1940, Inspectorate was under the ministry of transport and communication.

- In 1961 an attempt to give better status, Rly. Inspectorate was re-designated as commissioner of Rly. Safety on 01-11-1961.

- **Presently, CRS organisation headed by CCRS with Headquarters at LKO, under the Ministry of Civil Aviation.**

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Organization

C.C.R.S. Lucknow	
CIRCLE	**Juridiction**
CRS/W. Circle, Mumbai	Western Railway, North Western Railway
CRS/C. Circle Mumbai	Central Railway, West Central Railway, KRCL
CRS/E. Circle Kolkata	Eastern Railway, East Central Railway
CRS/S.E.Circle, Kolkata	South Eastern Railway, South East Central Railway, East Coast Railway
CRS/N.F.Circle, Kolkata	North East Frontier Railway, Kolkata Metro
CRS/S. Circle, Bangalore.	Southern Railway, South West Railway
CRS/S.C.Circle, Secunderabad	South Central Railway
CRS/N.E.Circle, Lucknow	North Eastern Railway, North Central Railway
CRS/N. Circle, New Delhi	Northern Railway, DMRC

Function / Duties

The main task of the commission of Rly. Safety is to direct, advice & caution the Rly executives with a view to ensure that all reasonable precautions are taken in regard to soundness of rail construction & safety of train operations.

(i) Opening of new lines/doubling/gauge conversions.

(ii) Introduction of new rolling stocks.

(iii) Works in existing lines.

(iv) Inspections of existing lines.

(v) Sanction of infringement to Schedule of Dimensions.

(vi) Inquiry into serious accidents.

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Extracts from P- Way manual, Chapter XIII

PARAS 1301 TO 1310 Including correction slip no 111

- **Safety of traveling public is governed by rules laid down in:**
  - IR act 1989 (24 of 1989) .(as amended from time to time).
  - General rules for IR.
  - The Rly. (opening for public carriage of passengers) Rules, 2000 (as amended from time to time).
  - IR schedule of dimensions (as amended from time to time).

- **Above rules specify the authority competent to sanction & procedure for obtaining sanction**

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Works requiring sanction of CRS

Under section 23 of Railways Act, 1989 (24 of 1989) and chapter VII of the “Railways (Opening for Public Carriage of passengers) Rules, 2000”,

Sanction of CRS is required for

(1) execution of any work on open line which will affect running of trains carrying passengers &

(2) any temporary arrangement necessary for carrying it out except in emergency

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(1) (i) Permanent diversion (deviation) more than 2 Km in length without any station in between and irrespective of length, when a new station is involved.

Note:- Permanent diversions more than 2 km in length and irrespective of length when a new station is involved, are to be treated as new lines covered by the provisions of section 21 to 23 of the Railways Act, 1989 (24 of 1989)

(2) For commencement & opening of following works, when they are connected with Rly, sanction of CRS shall be obtained:-

(a) Additions, extensions or alternations to running lines.

(b) Alterations to points and crossings in running lines.

(c) New signalling and interlocking installations or alterations to existing installations.

(d) New stations, temporary or permanent.

(e) The construction (but not the removal) of an ash pit on a running line

(f) Heavy regrading of running lines involving lowering/ raising of track in excess of 500 mm.

(g) New bridges including road over and under bridges, foot over bridges, strengthening, raising, reconstruction, dismantling or extension of existing bridges, addition or replacement of existing girders, including provision of temporary girders. Here, bridges shall include road over and under bridges, foot over bridges and subways affecting running lines. **(CS-138)**

(h) Provision of new LC, shifting of existing LC on running lines, de-manning and downgrading of LC, manning of unmanned LC, upgrading of LC involving changes in the method of working or operation (such as interlocking) and closing down of manned LC. However, sanction of CRS shall not be required for providing lifting barriers in place of leaf/swing gates at interlocked/non-interlocked LC or closing of unmanned LC/canal/cattle crossing. **(CS-120)**

(k) Temporary diversion irrespective of length, except those laid for restoration of through communication after accident.

(l) Addition or alterations to the electrical installations of tracks equipped for electrical traction.

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(3) Application for the sanction of CRS should ordinarily be made 30 days in advance of the expected commencement of such work.

If for any reason a sanctioned work is not taken in hand within 12 months from the date of sanction, the CRS should be approached for renewal of the sanction.

1303. Application for sanction of Works to CRS by JAG Officer of Division / S&C signed by All Concerned Departments (Eng / S&T / RE etc) (CS-133)

In all cases, the name and designation of the signatory should invariably be given.

- General Rules, CHAPTER 4, PARA 4.08 Defines that speed of a train in a section, is based on the sanction by approved special instructions
- Rules for opening of Railways for public carriage, 2005 determines the procedure to be followed for opening of new sections and Railway Board issued Policy Circular No.7 for various issues related to sectional speed. This rules were in force from 1933 and modified from time to time.
- Commissioner of Railway Safety is the authority to sanction the limits of speed for any section of Railway.

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- Indian Railway Act authorizes, the Railway Board, the safety controlling authority for regulating and sanctioning speeds of all type of Rolling stock.
- The procedure for certification of Maximum permissible speed for Rolling stock is defined in Policy Circular No.6
- PC 6 initially issued on 8.7.1980 subsequently revised on 23-12-99, 23-11-2006, 09/12-07-2010 and 05-01-16.
- The latest Policy Circular no 6 is now reissued on 31-10-2018 superseding all earlier instructions

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2.17 JE Bridge – Induction – Phase I(4 periods)

I. Opening of Line for Public carriage

II. Classification of lines

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Gist of

Opening for Public Carriage of Passengers - Rules, 2000

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Opening for Public Carriage of Passengers - Rules, 2000

Rule 3. Reference to the CRS - ensure that the railway line or a portion thereof to be opened for public carriage of passengers is complete in all respects as per the Indian Railways Standard Codes and Manuals of Practice and all the administrative formalities are complete and that the working of the railway is regulated by the Indian Railways(Open Lines) General Rules, 1976.

Before applying to the CRS, Railway Board permission shall be obtained by an application by the GM, The application shall contain: -

(a)Tabulated details; **(b)Index Plan and Section of railway;**
(c)Drawings of works; **(d)List of questions and answers;**
(e)Certificates;**
(f)List of infringements of Maximum and Minimum Dimensions;
(g)Working orders to be enforced at each station; and Administrative note giving the salient features of the project.

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ANNEXURES and FORMS

(a)Curve abstract as specified in Form I;

(b)Gradient abstract as specified in Form II;

(c)Bridge abstract as specified in Form III;

(d)Important bridges particulars of waterway and construction as specified in Form IV;

(e)Ballast and Permanent Way as specified in Form V;

(f)Stations and station sites as specified in Form VI;

(g)Station accommodation as specified in Form VII;

(h)Station machinery as specified in Form VIII;

(i)Level crossing abstract as specified in Form IX;

(j)Brief particulars of traction installations as specified in Form X;

(k)Power supply installation abstract as specified in Form XI;

(l) Traction maintenance depot abstract as specified in Form XII

(m)Restricted Over Head Equipment clearances abstract as specified in Form XIII;

(n)Electrical crossing over railway track abstract as specified in Form XIV.

1. Index Plan and Section sheet shall be prepared as laid down in paragraphs 443 to 451 of the Indian Railways Code for the Engineering Department as reproduced in Schedule.
2. Completion drawings of bridges, with drawings showing each type of girders used and giving the loading standard for which each is designed, and (if called for by the Commissioner), details of the calculations of their strength;
3. Completion drawings of tunnels, if any;
4. Diagrammatic plans of station yards showing the gradients, the layout of tracks and particulars of turn out, block working and of any signals and interlocking installed;
5. Implantation of diagrams of Over Head Equipment masts, if applicable.

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**(e)Certificates;

(i) maximum and minimum dimensions;
(ii) strength of bridges;
(iii) number of engines on one span ;
(iv) brake and communications;
(v) accommodation in coaches to cater for different categories of passengers ;
(vi) system of working;
(vii) electric traction equipment (only if applicable); and
(viii) types of rolling stock proposed along with list of restrictions.

Further, the Station working rules / Traction working rules proposed shall also be annexed

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GM Shall accompany CRS alongwith all officers concerned.

AEN shall be responsible for making arrangements for testing of Bridges.

CRS inspection including bridges, buildings, SOD, working rules etc., is completed and report submitted to Railway Board.

Board shall sanction the opening of the Railway line for carriage of Passengers subject to compliance of observations of CRS.

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CLASSIFICATION OF LINES

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CLASSIFICATION OF LINES

(Ref: Correction Slip No. 109 to IRPWM dt. 15.02.08)

IRPWM Para 202(1) - BG lines have been classified into 6 groups A to E based on future maximum permissible speed

- **Group A – Speeds upto 160 kmph**
- **Group B – Speeds upto 130 kmph**
- **Group C – Suburban section of Mumbai, Delhi, Chennai and Kolkata**
- **Group D Spl – Speed upto 110 kmph & Annual GMT 20 GMT or more**
- **Group D – Speed upto 110 kmph and Annual GMT less than 20**
- **Group E – All other sections and branch lines with speed upto 100 kmph.**

Gr A, B, C and (D & D Spl) routes have been identified

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THANK YOU

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2- BASICS OF RAILWAY TRACK

2.7 Classification of Released materials, their accountal and disposal.

(4 Periods)

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RELEASED MATERIAL HANDLING:

Works to be attended after completion of relaying–

(1) Classification and loading of released materials– Materials as and when removed during the progress of relaying should be collected and classified and despatched to the destination. No released material should be left at the site of the renewals. Relaying work shall not be considered complete until all released materials are removed from site and necessary credit accorded.

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Classification and use of released material -

After a section of track has been renewed, the released material shall be classified as per Clause 721 and 722 of IRPWM and carefully sorted out so that greatest possible use may be made them. They should then be classified by **the Sr.Section Engineer(P.Way).** Tools and plant left over should also be classified and action taken on their disposal.

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- **Classification of track materials** – para 721

Classification and Use of Released Material–

(1) Need for Classification-

(a) After a section of track has been renewed, the released material shall be carefully sorted out so that greatest possible use may be made of them. They should then be classified by the SSE (P.Way). Tools and plant left over should also be classified and action taken on their disposal.

(b) The rails should be graded according to their weight and condition into groups suitable for re-use in running lines, non-running lines and for conversion into posts or structural members for various purposes or for sale as scrap. Where rail-ends are worn or hogged, the feasibility of “Cropping” the ends should be considered if the condition of the rail is otherwise satisfactory.

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- **Classification of track materials** – para 721

(1) Need for Classification-

(C) The sleepers should be sorted into various grades suitable for re-use in the track or as unserviceable material not fit for use in track works.

(d) Fish-plates, fish-bolts, ERCs & Liners should be sorted into those suitable for re-use and the rest as scrap.

(e) If the switches and crossings themselves are badly worn to be re-used, the small fittings such as stretcher bars, switch anchors, stud-bolts and blocks can generally be used. Switches and Crossings should be reconditioned by welding, if the wear is not excessive.

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- **Classification of track materials** – para 721

2. Basis for Classification–

For the purpose of classification, Permanent Way materials should be divided into three classes depending upon the section and condition as detailed below–

(a) Class I material is that which is new and of standard section. New items of obsolescent sections, which are interchangeable with standard materials and are purchased from time to time to prevent wastage of other serviceable material, should be brought on to the stock account as Class I material. These items should be included in the price lists for the miscellaneous and common items.

No other material of an obsolescent section is to be treated as Class I, even though it may never have been put in the track.

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- **Classification of track materials** – para 721

2. Basis for classification: (contd..)

(b) Class II material includes all new material of obsolescent sections other than those included under Class I and all standard and obsolete material released from the track and fit for further use on track.

Class II released rails should be classified and sub-divided as under –

Class II (a) rails fit for use in running lines.

Class II (b) rails fit for use in non-running lines.

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- **Classification of track materials** – para 721

2. Basis for classification:

© Class III materials shall include all materials that has become unserviceable. This is either metal scrap or unserviceable sleepers. This class will include all rails which are neither Class I nor Class II.

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3. Accountal of released P.Way materials–

(a) The quantity of released materials from every work included for track renewal/ gauge conversion will be based on yardsticks for loss of weight to be fixed on the basis of data collected during foot by foot survey. If there is more than one work on the same route, near to each other and under similar ground conditions, only one set of yardsticks would suffice.

(b) List of materials likely to be released will be prepared indicating the quantum of such materials separately as second hand (SH) and scrap following the instructions given in sub Para (2) above.

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3. Accountal of released P.Way materials–

(c) While second hand materials will be indicated only in length/nos. in case of scrap materials, the accountal will be following:

(i) Rails– in length, then converted to weight.

(ii) Sleepers– nos. separately as whole and in parts.

(iii) Fittings & fastenings– by weight.

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3. Accountal of released P.Way materials–

(d) During foot by foot survey, actual observations will be recorded jointly by SSE (P.Way) and ISA/Stock Verifier giving the percentage loss of weight over the new component for each and every material likely to be declared as `SCRAP'. This can be done by actual weighment of few representative samples. Concrete sleepers that have been replaced on condition basis as per ***Para 702 (2)*** shall be declared as scrap.

(e) The yardsticks will then be approved by the Sr.DEN/DEN personally based on the report duly test checked by AEN or DEN. These will specify the maximum percentage loss of weight for different components under different ground conditions as per format given in the ***Annexure - 7/1.***

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Annexure - 7/1- *Para* 721

LOSS OF WEIGHT OF RELEASED SCRAP (P.Way COMPONENTS)

DESCRIPTION OF WORK:_____

FOOT BY FOOT SURVEY CARRIED OUT BY: _____

DATE: _____

DIVISION: _____

S. No.	Description of Material (Rail, Sleeper, Fittings etc.)	Weight of New item	Max.% loss of weight on release	Weight of released item	Remarks
(1)					
(2)					
(3)					
(4)					

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3. Accountal of released P.Way materials–

(f) The conversion to weight in case of each of the items for purpose of accountal will then be done by the SSE (P.Way) on the basis of the specified percentage loss of weight over the new components. In case, however, some abnormal variation of weight is observed after the materials have been released and the percentage loss is more than that specified for that category, specific justification will have to be recorded for the same by the SSE (P.Way) and all such cases would have to be certified by DEN/Sr.DEN after actual sample checking at site.

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3. Accountal of released P.Way materials–

(g) In case however, the actual loss after release is seen to be lower than the yardstick the accountal will be done on the basis of the actual.

(h) After actual releases of materials, the SSE (P.Way) will take the releases on books on the basis of summary sheet as per ***Annexure - 7/2*.**

(i) The sectional AEN will carry out test checks to the extent of 20% of each item and make entries to this effect in the summary sheet. The sectional DEN/ Sr.DEN will also carry out random checks to ensure that the category and weight of releases are correct to the maximum possible extent

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Annexure - 7/2-*Para* 721

Summary of P.Way material to be released

Name of work_____

Division……section……..SSE (P.Way)……

DEN/Sr.DEN_____

Period of execution of work from dd/mm/yy to dd/mm/yy_____

Km	Category of section	Name of material	List of material to be released				Remarks for abnormality, if any	Sign. of JE//SSE/P.Way (In charge/ Spl)	Test check by ADEN	Remarks
			Service-able or scrap	If scrap						
				No/ Length	Rate (/Wt.)	Wt.				

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3. Accountal of released P.Way materials–

(j) The periodical returns for track renewals/gauge conversions are to be submitted at the laid down periodicity as per rules and the existing procedure for checking should be streamlined to ensure that the returns are looked into detail in the AEN's office in nos.as also their conversion in weight. The returns will be specifically checked with regard to the correctness of input/output materials having been prepared on the basis of instructions given in ***Sub Para (2)*** above.

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3. Accountal of released P.Way materials–

(k) As an internal check by the department, one of the works accountants in the division with engineering department or with construction department should be made responsible to carry out methodical checks of all MAS accounts of track renewals/gauge conversion works.

(l) In cases where the track work is to be done by contractor, the list of released materials shall be jointly prepared on the basis of a field survey to be conducted by the SSE (P.Way) and contractor's representative after the work has been awarded but before the dismantling work is allowed to commence. The contractor shall be bound to hand over the materials according to the said agreed list and should be responsible for any shortages

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722. Marking of Permanent Way Material–

All Permanent Way material should be distinguished as follows or as otherwise directed–

(1)Class I– No marks.

(2) Class II

(a) For 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.

(b) For other track materials like sleepers etc-Second hand fit for use in track works to be painted with a daub of white.

(3) Unserviceable material Class III - not fit for use– Ends to be painted with a daub of red.

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It should be ensured by the ADEN and SSE/JE(P.Way) that the materials of each class including fittings, are separately stacked for convenience of accounting and despatch and indication plates erected accordingly.

Account of released P.Way materials:

(1) The quantity of released material from every work included for track renewal/gauge conversion will be based on yardsticks for loss of weight to be fixed on the basis of data collected during foot by foot survey.

If there is more than one work on the same route, near to each other and under similar ground conditions, only one set of yardsticks would suffice

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Account of released P.Way materials:

2. List of materials likely to be released will be prepared indicating the quantum of such materials separately as second hand (SH) and scrap following the instructions given

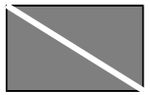
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Materials for which DS8 have been submitted by Divn to HQ. Ends to be painted with a Daub of Red.

A diagonal band across the s  top for 100 mm width with Red paint.

Materials for which deliery order has been received from COS. Ends already painted with a Daub of Red.  A diagonal band from opposite direction on the stack on top for 100mm width with Red paint.

Class II a. Ends to be painted with a Daub of White  A white band across the stack on top for 100 mm width.



Class II b. Ends to be painted with a Daub of Yellow A Yellow band across stack on top for 100mm width.

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3. While second hand materials will be indicated only length/nos. in case of scrap materials, the accountal will be as follows:

- Rails - in length, then converted to weight.
- Sleepers -Nos. separately as whole and in parts then converted to weight
- Fittings & fastenings - by weight

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4. During foot by foot survey, actual observations will be recorded jointly by PWI and ISA/Stock Verifier giving the percentage loss of weight over the new component for each and every material likely to be declared as "SCRAP".

This can be done by actual weighment of few representative samples

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5. The yardsticks will then be approved by the Sr.DEN/DEN personally based on the report duly test checked by AEN or DEN.

These will be specify the maximum percentage loss of weight for different components under different ground conditions as per format given in the Annexure

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LOSS OF WEIGHT OF RELEASED SCRAP

(P.WAY COMPONENTS)

DESCRIPTION OF WORK: _____RAILWAY

FOOT BY FOOT SURVEY CARRIED OUT BY: _____DIVISION

DATE:

Sl No	Description of materials	Weight of New item	Max. % loss weight on release	Weight oF Realeased	Remarks
1.	RAILS				
2.	SLEEPERS (a) Steel (b) CST-9 (c)Wooden FISH				
3.	PLATE TIE BAR				
4.					
5.	OTHER FITTINGS (a) Bearing Plates (b) ACB (c) ERC (d) Two way keys other fittings				

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6. The conversion to weight in case of each of the items for purpose of accountal will then be done by the Section Engineer (P.Way) on the basis of the specified percentage loss of weight over the new components.

If abnormal variation of weight is observed after the materials have been released and the percentage loss is more than that specified for that category, specific justification will have to be recorded for the same by the Senior Section Engineer (P.Way) and all such cases would have to be certified by DEN/S, DEN after actual sample checking at site.

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7. In case however, the actual loss release is seen to be lower than the yardstick the accountal will be done on the basis of the actual

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8. After actual releases of materials, the Section Engineer(P.Way) will take the releases on books on the basis of summary sheet as per Annexure

SUMMARY OF P.WAY MATERIAL TO BE RELEASED

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NAME OF WORK _____

DIVISION_____SECTION_____PWI _____

DEN/Sr.DEN_____

PERIOD OF EXECUTION OF WORK FROM (Date)_____TO (date)_____

Km.			
Category of Section			
Name of material			
List of material to be released	**Service able or scrap**		
	If scrap No/Length		
	Rate (WT)		
	WT		
Remarks for abnormality if any			
Sign PWI `			
Test check by AEN			
Remarks			

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9. The sectional AEN will carry out test checks to the extent of 20% of each item and make entries to this effect in the summary sheet.

The sectional DEN/Sr.DEN will also carry out random checks to ensure that the category and weight of releases are correct to the maximum possible extent

10. The periodical returns for track renewals/gauge are to be submitted at the laid down periodicity as per rules and the existing procedure for checking should be streamlined to ensure that the returns are looked into detail in the AEN's office in nos. as also their conversion in weight.

The returns will be specifically checked with regard to the correctness of input/output materials having been prepared on the basis of instructions given in para 2 above

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11. As an internal check by the department, one of the works accounts in the division with engineering department or with construction department should be made responsible to carry out methodical checks of all MAS accounts of track renewals/gauge conversion works

12. In cases where the track work is to be done by contractor, the list of released materials shall be jointly prepared on the basis of a field survey to be conducted by the Sr.Sec. Engineer(P.Way) and contractors representative after the work has been awarded but before the dismantling work is allowed to commence.

The contractor shall be bound to hand over the materials according to the said agreed list and shouldbe responsible for any shortage

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Handing over and taking over between construction and open line.

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