सत्यमेव जयते

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GOVERNMENT OF INDIA (भारतसरकार)
MINISTRY OF RAILWAYS (रेलमंत्रालय)
RAILWAY BOARD (रेलवेबोर्ड)

No. 2025/TK-II/22/1/2 **रेलभवन, नई दिल्ली – 110001**

दिनांक: 11.06.2025

Principal Chief Engineers,
All Zonal Railways.

Sub:-Uniformity in procurement of ERCs on Indian Railways

Ref:-(i) RDSO's letter No. CT/ET/Dev. dated 09.06.2025
(ii)Railway Board's letter of even no. dated 13.05.2025
(iii)RDSO's CT-48 report vide letter no. CT/PTX/insp./MT dated 17.05.2024

Vide letter at Ref. (i), RDSO has reviewed the subject of procurement standardization of Elastic Rail Clips (ERCs) on Indian Railways and based on its assessment and interaction with vendors, and has proposed discontinuation of procurement of ERC Mk-III in view of the superior performance and broader applicability of ERC Mk-V.

It is observed that ERC Mk-V offers better toe load performance, compatibility with wider base PSC sleepers (RT-8746, RT-8527), and is essential for LWR/CWR on points and crossings, as per provisions of CT-48. Furthermore, adoption of ERC Mk-V will help reduce track maintenance requirements due to its longer effective toe load retention.

Accordingly, Railway Board has **agreed to the proposal of RDSO** and decided that **further procurement of ERC Mk-III should be discontinued after 01.09.2025**. Zonal Railways are advised to take necessary action in this regard during the intervening period to ensure a smooth transition to exclusive procurement of ERC Mk-V.

This issues with the approval of the Competent Authority.

Anjana 11/06/25

(Anjana Kumari)
Deputy Director/Track-II
Railway Board
Tel - 011-478-45539

Copy to: **PED/Infra-1/RDSO**, Manak Nagar, Lucknow – For information and necessary action.

Room No. 146, Raisina Road, New Delhi-110001, Email: anjana.kumari87@gov.in

No. CT/EF/Dev. Dated: 09.06.2025

PED/ Track (M & MC),
Railway Board,
Rail Bhawan,
New Delhi-100 001

Sub: Uniformity in procurement of ERCs on Indian Railways

Ref: Railway Board's letter no. 2025/Tk-II/22/1/2 dated 13.05.2025

Railway Board, vide letter under reference, advised RDSO to review whether ERC Mk-III should be procured in future or not.

In this regard, it is pertinent to mention that ERC Mk-V provides better toe load compared to ERC Mk-III. At present, the new wider base PSC sleeper to drawing no. RT/8746 is being procured by the Railways. For better performance, use of only ERC Mk-V is recommended on RT/8746. It is also pertinent to mention that ERC Mk-V can be used on any PSC sleeper where ERC Mk-III is being used. At some locations, like points and crossings in LWR/CWR, only ERC Mk-V can be used. Since, the initial toe load of ERC Mk-V is higher, it takes longer time to reach to the minimum threshold value prescribed in para 628 of IRPWM, when TFR becomes necessary. Use of ERC Mk-V will reduce the frequency of TFR.

In the vendor directory for ERC, there are adequate number of vendors who manufacture ERC Mk-V. The vendors manufacturing ERC Mk-III alone, can easily switch over to ERC Mk-V within three to four months by installing hydro-copying machine and getting the prototype of ERC Mk-V approved. The issue was informally discussed with some of the vendors producing only ERC Mk-III. They informed that they can upgrade to ERC MK-V within a time period of about four months.

In view of superior performance of ERC Mk-V, it is proposed that further procurement of ERC Mk-III should be stopped.

This has approval of PED/Infra-I.

DA: Nil

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

No. 2025/TK-II/22/1/2 New Delhi, dt. 13.05.2025

PED/Infra-1
RDSO, Manak Nagar,
Lucknow.

Sub:- Uniformity in procurement of ERCs on Indian Railways
Ref:- RDSO's CT-48 report vide letter no. CT/PTX/insp./MT dated 17.05.2024

Even after proliferation of ERC-Mark-V, both ERC-Mark-III and ERC-Mark-V can be procured at present by the Railways. No guidelines exist for procurement or non-procurement of either type of ERC.

Considering that the toe load of ERC-Mark-V is better, it appears that only this version of the ERC should be procured for uniformity and reducing inventory. Also, for continuing the LWR through points and crossings as per CT-48, only this fastening can be used.

i) RDSO is advised to review the issue and advise whether ERC Mk-III should be procured in future or not. Also, this should be discussed with major explicit suppliers of ERC Mark III and a time schedule should be advised after which procurement of ERC Mark-III should be dispensed with.
ii) Review of Para 326 of IRPWM-2024 should also be done.

RDSO is advised to take further necessary action on the matter at the earliest and submit feedback within 7 days.

13/05/25

(Anurag Kumar)
Director Track(Mod.)
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अअमासं RDSO
रेल अग्रदूत Transforming Railways

No. CT/PTX/Insp./MT Date: 17.05.2024

Principal Chief Engineer,
All Zonal Railways & All concerned,
as per mailing list enclosed.

Sub: Continuing LWR through Turnouts.
Ref: i) Railway Board letter no. Track/21/2007/0401/7/1 dated 17.05.2024
ii) Railway Board letters no. 2019/CE-II/TK/LWR/Turnouts dated 06.09.2019 &1.09.2023
iii) This office letters of even no. dated 13.09.2019 & 08.12.2023

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Railway Board vide letter at reference i) above has approved the Report of Committee for 'Continuation of LWR Through Turnouts' for conducting field trial.

Based on above, the Report No CT-48 (Revised) May -2024 on 'Continuing LWR through Turnouts' containing detailed revised guidelines for laying LWR through turnouts has been prepared. This Revised Report replaces the earlier Report CT-48 (Revised) Nov - 2023 circulated vide this office letter dated 08.12.2023 at reference iii) above.

Related drawings are also uploaded on RDSO's Intranet website (10.100.2.12) hyperlinked at **Verticals→ Infrastructure→ Track Design→ Drawings →Points & Crossings→ Continuation of LWR through 1 in 8.5 & 1 in 12 turnouts** for ready reference.

This is for kind information and further necessary action please.

DA: As above

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Executive Director/Civil Engg. /Planning, Railway Board, Rail Bhawan, New Delhi-110001, for kind information please.

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II.

1. Executive Director, Track (M), Railway Board, Rail Bhawan, New Delhi – 110001
2. Director General, IRICEN, Pune – 411001
3. ED/Signal-II, RDSO, Lucknow.
4. Joint Director/Track-X (Inspection Unit), RDSO, Lucknow

III. Chairman-cum-Managing Directors

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GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

REPORT
ON
CONTINUATION OF LWR THROUGH TURNOUTS

Report No. CT-48 (Revised)

May - 2024

TRACK DESIGN DIRECTORATE
Research Designs & Standards Organization,
Lucknow-226 011

REPORT ON CONTINUATION OF LWR THROUGH TURNOUTS

1.0 Introduction:

A Fish Plated Joint is a major structural weakness in the track. Impact of the wheels at the Fish Plated Joints results into increased maintenance efforts, early wear and tear of assets, lower level of passenger comfort etc. LWR/CWR is a very effective way of elimination of Fish Plated Joints. A welded joint provides a continuous path for wheels and the need to jump a gap is avoided. However, there are track structures through which we have not been able to continue LWRs so far. Turnouts are one of such structures.

On the Indian Railway system, station yards are located at intervals of 8-10 km and LWRs are necessarily discontinued at turnouts in the yard. The discontinuation of LWR results into presence of a lot of Fish Plated Joints as well as the necessity of providing Switch Expansion Joints. Therefore, it is desirable to continue LWR through the turnouts of the station yards. The continuation of LWR through turnouts would enhance safety, reduce maintenance efforts and improve running and passenger comfort. The wear and tear would be reduced due to lesser impact. The problem of working out of liners, rubber pads, ERCs at joint sleepers will also be eliminated.

2.0 Past Efforts

In the past, arrangement of Stress Frame was used in switch and crossing portion for continuing LWR through Points and Crossings. The experiment was not successful owing to the cumbersome arrangement and various issues in maintenance.

In 2019 Railway Board ordered trial of continuation of LWR through turnouts in Up Line of Chamrola station yard of Tundla – Ghaziabad section of NCR. RDSO prepared a report on continuation of LWR through turnouts (Report No. CT-48) and the LWR continuation was carried out as per this report.

The performance of the LWR continued through turnouts was reported satisfactory by NCR. The behaviour of the LWR is satisfactory till date. No abnormal behavior of the LWR or creep at the turnouts have been noticed. The condition of fittings like bolts, nuts, rubber pads, ERCs, ACD etc. as well the track parameters at WCMS and Thick Web Switch are also satisfactory.

3.0 Recent Endeavors

Although, the LWR continued through turnouts at Chamrola yard of NCR performed satisfactorily, no further LWRs were continued through turnouts for a long time. Recently, Western Railway has done pioneering work in continuation of LWR through turnouts. 30.9 km LWR has been continued in Down Line through the turnouts at Chhayapuri – Pilol – Samlaya – Champaner stations. In the Up Line also, the LWR has been continued through the turnouts of Chhayapuri – Pilol – Samlaya. The LWRs continued through turnouts were inspected by RDSO team along with WR officials on 16.04.2024. The LWRs were found behaving properly and no creep on the turnouts was noticed.

Vide letter no. Track/21/2007/0401/7/1 dated 14.12.2023, Railway Board nominated a committee comprising of PED/Infra-1/RDSO, PCE/WR and SP/Track/IRICEN for a thorough review of previous CT-48 report. This report is prepared in compliance to Board's instructions.

4.0 Scope of Instructions Contained in the Report

Based upon discussions with various industry experts on the subject and experience of North Central and Western Railways, the instructions on continuation of LWR/CWR through turnouts have been framed to assist field officials in executing various activities for the continuation of LWR through turnouts. The instructions cover the following aspects:

i. Structural requirements
ii. Turnout –Welding of Internal Joints
iii. Welding Sequence of Internal Joints of Turnouts
iv. De-stressing of Turnout Zone of LWR before Integration with LWR
v. Integration of approaches of turnouts
vi. The sequence of integration of turnout and their approaches with LWR
vii. Placement of Anti-Creep Device (ACD)
viii. Monitoring / Inspection instructions
ix. De-stressing of Turnout Zone of LWR during service
x. Attention to Rail / Weld failures
xi. Anti-Creep Device (ACD)

5.0 Infrastructural Requirements

Weldable CMS Crossings and Thick Web Curved Switches are the basic requirements for continuation of LWR through turnouts. On IR, 1 in 12 and 1 in 8.5 turnouts with over-riding curved switches and CMS crossings were being used on majority on fan-shaped PSC sleeper layouts. However, nowadays, thick-web switches are being laid on entire 'A' routes and other high-density routes having annual traffic density of 20 GMT or more. In the thick-web switches, even the switch portion is provided with elastic fastenings. On such routes, only the replacement of existing CMS crossings by Weldable CMS crossings will be required for continuation of LWR. Following infrastructural requirements should be fulfilled in order to continue LWRs through turnouts:

i. Track structure for continuation of LWR through turnout should consist of minimum 60kg/90 UTS rails and PSC sleepers with and sleeper density of 1660 per km. Sleeper arrangement in the turnout portion shall be as per standard RDSO layout drawings.
ii. Ballast profile shall be maintained as per provisions of IRPWM - June 2020. Minimum ballast cushion of 300 mm with minimum 150 mm clean ballast cushion shall be ensured throughout the turnout.

iii. Extra shoulder ballast of 150 mm should be provided on both sides in the crossover portion. If there is a turn in curve instead of a crossover, extra shoulder ballast should be provided up to 150m length.

iv. A specially designed Creep Indicator Device known as Anti Creep Device (ACD) should be used in the switch portion of turnouts which permits movement of 7mm on either side of its central position (as per standard RDSO layout drawings).

v. The ACD allows a movement of 7 mm whereas the permitted relative movement between the stock and tongue rails is only 3 mm at present owing to the provision of heel blocks and distance blocks. Since, the purpose of providing the ACD is to observe the relative movement of stock and tongue rails, minimum 7 mm play needs to be provided at the heel blocks and distance blocks also. At present heel blocks and distance blocks are fixed using 25 mm diameter bolts through 28 mm diameter holes. A play of 7 mm on either side can be achieved by enlarging the diameter of the bolt hole. The diameter of holes of stock and tongue rails for fixing heel/distance blocks shall be increased from 28mm to 32mm to accommodate play of 7mm at ACD. At the time of initial installation of ACD and fixing of distance blocks/heel block, it must be ensured that all the blocks and their bolts are centrally placed and tightened with respect to the center of the holes so that equal play of 7mm is available on either side for unrestricted movement at ACD. To ensure the centrality of the bolts, it will be better to provide 30 mm diameter bolts during the laying process. These bolts should be replaced with 25 mm diameter bolts immediately after fixing of ACD. Care needs to be taken in the installation of ACD in the existing turnouts. The ACD should first be fixed in the stock rails. Matching holes in the tongue rails should be drilled subsequently to ensure the centrality of the ACD blocks.

vi. The latest RDSO standard layout drawings of 1 in 12 and 1 in 8.5 have been prepared keeping in view the continuation of LWR through the turnout. The latest drawings should be followed.

vii. Fastenings with Elastic Rail Clips Mk-V in the complete turnout zone as well as the rest of the LWR / CWR should be provided. The LWR/CWR with ERC Mk-V should only be continued through the turnouts. Continuation of LWR/CWR laid with ERC Mk-III shall be avoided and may be considered later, after adequate experience is gained, with approval of RDSO.

viii. Spring Setting Device (SSD) to be used at junction of rail heads (JOH).

ix. Check rail fabricated from standard 60kg (UIC)/60E1 rail section and connected to running rail through check rail blocks should be provided.

6.0 Turnout Drawings Suitable for LWR Continuation:

Previously, in order to enable continuation of LWR through turnouts, drawings of 1 in 12 turnout were revised with the provision of Weldable CMS crossing and Thick Web Switch. Recently, the drawings of 1 in 8.5 turnout have also been revised to suit LWR continuation through the turnout. Technical details of the revised drawings are given below:

1 IN 12 TURNOUT		
S. No.	**Drawing No.**	**Description**
1	RDSO/T-8779	1 in 12 turnout with 10125 mm Zu-1-60/60E1A1 thick web curved switch with anti creep device & weldable CMS crossing B.G. (1673mm) for 60kg (UIC)/60E1 on PSC sleeper.
2	RDSO/T-8780	10125mm curved switch with Zu-1-60/60E1A1 thick web tongue rails and anti creep device for 1 in 12 turnout B.G. (1673mm) for 60Kg (UIC)/60E1 on PSC sleepers.

3	RDSO/T-8780/1	Details of Zu-1-60/60E1A1 thick web tongue rails & 60Kg (UIC) stock rails with provision for anti creep device for 10125mm curved switch B.G. (1673mm) for 60Kg (UIC)/60E1.
4	RDSO/T-8781	1 in 12 weldable cast manganese steel crossing B.G. (1673mm) for 60Kg (UIC)/60E1 on PSC sleepers.
5	RDSO/T-8782 RDSO/T-8783	Anti creep device for 10125mm curved switch with Zu-1-60/60E1A1 thick web tongue rails B.G. (1673mm) for 60Kg (UIC)/60E1 on PSC sleepers.
6	RDSO/T-8784 RDSO/T-8785	Hardened packing plate for anti creep device for use with thick web switches for 60Kg (UIC)/60E1.
7	RDSO/T-8786 RDSO/T-8787	27 dia. HTS Bolt & Nut for Anti creep device for use with thick web switches for 60Kg (UIC)/60E1.
8	RDSO/T-5919	ERC Mk-V

1 IN 8.5 TURNOUT		
S. No.	**Drawing No.**	**Description**
1	RDSO/T-9774	1 in 8.5 turnout with 6400mm Zu-1-60/60E1A1 thick web switch (Curved) with anti creep device & weldable CMS crossing B.G. (1673mm) for 60kg (UIC)/60E1 on PSC sleepers.
2	RDSO/T-9775	6400mm curved switch with Zu-1-60/60E1A1 thick web tongue rails and anti creep device for 1 in 8.5 turnout B.G. (1673mm) for 60Kg (UIC)/60E1 on PSC sleepers.
3	RDSO/T-9775/1	Details of Zu-1-60/60E1A1 thick web tongue rails & 60Kg (UIC) stock rails with provision for anti creep device for 6400mm curved switch B.G. (1673mm) for 60Kg (UIC)/60E1.
4	RDSO/T-9776	1 in 8.5 weldable cast manganese steel crossing B.G. (1673mm) for 60Kg (UIC)/60E1 on PSC sleepers.
5	RDSO/T-9777 RDSO/T-9778	Anti creep device for 6400mm curved switch with Zu-1-60/60E1A1 thick web tongue rails B.G. (1673mm) for 60Kg (UIC)/60E1 on PSC sleepers.
6	RDSO/T-8784 RDSO/T-8785	Hardened Packing plate for anti creep device for use with thick web switches for 60Kg (UIC)/60E1.
7	RDSO/T-8786 RDSO/T-8787	27 dia. HTS Bolt & Nut for Anti creep device for use with thick web switches for 60Kg (UIC)/60E1.
8	RDSO/T-5919	ERC Mk-V

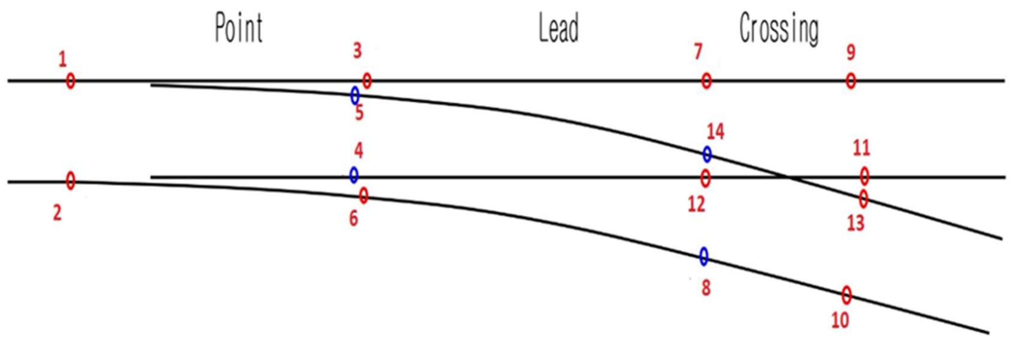
7.0 Sequence of Welding of Joints

While continuing the LWR through turnouts, sequence of welding of joints is very important. A wrong welding sequence may induce locked up stresses in the track structure which may adversely affect the behaviour of the LWR. All the internal joints of the turnouts should first be welded before integrating it with the adjoining LWRs. The scheme suggested in the following paragraphs should be strictly adhered to.

In case a different welding sequence is recommended by OEM, he should be asked to get their welding sequence approved by RDSO before taking any supply.

8.0 Welding of Internal Joints of Turnouts

Welding of internal joints of all the turnouts should be done before integration with the LWR. While welding the internal joints of the turnout, care should be taken to weld the joints in proper sequence with proper precautions. Joints No. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 & 14 indicated in the following sketch are the internal joints to be welded before integration of the turnout with LWR. There is no restriction of temperature while welding of Joints 1-14. The welding has to be done in the number sequence indicated in the sketch with the precautions indicated in the following table.

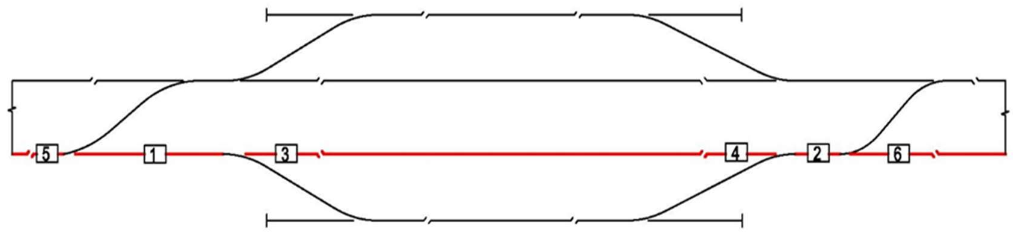


The welding of the internal joints of the turnouts should be carried out in the following sequence with precautions as indicated below:

Joint No.	Sequence of welding	Precautions
1	1	General precautions of AT welding should be observed.
2	2	General precautions of AT welding should be observed.
3	3	ERCs of Stock rail should be removed and general precautions of AT welding should be observed. ERCs should be refixed after cooling of the joint.
4	4	General precautions of AT welding should be observed.
5	5	General precautions of AT welding should be observed.
6	6	ERCs of Stock rail should be removed and general precautions of AT welding should be observed. ERCs should be refixed after cooling of the joint.
7	7	ERCs of straight lead between joint No. 3 to 7 should be removed and general precautions of AT welding should be observed. ERCs should be refixed after cooling of the joint.
8	8	ERCs of curved lead rail between joint No. 6 to 8 should be removed and general precautions of AT welding should be observed. ERCs should be refixed after cooling of the joint.
9	9	ERCs between joint No. 7 to 9 should be removed and general precautions of AT welding should be observed. ERCs should be refixed after cooling of the joint.
10	10	ERCs between joint No. 8 and 10 should be removed and general precautions of AT welding should be observed. ERCs should be refixed after cooling of the joint.
WCMS crossing, if not laid previously should be inserted with four closure rails.		
11	11	General precautions of AT welding should be observed.
12	12	ERCs of straight lead from Joint No. 4 to 12 should be removed and general precautions of AT welding should be observed. ERCs should be refixed after cooling of the joint.
13	13	General precautions of AT welding should be observed.
14	14	ERCs of curved lead from Joint No. 5 to 14 should be removed and general precautions of AT welding should be observed. ERCs should be refixed after cooling of the joint.

9.0 The Sequence of Integration of Turnouts and their Approaches with LWR

The sequence of welding of joints of the connecting track for integration of turnouts with the LWR is indicated in the following sketch.



i. The internal joints of all the turnouts should be welded first, following the procedure given in para 8.0 above.

ii. If there are more than one turnout at one end of the yard, the joints between the turnouts should be welded first. The location of these joints is indicated as [1] in the above sketch. **It should be ensured that the last pair of the joints between the turnouts are welded at the destressing temperature.** While welding the last pair of the joints between the two turnouts, all the ERCs up to both the turnouts should be removed. ERCs should be refixed after cooling of the weld at td

iii. The procedure indicated in para (ii) above should be followed for welding of joints between the turnouts on the other side of the yard. The location of these joints is indicated as [2] in the above sketch.

iv. If there are more turnouts, the same procedure should be followed for welding of joints between them.

v. Once all the joints between the turnouts are welded, the joints between the SEJ of the inner LWR of the yard and the turnout should be welded. The locations of these joints are indicated as [3] and [4] in the above sketch.

vi. The joints between the outer SEJs and the turnouts should be welded now. The location of these joints is indicated as [5] and [6] in the above sketch.

vii. Now, the SEJ of the inner LWR should be removed and normal rail should be inserted in their place. While welding the last pair of joints created due to removal of SEJ, it should be ensured that the welding is done at the destressing temperature and all the ERCs for 150 m on the LWR side and all the ERCs up to the turnout on the turnout side are removed. ERCs should be refixed after cooling of the joints.

viii. Procedure given in para (vi) above should be repeated for integrating the turnouts with the inner LWR on the other side of the yard.

ix. After the turnouts are integrated with the inner LWR, the integration with the outer LWR should be undertaken as described below.

x. The SEJ of the outer LWR (Block Section LWR) should be removed and normal rail should be inserted in its place. While welding the last pair of joints created due to removal of SEJ, it should be ensured that the welding is done at the destressing temperature and destressing is done by removing all the ERCs for 150 m on the LWR side and all the ERCs up to the turnout on the turnout side. ERCs should be refixed after cooling of the joints.

xi. Procedure given in para (x) above should be repeated for integrating the turnouts with the outer LWR (Block Section LWR) on the other side of the yard.

xii. ACD shall be fixed in the turnouts at td [Please see Para 5(v), Para 11]

10.0 Design of Anti Creep Device

In a CWR, the turnout is placed in the non-breathing length of CWR. Hence the stock Rail is not expected to move. Crossing (WCMS) of turnout is of sturdy design and its double-V shape effectively restricts any longitudinal movement. However, the straight and curved lead rails between the (WCMS) crossing and Switch, although partly restrained by the toe load of ERCs, do breathe under temperature variations. In order to monitor the effectiveness of restraining the movement by crossing and movements in switch portion, ACD is provided in CWR. The ACD consists of a fork and a pin. The fork side is fixed on stock rail and pin side is fixed on tongue rail. In centralized position 7mm gap exists on both sides of pin. ACD gaps indicate the relative displacement between the stock rail and the tongue rail. ACD absorbs movement of 7mm on its both sides from the centralized position without any resistence. In case there is further movement i.e. beyond 7mm the device is designed to absorb movement up to 2mm without breaking. Movement beyond this limit may result in bending/breakage of distance/heel block bolts and/or ACD and indicative of abnormal behaviour of CWR. The closure of gaps at ACD is indicative of possible abnormal behaviour/incipient break of ACD. Thus close monitoring of CWR and exercise to find the cause should be carried out to take remedial measures in such event.

The design of ACD thus limits the movement of tongue rails to 7 mm on either side which ensures the safe operation of the clamp lock and drive rod of the point machine.

ACD is designed to withstand a predetermined longitudinal force and should break when the force surpasses this limit. The theoretical extent of movement of tongue rail under thermal forces in extreme condition is 9 mm (Annexure-I). Since, 7 mm play is provided at the ACD, the design should be such that it should withstand the forces generated due to expansion/contraction of 2 mm. The calculation of forces has been done in Annexure-I. While arriving at the total force for which the ACD has to be designed, an expansion/contraction of additional 2 mm for the stock rail has also been assumed. Revised design of the ACD is being issued separately.

11.0 Placement of ACD

After integration of turnouts with LWR, the ACD blocks in stock and tongue rails should be fixed at the location shown in RDSO's drawing keeping the pin of the ACD in the central position between the forks. In this position, there will be a gap of 7mm on either side of the pin of the ACD. The part of ACD with fork should first be fixed in the stock rails. Matching holes in the tongue rails should be drilled subsequently to ensure the centrality of the ACD blocks. Photograph of a centrally fixed ACD is given below. Fixation of ACD should be undertaken at td.

12.0 Welding in the diverging track

The track diverging from the turnout will either be a crossover or a turn in curve. In the case of a crossover, all the joints of the crossover should be welded. The last pair of joints of the crossover should be welded at the destressing temperature after removing all the ERCs of the crossover. ERCs should be fastened after cooling of the joints at td. In the case of a turn in curve, all the joints up to 150 m length should be welded. SEJ should be provided at a distance of 150 m if the LWR is not continued in the turn in curve (Loop Line / Any other Line). The CWR should not be continued in case the stock rail is terminating in derailing switch on loop line/other line within 150m from SRJ. In case of cross overs, CWR shall be continued only when WCMS and TWS are provided on turnouts of both sides of the cross over. Further, if loop line/other line is not on LWR and/or the track structure is inferior to the one specified in Para 5, CWR should be continued at least for 150m into loop line from SRJ and SEJ should be provided. The track from SRJ to 150m length should comply to the requirements specified in Para 5 above. Integration of loop line with CWR to be done only after necessary upgradation of track structure of loop.

13.0 Continuation of LWR through Turnouts in New Works

The procedure given in the foregoing paragraphs are for continuation of LWRs through existing turnouts. However, in new works also, the same procedure should be followed. The last integration joints of the turnout approaches should be welded after the final tamping of the track and destressing following the same sequence and precautions.

14.0 Maintenance of LWR continued through Turnouts

Maintenance of LWR in the turnout portion should be done as per the stipulations for maintenance of normal LWR track given in Para-344, 345 and 346 of IRPWM. However, the diverging track of the turnout shall also be treated as a part of the LWR and all the precautions applicable for maintenance of LWR shall be applicable on the diverging track as well.

15.0 De-stressing of the LWR during service

In case of unusual behavior of LWR, de-stressing should be planned and carried out in the following steps:

i. Each turnout and its approaches should be isolated from LWR by cutting them ahead of SRJs and the back of the heel of the crossing joints.

ii. De-stressing of the LWR should be done as per the procedure laid down in para 347 of IRPWM-2020. It should be ensured that the small track patches between the turnouts are also de-stressed.

iii. The turnouts and their approaches should again be integrated with LWR following the procedure given in para 9.0 above.

16.0 Rail / Weld Failure in Turnout Zone

It is of paramount importance that whenever a fracture/crack of a rail/weld is noticed, immediate action is taken to restore the track, if necessary, with restricted speed, with the least possible delay. Emergency, temporary and permanent repairs should be carried out as per para-349 of IRPWM 2020.

If it is not possible to carry out emergency / temporary repairs due the space constraint for fixing of joggled fishplate or if the fracture has taken place in the tongue rail, traffic should be allowed after replacement.

17.0 Inspection and Monitoring of Turnouts

i. Inspection of LWR/CWR shall be done as per the provisions of IRPWM - June 2020 with up-to-date correction slips. However, for one weather cycle, the turnout zone shall be inspected weekly by JE/ SSE and fortnightly by ADEN.

ii. Availability of fittings and their effectiveness shall be ensured in complete LWR including turnout. Regular monitoring of the toe load shall also be done. Remedial measures should be taken in case the toe load is found to be less than 800kg.

iii. Deep screening should be done at the time of installation of LWR through turnout if the stipulated ballast cushion as detailed in para 5(i) is not available. Deep screening shall be ensured as per stipulations of Para 636 & 637 of IRPWM – 2020.

iv. Creep in the turnout region shall be measured fortnightly on the proforma prescribed in Annexure-III by providing creep posts at the following locations:

   A. At the actual toe of the switch (ATS) for stock rail & tongue rail tip.
   B. In the crossing portion at the actual nose of crossing (ANC).
   C. At mid of lead portion of the turnout.
   D. At 20m from ATS at approaches of turnout.
   E. At 50m beyond ANC at approaches of turnout.
   F. At mid point of crossover or at 50 m from heel of crossing (In turn in curve)

v. Initial testing and the periodic testing of AT welds shall be done as per para 8.10 & 8.11 of the Manual for Ultrasonic testing of rails & welds.

vi. Action for defects in AT welds shall be taken as described in Para 6.4 & 8.14 of Manual for Ultrasonic testing of rails & welds.

vii. The gap between the pin and fork on either side of the pin of ACD shall be measured and recorded fortnightly in the proforma given in Annexure III. The gaps should ideally be 7mm on both sides at destressing temperature and 0 & 14 / 14 & 0 in the extreme summer/winter seasons.

viii. Any abnormal Gap between the pin and fork of the ACD and/or distortion of bolts of the ACD and distance blocks/heel blocks of turnouts and/or breakage of pin/fork/bolts of the ACD indicates unusual behavior of the LWR in turnout or its approaches.

ix. The behavior of LWR on turnout shall be kept under strict observation and performance be evaluated as per the above provisions and provisions of the IRPWM - June 2020. On observing unusual behaviour, suitable action should be taken immediately to ensure safety. Any unusual behaviour should be reported to RDSO through PCE/CTE.

x. Special care should be taken to ensure ideal conditions on both approaches of P&C, namely before ATS and after crossing due to mechanism of force transfer and change in rigidity of track structure. These areas should be specifically monitored for development of alignment defects and in case such defects are observed careful investifation and remedial action should be taken.

xi. Considering the present design of TWS and fixation of ACD, the bolts of distance/heel blocks will start sharing load after movement of 7mm from centralized postion. Thus, it is expected that the bending/breakage of bolts may precede the breakage of ACD. Thus distance/heel blocks and distance block bolts should be carefully monitored for bend/breaks.

xii. The total movement at ATS may be up to 12mm in case of CWRs laid in temperature Zone-IV only in extreme weather conditions, say once or twice in a year. Existing point machines are designed to accommodate movement of tongue rail in longitudinal direction up to the extent of 10mm. Thus, in rare cases, point machines may need minor adjustments say once or twice a year in extreme weather conditions in zone IV. There will be no such issue in temperature zones I, II & III as total movement at ATS will be within the limit of 10mm. (Annexure -IV)

18.0 Action in case of closure of gap at ACD

ACD gap indicates the behaviour of LWR in the turnout zone. Whenever the gap on any side is closed, the creep at the points indicated in para 17 (iv) above should be observed. If there is no creep, no action is warranted as the closure is due to temperature variation and the ACD is expected to return to its central position when the temperature reaches the destressing temperature. However, if there is creep in any part, the reason for the same needs to be investigated.

i. The condition of the fastenings should be checked. The rubber pads may be crushed / displaced. The liners may be broken or missing. Missing / broken / crushed fittings should be replaced.

ii. Notching at the rail seat on sleeper should be checked.

iii. The toe load of ERCs should be checked. If it is less than 800 kg, ERCs should be replaced.

iv. Condition of packing at the sleepers should be observed. In case of loose packing, tamping should be done at the earliest.

v. Squareness of the sleepers should be checked and adjusted if required.

vi. After taking the remedial measures indicated above, the stock rail should be cut and pulled to adjust the gap at SEJ. Welding of the joints created due to this adjustment should be done at the destressing temperature following the procedure given in para 8.0 and 9.0 above.

vii. A close watch should be kept on the ACD gap after the adjustment.

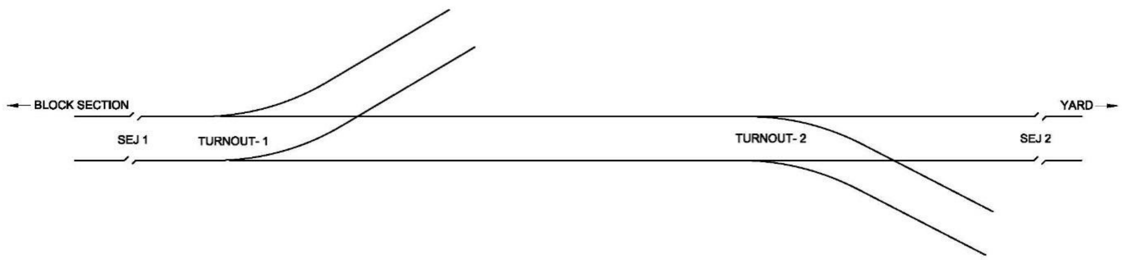
19.0 Roadmap for continuation of LWR through turnouts

LWRs may be continued through turnouts as discussed above. All the calculations have been made keeping the range of temperature variation in Temperature Zone IV but there is a need to tread with caution. Since, at present, we do not have sufficient experience of LWR continuation through turnouts, the continuation following the procedure described above should be done in Temperature <u>Zones I, II and III only</u>. In Temperature Zone-IV, each Railway may continue LWR through one yard and keep it under close monitoring for one weather cycle. Feedback on the behaviour of the LWRs in Zone IV should be shared with RDSO for further action.

20.0 Welding of fish plated joints in turnouts and approaches without continuation of LWR

There may be situations where LWR cannot be continued through the turnout because of the track structure not meeting the stipulated standards or any other constraints. In such cases, the fish plated joints in the turnout and approaches adversely affect the running quality and require a lot of maintenance input. Welding of these joints without integration with adjoining LWRs appears to be a good proposition. A typical layout on one side of a yard is indicated in the following sketch. In such cases all the joints between SEJ-1 and SEJ-2 should be welded. Calculations for movement at SRJ due to temperature variations have been made in Annexure-II. If the SEJ is situated at a distance of minimum 40 m from SRJ or back of crossing, the movement will be of the tune of 7 mm which can be accommodated by providing 32 mm diameter holes with 25 mm diameter bolts at heel blocks and distance blocks. If the SEJ is situated at a longer distance, the movement will be less than 7 mm. This movement will not affect the working of signalling gears.

As per existing LWR provisions, SEJ cannot be at a distance less than 40m. Hence this situation is not considered.



The following procedure should be adopted for welding the joints:

i. The track between SEJ-1 and SEJ-2 should meet all the requirements stipulated in para 5.0 above.

ii. The turnouts should conform to the drawings mentioned in para 6.0 above including the provision of ACD.

iii. Welding of internal joints of the turnouts should be done first following the procedure given in para 8.0.

iv. The welding of the track between the turnouts and the approaches should be done following the procedure stipulated in para 9.0. All the provisions stipulated in para 9.0 should be followed except the removal of SEJs.

v. For the purpose of inspection and maintenance the welded track shall be treated as LWR and all the precautions should be followed.

vi. Monitoring of the track between the SEJs should be done in the proforma given in Annexure-III as per para 17.0.

vii. Any unusual behaviour of the welded track should be reported to RDSO.

21.0 Conclusion

In view of the above, LWRs may be continued through turnouts with following arrangements on Main line:

i. Track structure should consist of minimum 60kg/90 UTS rails, PSC sleeper with ERC Mk-V and sleeper density 1660 nos. per km in LWR portion. Sleeper arrangement in turnout portion shall be as per standard layout.

ii. Use of Thick web switches laid on PSC sleepers with elastic fastenings.

iii. Use of a specially designed anti creep device (ACD) behind heel of switch in tongue rail portion of turnouts.

iv. Use of weldable CMS crossing.

v. Welding of tongue rail & lead rail joints.

vi. Ballast profile shall be maintained as per provisions of IRPWM - June 2020. Minimum ballast cushion of 300mm shall be ensured in complete LWR through turnout. Minimum clean ballast cushion of 150mm would be maintained at all times.

vii. Stable formation and other provisions of IRPWM - June 2020 shall also be ensured.

viii. Availability of fittings & its effectiveness shall be ensured in complete LWR including turnout. Regular monitoring of toe load shall also be done and remedial measures be taken in case of unusual behavior.

ix. Deep screening should be done at the time of installation of LWR through turnout if the stipulated ballast cushion as detailed above is not available. Deep screening shall be ensured as per stipulations of Para 636 & 637 of IRPWM - June 2020.

x. Fish plated joints should be eliminated following the procedure given in para 20.0, if it is not possible to continue the LWR through the turnouts.

Annexure-I

Designed Capacity of ACD:

Designed Longitudinal load bearing Capacity of ACD for 1 in 12 Turnouts:

<u>Calculation for Zone-IV:</u>

Assumptions:

- Range of temperature variation= 76°C
- De-stressing temperature Td= Tm to Tm+5°C
- For the critical scenario of summer, Td =Tm
- For the critical scenario of winter, Td =Tm+5°C
- Max. increase in temperature from Td = increase from Tm =76/2=38°C
- Max. decrease in temperature from Td = decrease from Tm+5=38+5°C=43°C
- Length of lead rail = 22000 mm

Restraining Force of ERCs and its Effect on Breathing of Lead Rail:

Total restraining force due to toe load of ERCs in the lead portion
= No. of sleepers x 2 ERCs per rail seat x 0.4 x 1200 (Toe load of ERC/MK-V) (0.4 is transfer function)
= 37 x 2 x 0.4 x 1200 = 35520 kg = 35.5 tone

Assuming a 30% loss in toe load during service, min. restraining force available = 0.7 x 35.520 = 24.864 tone

This restraining force will be zero at ACD and 24.864 tones (full value) will be achieved gradually at the toe of the crossing.

Average restraining force = (24.864+0)/2= 12.432 tone, say 12.5 tone

Reduction in Expansion/ Contraction due to Restraining Force = Δl_r = (Fxl)/(AxE)

Δl_r=(12.5x 1000 x 2200)/ (76.86 x 2.11x10^6)=(12.5 x 2.2)/ (76.86 x 2.11)

Δl_r = 0.17Cm = 1.7mm

Max. free Expansion in Lead Rail due to increase in Temperature:

Max. free expansion = lαt = 22000 x 1.152 x 10^{-5} x 38 =**9.6 mm**

Max. free Contraction in Lead Rail due to decrease in Temperature:

Max. free contraction = lαt = 22000 x 1.152 x 10^{-5} x 43 =**10.89mm**

Net Expansion in Lead Rail due to increase in Temperature:

Net expansion in lead rail = Max. free expansion – restraining effect of ERC
=9.6-1.7 = 7.9 mm = **say 8 mm**

Net Contraction in Lead Rail due to a decrease in Temperature:

Net contraction in lead rail = Max. free contraction – restraining effect of ERC
= 10.89 -1.7 = 9.19 mm = **say 9 mm**

Force on ACD:

As calculated above, the unrestrained thermal movement of lead rail at ACD is 9 mm in extreme winter but the maximum play permitted on either side of the pin of ACD is 7 mm as any more movement will affect the signalling gears.

Therefore, the force coming on the fork and pin of ACD to compensate for thermal expansion/contraction of 2 mm in lead rail = F = ΔlAE/l

F= (0.2 Cm x 76.86 Cm^2 x2.11x10^6 Kg/Cm^2)/(22x100 Cm) Kg
F= 0.2x76.86x2.11x10^3/2200 tone = 0.2x76.86x2.11/2.2 tone
F= 14.74 tone = **say 15 tone**

Allowing further, 2 mm maximum movement in stock rail in opposite direction to give sign of misbehavior of LWR, **Additional force allowed in ACD = 15 tones**.

Therefore, the design capacity of ACD of 1 in 12 turnout = 15 + 15
= 30 tones of longitudinal force.

Designed Capacity of ACD for 1 in 8.5 Turnouts:

Calculation for Zone-IV:

Assumptions:

- Range of temperature variation= 76°C
- De-stressing temperature Td= Tm to Tm+5°C
- For the critical scenario of summer, Td =Tm
- For the critical scenario of winter, Td =Tm+5°C
- Max. increase in temperature from Td = increase from Tm =76/2=38°C
- Max. decrease in temperature from Td = decrease from Tm+5=38+5°C=43°C
- Length of lead rail = 16000 mm

Restraining Force of ERCs and its Effect on Breathing of Lead Rail:
Total restraining force due to toe load of ERCs in the lead portion
= No of sleepers x 2 ERCs per rail seat x 0.4 x 1200 (Toe load of ERC/MK-V) (0.4 is transfer function)
= 27 x 2 x 0.4 x 1200 = 25920 kg = 25.9 tone
Assuming a 30% loss in toe load during service, min restraining force
Available = 0.7 x 25.9 = 18.144 tone
This restraining force will be zero at ACD and 18.144 tones (full value) will be achieved gradually at the toe of the crossing.
Average restraining force= (18.144+0)/2= 9.072 tone, say 9.1 tone
Reduction in Expansion/ Contraction due to Restraining Force = Δl_r = (Fxl)/(AxE)
Δl_r=(9.1x 1000 x 1600)/ (76.86 x 2.11x10^6)=(9.1 x 1.6)/ (76.86 x 2.11)
Δl_r = 0.08Cm = 0.8mm

Max. free Expansion in Lead Rail due to increase in Temperature:
Max. free expansion **=** lαt = 16000 x 1.152 x 10^{-5} x 38 = **7.0 mm**

Max. free Contraction in Lead Rail due to decrease in Temperature:
Max. free contraction **=** lαt = 16000 x 1.152 x 10^{-5} x 43 =**7.92 mm**

Net Expansion in Lead Rail due to increase in Temperature:
Net expansion in lead rail = Max. free expansion – restraining effect of ERC
=7.0 – 0.8 = 6.20 mm = **say 6 mm**
Net Contraction in Lead Rail due to a decrease in Temperature:
Net contraction in lead rail = Max. free contraction – restraining effect of ERC
= 7.92 – 0.8 = 7.12 mm = **say 7 mm**

Force on ACD:
From above, the unrestrained thermal movement of lead rail at ACD is 7 mm in extreme winter and the maximum play permitted on either side of the pin of ACD is also 7 mm. Therefore, the force coming on the fork and pin of ACD to compensate thermal expansion/contraction in lead rail = F = Δl AE/l = 0, as Δl is zero in case of 1 in 8.5 turnouts.

Allowing further, 2 mm maximum movement in stock rail to give the sign of misbehavior of LWR, the force coming on the fork and pin of ACD to compensate expansion/contraction of 2 mm in lead rail = F = ΔlAE/l

F= (0.2 Cm x 76.86 Cm^2 x2.11x10^6 Kg/Cm^2)/(16x100 Cm) Kg
F= 0.2x76.86x2.11x10^3/1600 tone = 0.2x76.86x2.11/1.6 tone
F= 20.26 tone = **say 20 tones**

Therefore, the design capacity of ACD of 1 in 8.5 turnout = 0 + 20
= 20 tones of longitudinal force.

Annexure II

Calculation of movement at SRJ if turnout is not integrated with LWR

Assumptions:

(i) All internal joints of turnout are welded.
(ii) Track on approaches of turnouts are welded and integrated with turnout.
(iii) All turnout of one end of yard are integrated with each other and with the track on approaches but not integrated with LWR of yard and block section.
(iv) The stretch is isolated with SEJ on either sides.
(v) 30% loss is assumed in longitudinal resistance during service.
(vi) Maximum temperature variation from Td is assumed to be 43 °C in Zone-IV.
(vii) Longitudinal ballast resistance (min.)=12.98 kg/cm/rail seat.
(viii) Minimum Length available between SRJ and SEJ is 40 m.

Maximum thermal force in track due to temperature variations = $AE\alpha\Delta t$
$= 76.86 \times 2.11 \times 10^{6} \times 1.152 \times 10^{(-5)} \times 43$ Kg
= 80335 Kg = 81 tonne

Maximum breathing length with assumptions of 30% losses in restraining force during service: B.L = F/(0.7x12.98)= 81x1000/(0.7x1298) = 89.15 m = say 90 m

Out of this ~~100~~ 90m length of breathing, 40 m length is between SRJ and SEJ and the balance 50 metre is between SRS and Xing side. Therefore, Breathing of this 50 m length will cause movement of SRJ.

Free expansion/contraction at SRJ due to breathing of 50 m length, $\Delta l = L\alpha\Delta t$
$= 50 \times 1000 \times 1.152 \times 10^{(-5)} \times 43$
=24.77 mm, say 25 mm

Full restraining Force =81 tonne
Full restraining force at a point 50 m behind SRJ= 81 tonne
Therefore, Restraining force achieved at SRJ = 81x 40 /90Tonne = 36 tonne
Average restraining force= (36+81)/2 = 117/2= 58.5 tonne
Restraining effect on expansion and contraction behind SRJ (length available is 40 m towards SEJ and 50 m towards crossing)

= FL/(AE)

$= 58.5 \times 1000 \times 50 \times 100/(76.86 \times 2.11 \times 10^{6})$=1.8 cm, say 18 mm

Net maximum expansion/contraction Δl_{net}= 25- 18 = 7 mm,

This expansion/ Contraction is, within the permissible limit for which point machines are designed.

ANNEXURE - III

Proforma for monitoring performance of LWR at Turnout

1.	Date of Inspection			
2.	Rly./Division			
3.	Station			
4.	Point No.			
5.	Line			
6.	Type of Xing			
7.	Date of converting into CWR			
8.	GMT of the section			
9.	Condition of fittings Condition of bolts & nuts Condition of rubber pad & ERC			
10.	Condition of Anti-Creep device and its fittings along with movement of creep anchors & its direction, if any.			
11.	i) Creep at actual toe of switch (ATS) for stock rail & tongue rail tip. ii) Creep in crossing portion at actual nose (ANC). iii) Creep at the mid of the lead portion. iv) Creep at 20m from ATS at approaches. v) Creep at 50m beyond ANC at approaches. vi) At mid point of crossover or at 50 m from heel of crossing (In turn in curve) vii) Gap at ACD on the SRJ side viii) Gap at ACD on the crossing side			
12.	Squareness of sleepers in breathing length			
13.	Condition of welded joints of WCMS Crossing			
14.	Condition of WCMS Crossing regarding cracks			
15.	Remarks, if any			

Note:

1) This format shall be filled in addition to the formats being filled as per Para 354 of IRPWM - June 2020 for maintenance of LWR.

ANNEXURE - IV

Estimation of Movement of Tongue Rails at ATS

The thermal expansion/ contraction of free portion of tongue rail has been calculated as under:

Maximum increase in temperature from Td = 38 degree

Maximum decrease in temperature from Td = 43 degree

Length of free portion of tongue rail in case of 1 in 12 turnout = 10125mm

Maximum expansion in summer = $\Delta l = L\alpha\Delta t$ = 10125 x 1.152x10$^{(-5)}$ x 38 = **4.4 mm**

Maximum contraction in winter = $\Delta l = L\alpha\Delta t$ = 10125 x 1.152x10$^{(-5)}$ x 43 = **5.0 mm**

As elaborated earlier, movement of 7mm is permitted in ACD on either side of its central position due to thermal expansion / contraction in lead portion.

As such in rare cases, total movement at ATS may be up to 12mm in case of CWRs laid in temperature Zone-IV only in extreme weather conditions, say once or twice in a year. Existing point machines are designed to accommodate movement of tongue rail in longitudinal direction up to the extent of 10mm. Thus, in rare cases, point machines may need minor adjustments say once or twice a year in extreme weather conditions in zone IV. There will be no such issue in temperature zones I, II & III as total movement at ATS will be within the limit of 10mm.

ANNEXURE - IV

Proforma for monitoring performance of CWR

1.	Rly./Division	
2.	Station	
3.	Point No.	
4.	Line	
5.	Type of Xing	
6.	Date of converting into CWR	
7.	GMT of the section	
8.	Condition of fittings iii) Condition of bolts & nuts iv) Condition of rubber pad & ERC	
9.	Condition of Anti-Creep device and its fittings along with movement of creep anchors & its direction, if any.	
10.	ix) Creep at actual toe of switch (ATS) for stock rail & tongue rail tip. x) Creep in crossing portion at actual nose (ANC). xi) Creep in lead portion. xii) Creep at 20m from ATS at approaches. xiii) Creep at 50m beyond ANC at approaches.	
11.	Squareness of sleepers in breathing length	
12.	Condition of welded joints of WCMS Crossing	
13.	Condition of WCMS Crossing regarding cracks	
14.	Monitoring of fish-plated joints of loop line of turnout	
15.	Remarks, if any	

Note:

2) This format shall be filled in addition to the formats being filled as per Para 354 of IRPWM - June 2020 for maintenance of CWR/LWR.