ज्ञान ज्योति से मार्गदर्शन
To Beam As A Beacon of Knowledge

Quality Control in Mechanised Track Relaying

November 2015

Indian Railways Institute of Civil Engineering
Pune 411001

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Preface

Modern Track structure necessitated need for mechanized laying & maintenance. With mechanization, work with greater accuracy is only possible if we adhere to prescription for quality control provided in our manuals.

The book covers brief procedure of track relaying by different machines and important items for quality control. Apart from mechanized relaying, it also covers other details like track tolerances for new track, track structure for new track, precautions during rail handling of 90 UTS rails, provision of LWR on bridges, etc.

It is hoped that the book will be very useful in field to improve quality of track relaying work.

Suggestions for improvement are welcome

01st November 2015

Vishwesh Chaubey
Director / IRICEN
director@iricen.gov.in

Acknowledgement

For supervision of relaying work in field the absence of a proper literature was felt, which could be referred to ensure quality control during mechanized track renewal. Hence a book was written originally in Hindi to compile instructions from different manuals and circulars etc. Now to cater demand of larger group of officials the same Hindi book has been translated in English. In this book I tried to include main items for quality control during track renewal by different machines. Apart from track relaying, general items have also been included like steps required at planning stage, track tolerances and track structure for new track, precaution during handling of rails, check list for thermit weld, guide lines for laying LWR on bridges and preparing project reports.

In this effort, the IRICEN faculty and staff have contributed immensely. I am grateful to my senior faculty for their valuable guidance.

Above all, I am grateful to Shri Vishwesh Chaubey, Director, IRICEN for his encouragement and guidance in bringing out this book.

01st November 2015

N.R.Kale
Assistant Professor/Works
IRICEN
kale@iricen.gov.in

CONTENTS

CHAPTER - 1

TRACK TOLERANCES FOR NEW WORK

1.1 Pre-Requisites for Ensuring Quality:

To ensure good quality, some of the important pre-requisites are

a. Knowledge of standards
   i. Prescribed and
   ii. Accepted
b. Use of standard materials
c. Use of standard equipment and tools
d. Avoidance of short cut methods, and above all
e. Quality control at each stage execution

1.1.1 Standards of Track Geometry:

Track is a composite structure consisting of rails, sleepers and their fastenings with ballast under and around the sleepers laid on a well prepared formation.

Each component of track has permissible dimensional tolerances in their manufacture/laying. Even though adequate care is taken while specifying these tolerances, any adverse combination of such tolerance in two or more components can affect the final result and therefore it is very necessary to avoid such situations by taking all possible care by way of:

i. Instructions – timely and suitable, during the work
ii. Periodical check of work done, and
iii. Reference to correct data in case of doubt, and so on

1.1.2 Prescribed Standards of Track Geometry:

Let us now see as to what are the prescribed standards and acceptable variations in track geometry for track linked using new materials. (As per IRPWM chapter III)

Gauge	Sleeper to sleeper variation	2 mm
Expansion gap	Over average gap worked out by recording 20 successive gaps	+/- 2 mm
Joints	Low joints not permitted High joints not more than	2 mm
	Squareness of joints in mm with straight line.	+/-10mm
Spacing of sleepers	With respect to theoretical spacing	+/-10mm
Cross level	To be recorded on every 4th sleeper	+/- 3 mm
Alignment	In straight on 10 m chord On curves of radius more than 600 m on 20 M chord	=/- 2 mm
	Variation over theoretical versines	5 mm
	On curve of radius less than 600 m on 20 m chord Variation over theoretical versines	10 mm
Longitudinal level	Variation in longitudinal level with reference to approved longitudinal section	50 mm

The track geometry will be recorded three months after the speed is raised to normal.

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CHAPTER - 2

QUALITY CONTROL: SOME USEFUL HINTS

2.1 Some Useful Hints for Quality Control in Track Linking:

For achieving the final track geometry well within acceptable standard, quality control is necessary right from the beginning at each stage during various operations of track linking.

Some useful hints for exercising such control are discussed in this chapter

2.1.1 Primary Survey:

Requisite survey shall be carried out deciding final rail level. Longitudinal section showing the existing rail levels should be plotted showing the location of permanent structures like girder bridges, level crossings etc. Decide the proposed rail level taking into consideration the following points and as per relevant provision in the IRPWM-1986 and Schedule of Dimensions 2004:

i. Minimum 350mm ballast cushion is available below the concrete sleepers.

ii. Elimination of sags and humps.

iii. Clearances between structures is not infringed.Where lifting of track is not possible at places like-below ROB, FOB, on girder bridges and in yards, etc., suitable ramp should be decided.

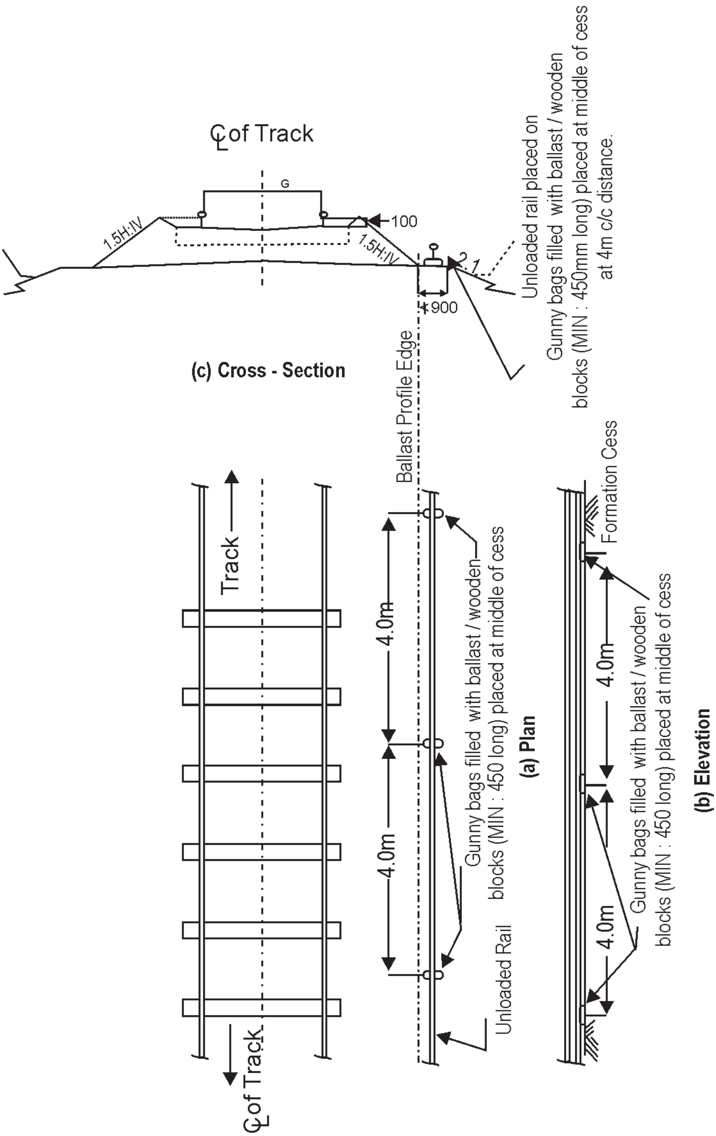
iv. On electrified section, clearance from OHE staff should also be taken before deciding final rail level.

2.1.2 Unloading of Rail Panels:

Presently rail panels of 130 M or 260 M are being unloaded at site. Once these panels are unloaded, shifting is very difficult hence before unloading, proper survey should be done and location of each panel should be marked on existing rails by paint which will reduce the shifting work. During unloading of 10/20 rail panels from EUR (End Unloading Rake), following precautions must be taken:

I. Unloading should be started from top layer panels.
II. Rail panels should be tied with manila rope/slings with the help of HTS bolts only.
III. Rail panels at equal distances from centre line should be unloaded. Eccentric unloading or unloading from only one side of NFR is strictly prohibited.
IV. Just before complete unloading of first pair of rail panel, the rake should be stopped and next rail panel to be unloaded is tied with the near end of rail panel partially unloaded, with sling. Then, the rake should be moved forward to unload next rail panel. This process is to be continued for unloading of successive rail panels.
V. The EUR rake shall never be moved backward during unloading.
VI. Unloading shall not be undertaken at locations having vertical clearance less than 4500 mm from rail level to the fixed structure.
VII. Unloading of rail panels shall not be undertaken in platform area and on ballast-less open web girder bridges.
VIII. Unloading of panels should be arranged in such a way that turn out and cross-overs are avoided.

After unloading the panel, ensure that panel is resting on complete flange; also give support of wooden block at suitable interval to avoid permanent deformation / kink formation as shown in Fig.2.1



C L of Track
G
100
1.5H:IV
1.5H:IV
2:1
900
Unloaded rail placed on
Gunny bags filled with ballast / wooden
blocks (MIN : 450mm long) placed at middle of cess
at 4m c/c distance.
(c) Cross - Section
Ballast Profile Edge
Track
C L of Track
4.0m
4.0m
Gunny bags filled with ballast / wooden
blocks (MIN : 450 long) placed at middle of cess
Unloaded Rail
(a) Plan
Formation Cess
4.0m
4.0m
Gunny bags filled with ballast / wooden
blocks (MIN : 450 long) placed at middle of cess
(b) Elevation

Fig 2.1

Before inserting the rail panel in track, give two coats of thickness of 100 micron each by anticorrosive bituminous black paint conforming to IS: 9862 ensuring an interval of minimum 8 hours between two coats. This should be done strictly in corrosion prone area.

2.1.3. Drilling of Holes & Chamfering:

Drilling of holes is not permitted in 90 UTS rail where panels are to be welded for laying LWR/CWR. But at locations where LWR is not permitted, drilling of holes is unavoidable.

This should be kept in mind that tolerance in diameter of bolt hole and position of hole is only 0.8 mm. The position of hole is at specified distance from base of the rail which is 76.25 mm for 60 Kg rails and 66.50 mm for 52 Kg rails. Therefore it is advisable to make use of proper template made from half length fish plate or metal plate for marking the position of holes.

It is also important to make use of proper size of drill bit for drilling the holes in rail. Drill bit of 31.5/32 mm diameter should be used for drilling the holes in 52 Kg and 60 Kg rails where gap is desirable. For gapless joints, drill bit of 26.5/27mm diameter should be used.

After drilling the hole, the bolt hole should be chamfered by chamfering tool. This will take three to four minutes but this will reduce the stress concentration by 14 to 16 percent, thereby delaying the development of star cracks. The detailed about chamfering the bolt hole is given in para 251 of IRPWM.

Presently only 90 UTS rails are used for track linking hence proper care is required for 90 UTS rail particularly:–

I. Avoid chisel marking on rail.

II. Gas cut rails are not to be used as these become more brittle.

III. Use of gas cutter for fish bolt hole should not be permitted.

Minimum length of rail closer: As per IRPWM, the minimum length of rail closer in fishplated track is 5.5 Meter and in SWR or LWR track minimum closer for welding should not be less than 4 meter.

2.1.4 Use of One Meter Long Fish Plate:

In case of SWR on concrete sleepers, 1M long fish plate with six bolts only should be used and sleepers spacing should be kept uniform.

2.1.5 Position and Location of Joints:

All joints should be laid square except on sharp curve, however joints should be avoided within six meters of level crossings in case of SWR track.

Joint should be avoided on small bridges opening less than 6.10 M. For other spans, the preferred position of joint is at 1/3rd the span from either end.

On bridge approaches, rail joint should be avoided within three meters from abutment.

2.1.6 Staggering of Joints on Curves:

Rail joints on curves normally should be laid square. On the sharp curves less than 400M on the B.G. the rail joints may be staggered.

2.1.7 Expansion Gaps at Joints:

To avoid excessive compressive or tensile forces at the joint, it is necessary to provide the expansion gap as per following table for different zones. To ensure the correct expansion gap, proper size of metal liner should be used.

Table:1 Initial Laying Gaps for SWR 39/26m Panel for Various Installation Temperature

Rail temperature at the time of installation (ti) centigrade		t_m- 22.5 to t_m - 17.6	t_m - 17.5 to t_m - 12.6	t_m - 12.5 to t_m - 7.6	t_m - 7.5 to t_m - 2.6	t_m - 2.5 to t_m + 2.5	t_m + 2.6 to t_m + 7.5	t_m+ 7.6 to t_m + 12.5
Initial laying gaps for zone I & II	For 39m long panel	-	12mm	10mm	8mm	6mm	4mm	2mm
	For 26m long panel	-	10mm	9mm	7mm	6mm	5mm	3mm
Initial laying gaps in mm for zone III & IV	For 39m long panel	12mm	10mm	8mm	6mm	4mm	2mm	-
	For 26m long panel	10mm	9mm	7mm	6mm	5mm	3mm	-

(t_m is the mean rail temperature)

If the laying is done outside the temperature range given in the above table or gap at joints could not be provided as per the table, readjustment of the gap shall be carried out within two days of laying before the track consolidates. Along with gap adjustment any re-spacing sleepers if required must be carried out.

2.1.8 Greasing of Fishing Planes and Oiling of Fishbolts:

For proper functioning of the joint and to reduce the wear and tear of fishing planes, lubrication of joints and proper tightening of full complement of fishbolts are necessary not only during service but also at the initial stage of linking of track.

Spanner of standard size i.e. 680 to 760 mm long should be used for tightening of fishbolt. Bolt should not be hammered; rear end of spanner should be used to align the hole properly for hand-insertion of fishbolt.

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CHAPTER - 3

MECHANIZED TRACK RELAYING

3.1 Introduction

In simple words the meaning of Mechanized Relaying is "Replacement/ renewal of complete track or one or more of it's components namely rail,sleepers or turn outs etc. with the help of machines"

Earlier most of the track relaying was done manually but now a days mechanized track relaying is preferred due to following reasons.

I. Due to Heavy track structure, manual renewal is very difficult.

II. Due to increased traffic, availability of traffic blocks is limited.

III. In manual relaying, output was very less whereas mechanizes renewal gives better productivity.

IV. Manual relaying was interrupted frequently due to change in season whereas in mechanized relaying, progress is independent of seasonal variation.

V. Better quality in mechanized relaying which was very difficult in manual relaying.

VI. Due to slow progress manual relaying was not economical whereas mechanized renewal is economical in long run.

VII. Most importantly, safety is improved at work site in case of mechanized renewal.

3.2 System of Mechanized Renewal:

There are two systems of Mechanized Relaying:-

i. Panel wise renewal: In this system complete frame of rail, sleeper is replaced. P.Q.R.S.(Plasser quick relaying systems) used for track relaying and T-28 machine is used for Turn out replacement in this category.

ii. Component wise replacement: In this system only sleepers or rail can be replaced or both can be replaced together. Track Relaying Train (TRT) is used for this type of replacement.

3.3 PQRS (Plasser's Quick Relaying System) :

It is a semi-mechanised system of track renewal. It consists of two self propelled portal Cranes used for mechanized track renewal which are loaded in BFRs. Normally two portal cranes and pre-assembled panels are taken to the site. Portal cranes are unloaded on auxiliary track of 3400mm gauge track, which lift the old track and place the new pre-assembled panels. Old track is cut in 13 M length. Two empty BFRs are also taken to the site in which old dismantled track is loaded.

Tamping machines are also deployed following the portal cranes for lifting and tamping of newly laid track.

Block requirement: Minimum 2 hrs and 30 minutes.

Fig:1 Plasser's Quick Relaying System

3.3.1 Activities at Base Depot.

- Unloading & stacking of PRC Sleepers
- New panel fabrication
- Loading into BFR
- PQRS Rake formation
- Unloading of released panels
- Dismantling released panels
- Segregating & stacking released material
- Paint marking on released rails
- Machine maintenance
- Dispatch of released materials

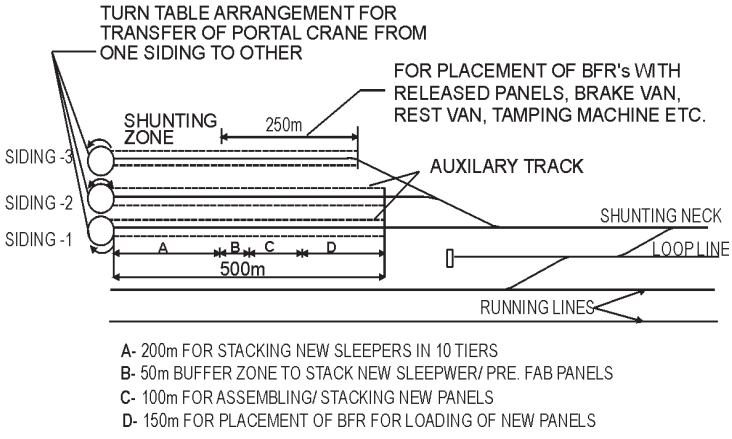


Fig:2 Layout of PQRS Depot

3.3.2 Quality Control at Base Depot:

Quality control at base depot is very important. If proper care is not taken at base depot, end result at site will also not be upto the standards.

I. Service rails should be of same section by which TRR is to be done afterwards.

II. Service rails should be of good quality and USFD tested. Rails having severe corrosion, liner bite should not be used.

III. All service rails to be exactly measured and length should be written by paint.For linking service rails, rails of equal measurement should be selected so that joint will be square at site. This will also ensure correct squaring of sleepers at site.

IV. While linking the service rails, it should be ensured that rails are placed squared.

V. For maintaining correct spacing, template should be used. In addition to this, paint marking should also be done on service rail.

VI. At the base depot, all the elastic rail clips and Malleable Cast Iron Inserts should be thoroughly cleaned. Grease confirmed to IS: 08-1981(Specification for Grease No. 'O' Graphited) should then be applied on the central leg of the E.R.C. and eye of the M.C.I. insert and then the clip should be driven at the time of assembly of the service panel.

VII. While linking the track at base depot, all the liners should be fixed properly otherwise sleepers may shift laterally and ultimately this may give problem at the time of TRR.

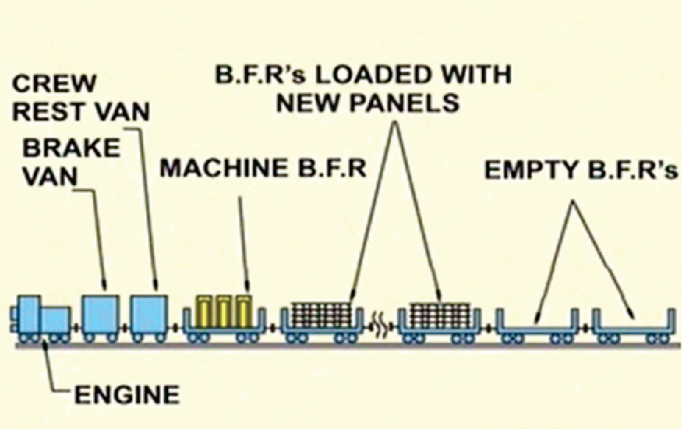


Fig : 3 Formation of PQRS Rake

3.3.3 Activities at Site

Auxiliary Track: For movement of portals, auxiliary track is required to be laid in advance at the relaying site. Auxiliary track is also required at base depot for movement of portals. The gauge of auxiliary track is 3400 mm. Auxiliary track is laid to proper line and level with the new rail panels, if rail renewal is also to be carried out as part of track renewal. Otherwise, service rails are used for making auxiliary track. For linking of auxiliary track, wooden blocks are used or alternatively CST-9 plates also can be used.

3.3.3.1 Precautions in Linking of Auxiliary Track:

i. Centerline of main track and auxiliary track should be same so that clamps of the portal will grip the both rails of the main track.

ii. Rail level of main track and auxiliary track should be same or maximum 50 mm above the existing track level, otherwise clamps of portal will not be able to grip the rails of main track.

iii. Rail head of auxiliary track should be clear from ballast jam otherwise movement of portal will be obstructed.

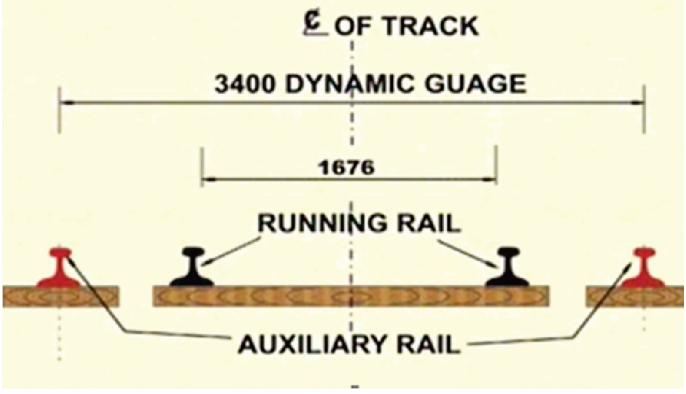


Fig : 4 Layout of Auxiliary Track

3.3.3.2 Activities for Quality Control Prior to Block:

i. As far as possible deep screening should be completed prior to PQRS as the preparing bed is very easy on screened track.

ii. To maintain the alignment, take the measurement of existing track centre from adjoining track at every 30 Meter, from each OHE mast and mark with paint. After laying the track with PQRS, same should be checked and corrected if required.

iii. The proposed predetermined rail level should be

indicated at suitable intervals (preferably 30m) along the track. This can be written by paint on rail web / flange outside gauge face of parallel track in case of double / multiple lines.

iv. If section is electrified, proposed rail level can be written by paint on each OHE mast.

3.3.3.3 Activities for Quality Control During PQRS Block:

i. Fill up crib ballast during block period otherwise sleepers will get out of square.

ii. All the four bolts should be provided and tightened before clearing the block.

iii. At the junction joint, there should be no gap.

iv. Provide wooden block at the junction joint.

v. Track should be aligned by matching the distance written on adjoining line / OHE mast.

3.3.3.4 Activitiesfor Quality Control During TRR Block:

(This work can also be done in shadow block of PQRS)

i. Before taking the block, ensure that rails are painted with anticorrosive paint as per specification.

ii. Remove the kinks if any with jimscrew before TRR block, otherwise it will give permanent problem in maintaining gauge / alignment.

iii. As far as possible, take the block for TRR within 't_d' range. This will minimize chances of buckling and rail/weld fractures.

iv. At the closer of TRR work, provide a piece of new rail between new rail panel and old rail otherwise joint will be battered and afterwards, weld may be defective.

v. Though the rail closer of 4M is permitted, it is advisable

to use closer of minimum 6M as the small rail closers give problem in maintaining alignment.

vi. All the four liners should be provided properly then only gauge will be perfect.

vii. Do not allow Bond fitter of OHE department to fix the structure in between two sleepers because at the time of tamping, both sleepers of either side of bond cannot be tamped without removing the bond. If same if provided near to sleeper, tamping can be done even without removal of bond.

3.4 Track Relaying Train:

TRT is a complete mechanized track renewal system which removes old Rails and sleepers and inserts the new sleepers which are loaded in trains and then inserts the new rails which are already unloaded at site.

Fig: 5 Track Relaying Train

3.4.1 Advantages of TRT:

i. Prefabricated panels not required, concrete sleepers loaded on modified BRHs are directly taken to site and relayed one by one.

ii. Auxiliary track not required.

iii. New rails unloaded at site and placed on sleeper shoulder are exchanged with old rails along with sleeper renewal.

iv. It can work in electrified section.

v. Separate block for TRR is not required as rails are also replaced along with the sleepers.

vi. Only TSR can also be done without replacing the rails.

3.4.2 TRT does Following Jobs in One Pass:

i. Threads out old rails from track.

ii. Removes old sleepers.

iii. Levels and compacts ballast bed.

iv. Places new sleepers.

v. Threads in new rails into track.

3.4.3 Track Relaying Train has Three Modes of Operation

i. Complete track renewal.

ii. Replacement of sleepers only.

iii. Replacement of rail only.

3.4.4 Track Renewal by TRT

3.4.4.1 Materials Required for Track Renewal by TRT

Sleepers	Sleepers are loaded in BRHs having modified auxiliary track at sides
ERCs and Liners	These are loaded on modified BRH attached in rear of TRT
Rubber pads	These are also loaded in racks specially provided on machine
Dunnage	Sleepers loaded in modified BRH's are separated by 75 mm x 75 mm dunnage
Rail	10/20 rail panels or welded rail panels are unloaded in advance and kept on sleeper shoulders.

3.4.4.2 Other Follow up Machines Required at Site:

. Ballast Regulator Machine

. Tamping Machine

. Rail Pick up unit with 3 modified BRHs. Road crane and slinging arrangement.

3.4.4.3 Advance Track Preparations at Site:

(Prior to arrival of Machines)

i. Sufficient stock of new sleepers with proper dunnage, ERCs, liners and pads are loaded in modified BRHs (quantity –for approx. 1 km track)

ii. Rail panels unloaded at site must be laid on sleeper shoulder and joints are welded /fish plated.

iii. All obstructions within 1 M of sleeper ends must be removed.

iv. Level crossings should be opened up to 1M on both ends of sleepers to allow movement of dynamic plough of TRT.

v. Unload the required quantity of ballast before relaying operation so that adequate ballast is available for tamping and relaxing speed.

3.4.4.4 Depot Activities:

a) Unloading and stacking of old/new sleepers.

b) Loading of new sleepers on the modified BRHs with proper dunnage.

c) Loading of rail sleeper fastenings such as liners, GR pads, and pandrol clips etc.

d) Unloading, stacking and dispatch of old sleepers.

e) Daily maintenance of machines.

Track Relaying Train Consists of 3 Segments/Units Called

i. Power Car (14.81 M) : It has main Engine 350HP and some space to stack sleepers for emergency use.

ii. Handling Car (21.05 M) : For working (It s also called conveyer car). Conveyer car has got conveyer for new sleepers called NT1, NT2 & NT3 Conveyers for old sleepers called OT1 & OT2. OT2 can be raised so that sleepers may not fall down. It also has old sleepers pick up plough and new sleeper dropping arrangement.

iii. Beam Car (22.34 M) : For threading new rails, sled is hung under this car. Cam wheel for spacing of sleeper is also at rear of this car.

3.4.4.5 Sequence of Operation of TRT :

a. The TRT is stopped at site of work in such a position that side plough is on first sleeper of cut rail.

b. Lowering of shoulder / slide plough.

c. Remove 3.4 meter long rail closure.

d. Lower sled from beam car on to the rail seats of rail closure.

e. Bring idle bogie of handling car on the sled and lockup(by bringing back the machine).

f. Slew out old rails and move TRT ahead so that sled clears rail closure portion.

g. Remove old sleepers manually from the closure area and level the ballast bed.

h. Old sleeper pick up wheel and dynamic plough are lowered in place cleared by removal of old sleepers.

i. Rail ends of proceeding day's work shall be connected to the new rails laid on the sleeper shoulder.

j. Start removing old sleepers by pick up wheel.

k. Set cam wheel on to the rail. Commence laying of new concrete sleepers by advancing the machine in automatic mode.

l. As TRT moves ahead, old rails are threaded out and new rails are threaded in with the help of 5 pair of guiding rollers provided all along the length of TRT.

m. No power block is required for working of TRT.

Sequence of machine working at site:-

Direction of Work ⟹

Rail Pick up System	TTM + DGS	Ballast Regulator	Clip Applicator	TRT + Modified BRH	Loco

3.4.4.6 Ballast Cleaning: It will be desirable to deep screen the ballast by BCM either much in advance or much in rear due to following reasons.

i. Output of BCM may not match with TRT.

ii. Requirement of speed restriction length will be much more.

3.4.4.7 Block Requirement:

Total : 4 Hrs. Out of total block, granted about 90 mts. of block period is consumed for the following activities:

1	Time taken by machine to reach site of work	20 mins.
2	Setting up of TRT in working	20 mins.
3	Winding up operations	20 mins.
4	Clearing block section	20 mins
	Total	80 mins.

Therefore it is necessary to work TRT in a minimum block of 4 Hrs. duration so that machine could be used optimally.

The rated output of machine is about 350m per effective hour of working & therefore in a total block of 4 Hrs, about 1 Km.Track renewal will be done.

It should also be kept in mind that block is also required for other activities such as –

i. Unloading of ballast and rails in 1 to 2 block sections ahead.

ii. Working of other machines such as Ballast regulator and Tamping machine.

iii. Welding, insertion of SEJ etc.

3.4.4.8 Speed Restriction (Suggested):

Days	Activities	SR	Track length
1st	Relaying and tamping	40 kmph	1 km
2nd day	2nd Tamping & Welding	60 kmph	1 km
3rd day	3rd & Final Packing	80 kmph	1 km
4th Day	----	Normal	

However, depending upon site conditions, exact requirement of speed restriction may change.

3.4.4.9 Picking of Old Rails:

TRT can thread out old rails up to 3 m away from centre of track. Released old rails are cut into single rails lengths by gas-cutter Single rails are then picked up by old rail pick up system consisting of 3 modified BRHs hauled by Utility Vehicle on which road crane is mounted. Road crane travels from Utility Vehicle to BRHs and load single rails in BRH, one by one.

3.4.4.10 Precautions While Working of TRT

a. No hand to be kept on modified BRH rails for Gantries.

b. Man in the gantry cabin must fasten seat belt.

c. Rear gantry if coming too fast towards the end of BFRs, there is no track further and may fall, speed to be regulated and one empty wagon must be kept.

d. A common point has to be decided beyond which each portal must not go for safety reasons.

e. Bridge between two BFRs must be inspected daily for any cracks etc.

f. While travelling with locomotive gantry must not move and jaws should rest on the sleepers to give some resistance .

g. Various assemblies should be chained and locked e.g. sled, Dynamic plough, Rollers etc.

h. When gantry is moving the jaws should be fully lifted up.

i. While parking, both the wheels of gantry must be on a wagon.

j. All broken sleepers should be removed in advance.

k. In wooden sleepers some of the longer sleepers or eccentrically placed get stuck up in the machine, therefore should be removed in advance.

l. Sled cannot jump a gap of two sleepers.

m. Sled has to be fastened properly during entry and exist of wheels otherwise chances of derailments are there.

3.4.5 Steps Required for Ensuring Quality Control at TRT Site:

a. A detailed survey should be conducted for existing rail level etc, and final rail level should be decided in advance, giving due care for fixed structures like bridges, turnouts, level crossing etc.

b. Ensure that ballast bed is properly consolidated after deep screening.

c. Remove all obstructions up to 1 meter from sleeper end like foundation; pegs etc should be removed in advance.

d. Check rails should be removed in advance.

e. Fittings of old sleepers should be roused in advance.

f. All the liners should be properly seated to maintain uniform gauge.

g. Proper ballasting after block must be ensured.

h. Track should be destressed within proper 'td' range.

3..5 Points and Crossing Changing Machine (T-28):

This machine is used for replacement of Turn outs. The portal crane of this machine lifts the new/old turn out assembly during replacement of turnout. The new turnout assembly is loaded and shifted to site on motorized trolleys. These trolleys have facility to move laterally and vertically by 300 mm for clearing the obstruction if any. The jib crane is also a part of this machine which is used for loading / unloading and spreading of PSC sleepers.

3.5.1 Activities at Depot

i. Unloading of sleepers by Jib crane

ii. Unloading of switches & crossing

iii. Spreading of sleepers of assembly after anti-corrosive paint.

iv. Linking of turnout on PSC sleepers

v. Welding & grinding of Rail Joints

vi. Dismantling of old turnout and stacking

3.5.2 Pre-Block Activities:

i. Take'L-section' initially considering ballast cushion, height of OHE, rail level of adjacent track, drainage etc. Decide final levels. Mark proposed levels on OHE mast or on some pegs.

ii. Decide the path for motorized trolley and check for any obstruction during the movement of pre-assembled turnout.

iii. Decide the path for movement of crawler and remove all obstructions like rail post, shunt signals etc.

iv. Do the detailed survey of site jointly with S & T department decide the position of ATS, SRJ. If any shifting is involved

the OHE staff also to be involved in marking Overall length & layout.

v. Deep screening and lifting if any should be done in advance and given some time for consolidation.

vi. Cutting at SRJ & one rail head & fish plating.

vii. Shifting of OHE mast& signal post if required should also be planned in advance.

3.5.3. Activates During Block:

i. Disconnection of point by S & T staff.

ii. Opening of joints.

iii. Removing existing T/out.

iv. Levelling of bed.

v. Bring newly assembled T/out.

vi. Laying & aligning.

vii. Reconnection of point by S&T staff.

viii. Adjustment of OHE if any shifting of mast is involved.

ix. Tamping.

x. Taking old T/O to safe place & distance.

3.5.4. Important Points for Quality Control:

i. Use correct switch according to RH/LH T/Out.

ii. Check curvature of tongue rail before linking the T/Out at depot.

iii. Mark the correct spacing as per drawing of Fan-shape T/Out.

iv. Use spherical washers.

v. Marking of holes for stretcher bar bolt in half throw condition on both sides.

vi. Use of half head stud bolts up to three sleepers from ATS.

vii. Use of proper liners to maintain the gauge.

viii. Don't forget to provide approach sleepers in sequence to run out the cant.

ix. Weld the SRJ to improve the running. Fishplated joints in lead portion can also be welded to minimize the free joint. This will also help in maintain the uniform versines in lead curve.

x. In case of CMS crossing, at toe of crossing and heel of crossing, joint should be gapless hence fishbolt holes in adjoining rails of CMS crossing should be drilled with proper size of drill bit (26.6/27mm).

xi. In case of LWR territory, three normal rail length shall be provided between stock rail Joint (SRJ) and SEJ as well as between heel of crossing and SEJ. Three normal rail length shall be provided with elastic rail clip / creep anchor to arrest the creep. However, where concrete sleeper turn out are laid, instead of three normal length one three rail panel shall be provided between SRJ and SEJ as well as between heel of crossing and SEJ.

xii. Ensure full crib ballast to maintain proper sleeper spacing.

xiii. Stock rail on turn out side of straight switch or curved switch having switch entry angle of more than o20' should be bent at theoretical toe of switch to such an extent that after the switch assembly is laid in track, the gauge measured between two stock rails just ahead of actual toe of switch is equal to nominal gauge + 6 mm.

3.6 Ballast Cleaning Machine (BCM):

On concrete sleeper track, manual deep screening should be avoided due to following reason-

i. Due to depth of concrete sleeper and increased ballast

cushion, it is very difficult for workman to do the work by standing between two sleepers. Hence quality cannot be ensured.

ii. Output is very less therefore time required to complete the section is more.

iii. Time required for relaxing the speed is more.

iv. The most important, It is unsafe and risky.

Fig: 6 Ballast Cleaning Machine.

BCM is the best option to avoid the above problems. As per IRPWM, deep screening should be done before CTR or TSR but BCM can be deployed even after CTR/TSR. Two types of ballast cleaning machines are used on track relaying site -

i. Plain track ballast cleaning machine RM-80 which can deep screen 140-150 meter track per effective hour

ii. Points and crossing ballast cleaning machine RM-76 which can deep screening a 1 in 12 turn out in 1 hour 30 minutes.

Normally a tamping machine and DTS are also deployed behind BCM in plain track so that track can be restored with SR 40 kmph.

3.6.1 Quality Control in Deep Screening by BCM:

Though the output of BCM is much more in comparison to manual deep screening, following precautions are required to ensure the quality.

i. Rail levels should be taken at every 30 m and drawn on a graph paper. Then decide proposed rail levels which should be marked on pegs or OHE mast.

ii. Survey should also be done to see the condition of track components, ballast, cess width and availability of land for waste disposal.

iii. Ensure that there is no obstruction like foundation, rail post etc within a width of 4100 mm to avoid infringement to cutter chain.

iv. Any signal rodding or cable which may interrupt the work should be removed.

v. Bridge approached which can not be screened by BCM should be screened manually in advance.

vi. Level crossing should be opened in advance.

vii. In electrified section, foundation of OHE mast should be measured in advance to ensure free movement of chain.

viii. Sufficient quantity of ballast should be available at site for tamping machine.

ix. The cutter bar will cut the formation if minimum 250 mm ballast cushion is not available. If the existing cushion is less then track should be lifted by BCM itself during working. Before doing so TRD staff should be consulted.

x. In LWR track, temporary destressing should be done as per provision of LWR manual.

3.6.2 Schedule for Speed Restriction for Deep Screening by BCM

As per correction slip no.122 of IRPWM, normal speed can be resumed in 8 days provided TTM and DTS are deployed along with Ballast cleaning machine.

Table showing the schedule for relaxing the speed-

Details of Work Work	Day of Restriction Work	Speed
Deep Screening of the track by BCM, ballast equalization followed by initial packing and initial stabilization	1st day	40 kmph
First round of tamping followed by stabilization of track by DTS	2nd day (1st tamping)	40 kmph
Survey of track for design tamping mode, boxing of ballast section and tiding	3rd day	40 kmph
Second round of tamping followed by stabilization by DTS	4th day (2nd tamping)	40 kmph
Survey of track for design tamping mode, boxing of ballast section and tiding	5th day	40 kmph
Third round of tamping followed by stabilization by DTS	6th day	75 kmph
Inspection of track, boxing of ballast and tiding	8th day	Normal speed

The period shown above may be increased depending upon local condition and consolidation of ballast.

3.6.3 Precautions During Deep Screening of Ballast by BCM Followed by TTM and DTS Machines-

a. Remember that maintenance temperature for LWR track is maximum t_d+10°C. If rail temperature is likely to go beyond this limit then temporary distressing should be carried out at 10° below the maximum rail temperature likely to attain during the period of work to avoid chances of buckling.

b. Hard sal wood block of size 600x300x300 mm (six nos) duly bounded should be kept ready at site for supporting adjoining three sleepers where cutter bar left in track and remains untamped. (It is advisable to remove cutter bar from track)

c. Sleepers of cutter bar area should be manually packed and ballast under cutter bar location sleepers should be removed only half an hour before expected traffic block.

d. In case of any fracture or cut in LWR, speed restriction of 20 kmph should be imposed.

e. During progress of work rail temperature should be closely monitored. If rail temperature goes below td-30^{0}C, the cold weather patrolling should be introduced to detect rail/weld failure if any.

f. After completion of deep screening and consolidation, LWR should be again distressed at proper t_d range.

g. Minimum distance of two rail length should be kept between ramp and level crossing, girder bridge, transition portion of curve etc.

h. In case malfunctioning of TTM and/or DTS, deep screening should be immediately stopped and suitable speed restriction should be imposed as in case of manual deep screening, on the portion of track which has been screened but not attended by TTM and /or DTS.

i. If Ballast regulating machine (BRM) is not deployed at site then sufficient man power should be deployed to

recoup ballast particularly on shoulders after machine working.

j. Before lifting of track, availability of ballast at site should be ensured.

Lines for Design Mode Tamping:

After track renewal work, particularly after deep screening work, the vertical levels and alignment get disturbed, hence, it is advisable that before relaxing the speed, tamping should be done in design mode-

a. For taking longitudinal levels and alignment in straight track, non-cess rail in case of double line section should be selected as datum or base rail, and for single line or middle line in multiple sections any of the two rails which is less disturbed, should be selected as datum rail.

b. For curve, inner & outer rail should be selected as datum rail for taking longitudinal section and alignment respectively.

c. For taking longitudinal levels, the zero station should be opposite to Km post and then at every 10 meter interval. Station no. should be painted on web of the datum rail.

d. Bench marks should be established at 200 – 1000 meter interval (on top of foundation of OHE mast) relating them to the GST bench mark levels.

e. Formation level should also be recorded at every 5th station. For this purpose, cushion ballast should be removed up to a level below it is not desirable to go, while carrying out deep screening.

f. During survey, obligatory points like girder bridge, level crossing, points & crossing should be noted down in reference to station no. and running kilometer.

g. Location of Km post and gradient post also be noted.

h. While plotting vertical rail profile and formation profile, horizontal scale of 1:1000 and for vertical scale 1:10 should be adopted.

i. Proposed rail level should be decided considering high points, ballast cushion, vertical clearance to over head structure including OHE & obligatory points etc.

j. Proposed rail level should be so decided that only lifting is involved as BCM can do the lifting only.

3.8 Mobile Flash Butt Welding Plant :

Flash butt welding are preferred due to less defects and better fatigue strength as compare to AT welds. Earlier, these welds were carried out in static plant only but now it has become possible to carry out this job on field with mobile flash butt weld plant. This plant is mainly deployed where number of welds are to be carried out in mass like construction site, through weld renewal work and conversion of SWR into LWR.

This machine can weld rail in the centre of track, on the shoulder, cess and in the track on which it is standing.

Fig. 7 Mobile Flash butt plant

In this process, rail ends are clamped and brought towards each other till flash starts. The flash will lead to heat generation and which will soften the steel. Current of about 5 volts and 35000 Amperes is passed between interfaces of two rails. Lot of flashing takes place and considerable heat is generated. The rail ends are moved to and fro automatically by the machine till the temperature rises to fusion limit of 1000^0C to 1500^0C. The rail ends are hydraulically pressed so that the soften rail ends are fuse together and form weld. The time taken for one weld is about 6 minutes.

3.8.1 Steps to Ensure Good Quality FB Weld with Mobile Flash Butt Welding Plant:

a. Ensure that rail ends are straight.(tolerance is +0.7mm / -0 mm for vertical plane and +/- 0.7 mm for horizontal plane with straight edge of 1.5m)

b. Rail ends should be cleaned by grinding to get clean surface.

c. In case of second hand rails like TWR work, height difference in both rail ends should not be more than 1.2 mm and Individual height should not be less than 164/ 150 mm for 60kg/52kg rails.

d. When weld is carried out in situ, train should not be passed up to 20 minutes after trimming operation.

e. Excess butting pressure is strictly prohibited as it leads to high joints.

f. To avoid buckling of track, a gap should be left at every 500 meter interval which will be utilized for distressing.

g. Welding work during night time and rainy season should be avoided.

■ ■ ■

CHAPTER - 4

GENERAL

4.1 Precautions During Handling of 90 UTS Rails:

(Abstract of RDSO's guidelines vide No.CT-35 of October 2014)

The rails, being the most important component of track, require careful handling to achieve desired service life. Improper handling of rails may cause damage to the rails. The use of higher UTS Rails has been necessitated to meet the requirement of traffic. The rails of higher UTS (90 and above), being brittle in nature, are particularly susceptible to sudden fracture from locations of even minor dents/deformity. As per RDSO's investigation, the presence of dent/deformation at the edge of the rail foot has been found as main cause of premature fractures. In case any damage is noticed, such rails, should not be used in track without removal of damaged portion of rails.

4.2. Steps to Ensure Quality Control in Thermit Welding:

a. Ensure that trained welder with valid competency certificate.

b. If welding is in-situ, then ensure adequate block.

c. Check condition of portion. Portion containing moisture should not be used.

d. Portion of same UTS and section should be used. If both rails are of different UTS then portion of higher UTS should be used.

e. Ensure that rail ends are cleaned properly as the improper cleaning of rail end can lead to lack of fusion.

f. Ensure proper gap with gap gauge before fixing the mould.

g. Ensure proper alignment with 1 M straight edge. (Should be within +/- 0.5 mm)

h. Ensure that rail ends are kept higher by providing wedges. (3-4 mm for 72 UTS rails and 2-2.4 mm for 90 UTS rails)

i. Ensure proper position of moulds. (Only 3-piece moulds manufactured by A.T. portion manufacturer should be used)

j. Ensure proper sealing by luting sand to avoid leakage.

k. Ensure adequate pressure in fuel tank. (In case of Air-Petrol tank :- 7+/- 0.7kg/cm^2, In case of compressed Air-Petrol pre-heating technique :– 2.0 -2.50 kg/cm^2 and for preheating by Oxy-LPG process pressure of oxygen and LPG cylinders should be 7.0-8.0 kg/cm^2, 2.0-2.50 kg/cm^2 respectively)

l. Ensure proper pre-heating time i.e. 10 - 12 minutes, 4.0-4.5 minutes and 2.0-2.5 minutes for Air-Petrol, Compressed Air-Petrol and Oxy-LPG preheating technique respectively.

m. Ensure proper reaction time as the premature tapping can cause slag inclusion.

n. Before tapping the molten metal, check the condition of lutin to avoid chances of leakage.

o. After tapping, proper waiting time should be given(mould waiting time) which is 6 minutes for 25 mm gap joint and 12 minutes for 75 mm gap joints.

p. Trimming should be done only by hydraulic weld trimmer, No chisel cutting should be permitted.

q. The wedges provided for aligning should not be removed up to 20 minutes from trimming.

r. Runners and risers also should not be removed until cold and that too knocking towards the rail.

s. Don't pass any train up to 30 minutes after pouring molten metal into mould as the inadequate cooling may result in cupped joint or even joint may fail.

t. Provide wooden block and joggled fish plate with clamps till joint is tested by USFD.

4.3 Use of Rail Free Fastening on Girder Bridges:

On girder bridges only rail free fastenings to be provided used. Presently we are providing channel sleepers which are permitted with suitably designed canted bearing plates, rubber pads, rail free clip and bolt type of fastening.

4.4 Provision of Short Welded Rails (SWR) on Unballasted Girder Bridges:

a. If the length of SWR is symmetrical to the centre line of bridge.- Up to 13.3 m opening.

b. If the length of SWR is unsymmetrical to the centre line of the bridge – Up to 6.1m opening

4.5 Provision of Long Welded Rails / Continuous Rails (LWR/CWR) on Bridges:

4.5.1. Bridges with Ballasted Deck (Without Bearing):

LWR can be continued over bridges without bearings like slabs, box culverts and arches.

4.5.2 Bridges With/Without Ballasted Deck (with Bearings):

i) Bridges provided with rail free fastenings (single span not exceeding 30.5m and having sliding bearings on both ends). Details in table below:

Zone	Rail Section	Overall length of Bridge	Remarks
I	60 kg	30 m	1.PSC/ST sleepers on approach 2. The approach track upto 50 on both sides shall be well anchored by providing any one of the following:- i) ST sleepers with elastic fastenings ii) PRC sleepers with elastic rail clips with fair 'T' or similar type creep anchors. 3. The ballast section of approach track upto 50 metre shall be heaped upto the foot of the rail on the shoulders and kept in well compacted and consolidated condition during the months of extreme summer and winter.
	52 kg	45 m	
II	60 kg	11 m	
	52 kg	27 m	
III	60 kg 52 kg	11m 27 m	
IV	60 kg	11 m	
	52 kg	27 m	

ii) Bridges provided with single span not exceeding 30.5m and having sliding bearings on both ends (with partly box-anchored). Details in table below:

Zone	Rail Section	Overall length of Bridge	Remarks
I	60 kg	77 m	1. On each span, 4 central sleepers shall be box-anchored with fair 'V' or similar type creep anchors and the remaining sleepers shall be provided with rail-free fastenings.
	52 kg	90 m	
II	60 kg	42 m	2.PSC/ST sleepers on approach The approach track upto 50 m on

	52 kg	58 m	both sides shall be well anchored by providing any one of the following:- i) ST sleepers with elastic fastenings ii) PRC sleepers with elastic rail clips with fair 'T' or similar type creep anchors.
III	60kg	23m	3. The ballast section of approach track upto 50 metre shall be heaped upto the foot of the rail on the shoulders and kept in well compacted and consolidated condition during the months of extreme summer and winter.
	52 kg	43m	
IV	60kg	23m	4. The girders shall be centralised with reference to the location strips on the bearing, before Llaying WR/CWR.
	52 kg	43m	5. The sliding bearings shall be inspected during the months of March and October each year and cleared of all foreign materials. Lubrication of the bearings shall be done once in two years.

iii) Welded rails may be provided from pier to pier with rail-free fastenings and with SEJ on each pier. The rail shall be box-anchored on four sleepers at the fixed end of the girder if the girder is supported on rollers on one side and rockers on other side. In case of girder supported on sliding bearings on both sides, the central portion of the welded rails over each span shall be box-anchored on four sleepers.

iv) LWR/CWR may also be continued over a bridge with the provision of SEJ at the far end approach of the bridge using rail-free fastenings over the girder bridge.The length of the bridge in this case however, will be restrictedby the capacity of the SEJ to absorb expansion, contraction and creep, if any, of the rails. The length of the bridges with the above arrangement that

can be permitted in various rail temperature zones for LWR/ CWR with SEJs having maximum movement of 120 mm and 190 mm are as follows:-

Rail temper-ature Zone	Maximum movement of SEJ used (mm)	Maximum length of Bridge in meters	Initial gap to be provided at t_d in (mm)	Remarks
IV	190	55	70	1. Approach sleepers – PSC or ST 2.SEJ to be provided at 10M from abutment
III	190	70	70	
II	190	110	65	
I	190	160	65	
II	120	20	40	
I	120	50	40	

v) Welded rails may be provided over a single span bridge with rail free fastenings and SEJs at 30m away from both abutments. The rail shall be box anchored on four sleepers at the fixed end of the bridge, if bridge is supported on rollers on one side and rockers on the other side. In case of bridge supported on sliding bearings on both sides, the central portion of the welded rails shall be box anchored on four sleepers. On both sides of approaches fully creep anchored fastening shall be used.The length of single span bridge permitted temperature zone-wise shall be as under:

Rail Temper-ature Zone	Maximum length of single span girder bridge with SEJ (190 mm gap) at 30 m away from both abutments with full creep resistant fastenings atapproaches ($t_d = t_m$)
IV	75 m
III	87 m
II	110 m
I	146 m

4.5.3 LWR on Ballasted Deck Bridges :

As per RDSO letter No. CT/IM/LWR (Part) dated 25.03.2014, LWR can be permitted on trial basis with the approval of PCE on Ballasted deck bridge up to the total bridge length of 110 m with following conditions-

a. Individual span does not exceed 24.4 m if bearings are fixed and free type.

b. Individual span does not exceed 45.7 m if elastomeric bearings, without restraint in longitudinal direction are used.

c. Minimum track structure – 52 kg (90 UTS) rail on PSC sleepers ,1540 nos/km

d. Track alignment on bridge is straight.

e. No SEJ within 100 m on both approaches.

f. All welds on bridge and up to 100 m on both sides are protected with joggled fishplate & clamps or two far ends bolts.

g. Full ballast cushion on bridge and 100 m approaches.

h. Bearings should be inspected in March and October every year.

i. On 100 m approaches, full ballast section and clear cess width of 90 cm.

j. Creep post on approaches at 20 m from both abutments.

k. Toe load of ERC should not be less than 600 kg. If found less, should be replaced.

4.6 Track Structure for New Lines and Renewal:

4.6.1 Proposed Rail section:

As per correction slip No. 117 dated 19.05.2009 of IRPWM, the recommended track structure will be as under:

Description	Rail Section	Remarks
For Track Renewal and doubling	60 kg	1. Applicable For All B.G. routes 2. Minimum UTS 90 UTS
For New line and Gauge conversion where expected traffic density is 5GMT & above	60 kg	
For New line and Gauge conversion where expected traffic density is 5GMT	52 Kg	
For Loop lines	52 kg or 60 kg SH	SH New Rails can be used on A, B and C routes with Board's prior approval.
For Private and other sidings having speed up to 50 kmph	52 kg SH or 52kg IU	IU- Industrial Use rails
For Private and other sidings having speed more than 50 kmph	60 kg	

4.6.2 Minimum Sleeper Density:

Description	Minimum Sleeper density	Remarks
For TSR, CTR, New line construction, doubling and Gauge conversion	1660 nos/ km	

For loop lines on A, B. & C route	1540 nos/km	
For Loop lines on D spl, D & E route	1340 nos/km 1540 nos/km	For temperature zone I & II For temperature zone III & IV
For Private and other sidings with permissible speed up to 50 kmph	1340 nos/km 1540 nos/km	For temperature zone I & II For temperature zone III & IV
For Private and other sidings with permissible speed more than 50 kmph	1660/km	

4.6.3 Recommended Depth of Ballast Cushion:

As per correction slip No. 126 dated 21.06.2011 of IRPWM, the ballast cushion to be provided as under, hence while assessing the quantity of ballast this depth should be taken in to consideration.

In case of	Minimum depth of ballast cushion	Remarks
Track renewal (CTR and TSR)	300 mm	Where possible 350 mm
All doubling, Gauge conversion and new line construction	350 mm	
Loop line	250 mm	
Private and other sidings,	300 mm	Permissible Speed up to 50 kmph
	350 mm	Permissible Speed more than 50 kmph

4.7 Protection of Alumino Thermit Weld (AT weld):

AT weld to be protected by Joggle fish plate with clamps or two far end bolt, at following locations-

a. On bridges having water way of 100 m or more and on approaches up to 100m length. (As per para 277 (a) (7) of IRPWM).

b. On curve 3 degree and sharper (As per para 429 of IRPWM).

c. On high embankment of 5 m height and above((As per para 502 of IRPWM).

4.8 Criteria for Rail Renewal:

i. Incidence of Rail fracture / failures.

ii. Wear on rail.

iii. Maintainability of track to prescribe standards.

iv. Expected service life in terms of Gross Million Tonnes carried.

v. Plan based renewals.

i. Incidence of Rail fracture / failures:

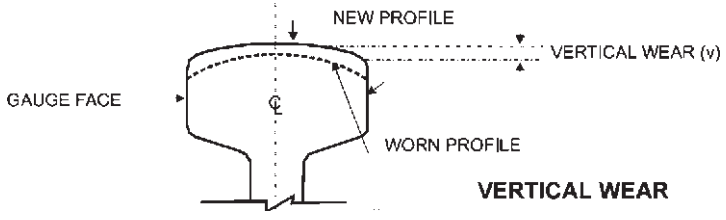
Section having number of rail renewal due to rail fracture and/or due to IMR defects are 5 per 10 km shall be given priority while deciding rail renewal. Trough Rail renewal is also allowed if numbers of defective welds existing are more than 30 per kilometer.

ii. Wear on Rail:

a. **Limiting loss of Section**: if loss in section is 6% in case of 52Kg rail. This can be known by taking actual weighment or by taking the rail profile of existing rail at rail end with special type of gadgets

b. **Wear due to corrosion:** Corrosion beyond 1.5 mm on web and foot of rail may be taken as criteria for rail renewal. Localized corrosion such as corrosion pit specially under rail foot and liner biting on rail foot acts as stress riser from origin of fatigue crakes and would necessitate renewal.

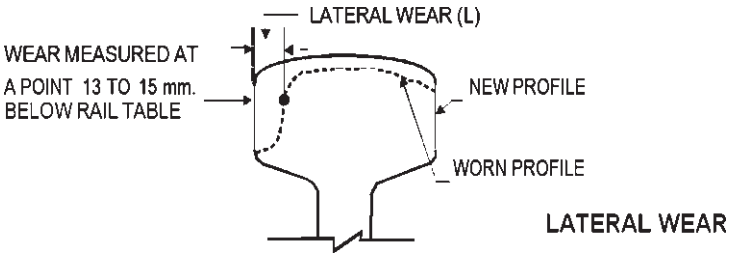
c. **Vertical wear:** If the vertical wear exceeds prescribed limiting wear of 13 mm for 60 kg and 8 mm for 52 kg rail. Wear should be measured at centre of rail head by measuring height of the rail by calipers or by taking profile of worn out rail.



VERTICAL WEAR

d. **Lateral Wear – Limits of lateral wear from relaying considerations are as under**

Section	Gaug	Category of track	Lateral wear
Curves	B.G.	Group 'A' & 'B' Routes..	8 mm.
		Group 'C' & 'D' Routes ..	10 mm.
	M.G.	Group 'Q' & 'R' Routes ..	9 mm.
Straight	B.G.	Group 'A' & 'B' Routes..	6 mm.
		Group 'C' & 'D' Routes	8 mm.



iii. Maintainability of track to prescribed standards: In case of poor running quality of track in spite of extra maintenance efforts is also a criterion for TRR. This may be in case of excessive battering / hogging, wheel burn or scabbing on rail top.

iv. Expected service life in terms of total G.M.T. of traffic carried – The rail shall be planned for through renewal after it has carried the minimum total traffic is given below. For tunnel and 100 m approaches and major & important bridges on high embankment (>4m) including 100 m approaches the life will be half of the GMT shown below.

	Service life in terms of G.M.T. carried	
Rail Section	**T-12 MM rails**	**90 UTS rails**
60 Kg/ m	550	800
52 Kg/ m	350	525

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

4.9 Project Report for Track Renewal Works:
(Abstract of Para 309A of IRPWM)

For every sanctioned track work e.g. CTR, TSR, TRR, deep screening, bridge timber renewal, etc. a detailed project report should be prepared. The report should cover the following aspects:

a. **Details of Work –** Name of the work, scope of work, cost of work, estimate details, exact location, reference of pink book to be given..

b. **Existing track structure –** Details of existing track component with deficiency if any, ballast deficiency in track, width of formation and other details should be taken as prescribed in P.Way diagram, details of level crossings, bridges, curves, height of bank/cuttings, details of yard if work to be done in yard, sidings, etc. should be given.

c. **Classification of track materials -** During taking inventory of the existing track structure by foot to foot survey, identification, classification and colour making of existing track materials as second hand and scrap would be done.The classification should be approved by the competent authority. Action plan for stacking/ storage and disposal of the released materials should be clearly indicated. Inventory of existing track materials would normally be prepared jointly by the PWI of the section and the PWI (Spl) for the renewal.

d. **Proposed track structure -** The proposed P.Way diagram of the affected length should be prepared in the same format as done for the existing track structure and incorporated in the project report.

e. **Existing/proposed gradient profile -** The levels of existing track should be taken at every 20 metres and a gradient diagram prepared. Introduction of vertical curves should be critically examined and the proposed profile of track shown in red line indicating the proposed grades.

Lowering of track should be avoided. Precise lift of track at girder bridges should be worked out and a separate scheme developed for lifting of girders on each of the affected bridges. Similarly, the magnitude of lifting at level crossing should be worked out and indicated in the report. Care should be exercised to keep the road surface in one level on level crossings spanning to across multiple tracks. This may require regrading of adjacent lines too.

f. **Realignment of curves -** All curves should measured and slew to be calculated for realignment if any considering the obligatory points.

g. **Method of execution –** The sequence of work should be indicated. Generally the work should be executed "bottom upwards" i.e. formation, ballast, sleepers then rails. In case of mechanized renewal, this sequence may not be followed exactly.

h. **Formation:** The project report should indicate the plan for widening of formation in both banks and cuttings wherever necessary. Provision of proper drains in cuttings should also be planned.

Formation treatment: Areas needing formation rehabilitation should be identified and a study for possible solutions and method of execution of the rehabilitation scheme should form part of the project report.

i. **Ballast:** The requirement indicating bifurcation of cess supply and depot supply and the source and means of each should be indicated. Mode of providing ballast cushion i.e. deep screening or raising should be identified along with sketches of cross sections present and proposed.

j. **Transportation of P. Way materials:** The mode of transportation for various tracks components and unloading of rails and sleepers in particular, at the work sites / depot should be indicated in the project report.

k. **Welding:** The complete details of welding requirements, and arrangements need to be made for its execution

whether departmentally or through contract should be clearly indicated in the report.

l. **Renewal of turnouts, bridge timbers, etc:** Complete details of turnouts, bridge timbers, level crossings, etc. where renewal is to be carried out should be indicated. Whether turnouts are to be laid manually or by mechanized means, with arrangements made. The report should also include the mode and agency for overhauling and relaying and making up of road surface at the level crossings

m. **Use of machines:** The machines that would be deployed for renewal, deep screening, and stabilization and tamping should be identified with staff nominated. The planning for repair and fueling of machines at the works site. The requirement of additional lines in the existing yards for making base depot and arrangements made for the same should be indicated in the report.

n. **Contracts:** The contracts required for various activities of works and planning for deployment of staff/supervisors for execution at various activities should be indicated.

o. **Material Planning:** The material requirement should indicate the materials to be arranged by the headquarters and by the Divisions. Rails with length, sleepers (including special type of sleepers), fastenings, switches and crossings, bridge sleepers and fittings, etc. should be fully covered.

p. **Manpower Planning:** The requirement of manpower including the officers, supervisors, and other staff should be worked out with minute details. The arrangements made for camping of these officials and mobilization should be reflected in the report

q. **LWR/CWR plans:** The LWR plan should be got approved by the competent authority in advance which should be a part of the project reports.

r. **Requirement of speed restrictions:** The report should indicate requirement of speed restrictions and traffic

blocks with duration. The corridor for blocks is required to be planned in consultation with the Operating Department and accordingly reflected in the report after obtaining the approval of DRM. Arrangements made for various types of wagons for transportation of ballast, sleepers, etc. together with requirement of locomotives should be indicated in the report in consultation with Sr. DOM and with the approval of DRM.

s. **Monitoring mechanism:** The list of all activities involved and the time estimation for each activity should be worked out. These activities should be sequenced and co-related in logical manner and network diagram prepared using CPM (Critical Path Method) method. The critical activities should thus be identified. These should form part of the project report.

The detailed project report covering the various points as mentioned above should be prepared as soon as the approval of Board is received for inclusion of that work in FWP. These reports should be submitted to headquarters for scrutiny and approval.

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For suggestions, please write to:
mail@iricen.gov.in

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