



EAST COAST RAILWAY

**Engineering Department
Bhubaneswar**

Expression of Interest

**Notice inviting Expression of Interest (EOI) for
“Providing data to facilitate predictive maintenance of
critical identified Engineering assets in the nominated
section of East Coast Railway with use of Artificial
Intelligence (AI) based system”**

EOI No: ENGG/TRACK/EOI/W7/628/Pt.I/2021/01

Dated 30.11.2021

**Last date of EOI submission :- 15:00 Hrs of 14.02.2022
EOI opening date :- 16:00 Hrs of 14.02.2022**

EXPRESSION OF INTEREST

Expression of Interest (EOI) for "Providing data to facilitate predictive maintenance of critical identified engineering assets in the nominated section of East Coast Railway with use of Artificial Intelligence (AI) based system of the Firm by measurement of various controlling parameters/items of each asset to be monitored, enabling sharing of the measured data on real time basis . analysing the data of measured parameters/items and comparing with their respective allowed/ threshold values , giving alarms when the parameters/items exceed their threshold value/ maximum maintenance limits, generation of periodical reports at specified interval along with recommended measures therein and there by assisting Railway officials in attending the run down track/assets in the field and there by bringing down in overall saving in the maintenance cost by at least 10 %.

1. PURPOSE:

This Expression of interest is invited from various firms/organizations who have proven technology for providing data to facilitate predictive maintenance of critical identified engineering assets in the nominated section of East Coast Railway with use of Artificial Intelligence (AI) based system of the Firm by measurement of various controlling parameters/items of each asset to be monitored, enabling sharing of the measured data on real time basis . analysing the data of measured parameters/items and comparing with their respective allowed/ threshold values, giving alarms when the parameters/items exceed their threshold value/ maximum maintenance limits, generation of periodical reports at specified interval along with recommended measures therein and there by assisting Railway officials in attending the run down track/assets in the field and thereby bringing down in overall saving in the maintenance cost by at least 10 %.

The system should meet the functional requirements given in **"Functional requirement specification for technology for predictive maintenance of engineering assets of nominated section"** (hereafter referred as **FRS, Clause 4.0 of this document**).

2. SCOPE OF WORK:

- 2.1 The detailed scope of work is given in Para-4, Functional Requirement System (FRS)
- 2.2 The service conditions on Indian Railways are given in Functional Requirement System (FRS). Suitable modification, customization and further development may be required to suit the Indian Railway condition for satisfactory functioning.

3. GENERAL INSTRUCTIONS FOR SUBMITTING RESPONSE TO EOI:

3.1 Eligibility Criteria:

The eligibility criteria for firms for evaluation of their offers for use on Indian Railways shall be as per FRS in clause- 4.0 of this document.

Applicant must have past experience of the activities indicated in scope of work. Applicant must be a registered company for the activities indicated in the scope of work.

The firm will be required to furnish supporting documents to establish that they are meeting the laid down eligibility criteria.

3.2 Technical Details to be provided by firm:

The details shall be submitted as per FRS by the firm with their offer.

- 3.3 The details submitted by the firm shall be scrutinized at PCE's office, ECoR. The deficiency as observed during technical scrutiny or additional information as considered necessary will be advised to the firm/organization. The information must be made available by firm/organization within one month of advice. In case the additional information is not received within stipulated period, the evaluation will be done based on information made available originally.
- 3.4 The firm may have to arrange detailed technical presentation at PCE's office, ECoR for their technology for providing data to facilitate predictive maintenance of assets in identified section covered in present EOI document.
- 3.5 **Submission of offers:** The intending firm/ organization shall submit their offer in the format given in Annexure – 'I' and undertaking as given in Annexure – 'II'. Apart from this, the requisite documents in proof of meeting the eligibility criteria and para-wise compliance of items of FRS as per clause-4 of this document shall also be submitted.
- 3.6 Railway reserves the right to consider evaluation of any offer in whole or part or may reject all the offers without assigning any reason. Indian Railways also reserves the right to decline to discuss the process further with any party expressing interest.
- 3.7 The applicants shall not be entitled to any refund of cost of documents or any other costs incurred by them in participating the EOI process.
- 3.8 **No obligation to issue an RFT:** Railways shall be under no obligation to issue a Request For Tender (RFT) at any later stage after opening of EOI applications as this EOI is only a prospective exploration of system available in the market with the intent to frame respective functional parameters/broad generic specification required for predictive maintenance of critical identified assets mentioned in annexure A of this EOI.
- 3.9 The authorized person should derive his authority through power of attorney duly witnessed by two witnesses with detailed address and notarized or registered and backed by the resolution of Board of Directors, of company.
- 4.0 **Functional requirement system (FRS) for exploring the technology for providing data to facilitate predictive maintenance of *identified engineering critical assets in nominated ssection of East Coast Railway with use of Artificial Intelligence and assisting the railway officials to take timely action for proper upkeep of identified assets in the nominated section and bringing down present level of maintenance cost of assets by at least by 10% less thereof .***
- 4.1 The system shall be capable of providing data to facilitate predictive maintenance of critical identified engineering assets in the nominated section of East Coast Railway with use of Artificial Intelligence (AI) based system by the Firm by measurement of various controlling parameters/items of each asset to be monitored, enabling sharing of the measured data on real time basis, analysing the data of measured parameters/items and comparing with their respective allowed/ threshold values , giving alarms when the parameters/items exceed their threshold value/ maximum maintenance limits, generation of periodical reports at specified interval along with recommended measures therein and there by assisting Railway officials in attending the run down track/assets in the field and there by bringing down in overall saving in the maintenance cost by at least 10 % .

List of critical assets to be monitored along with the maintenance parameters in this regard are available at Annexure -A

- 4.2 It shall be a proven technology for providing data to facilitate predictive maintenance as stated above with use of Artificial intelligence system. To establish the capability of the offered system in meeting the functional requirement as mentioned above, the performance certificate from the user must be submitted by the Firm along with their offer.
- 4.3 The range of measurement as per stipulations laid down in relevant paras of IRPWM, June'2020, IRBM , IRSOD etc are to be furnished along with their offer as referred against the parameters/items as applicable and Listed in Annexure A .
- 4.4 The Firm along with their offer is required to furnish the methods of validation of measurements given for various parameters of critical assets as per this EOI. The firm must also provide the reliability percentage of technology and certify/give sufficient evidence as to whether it is adoptable to Indian conditions i.e. taking into consideration of Assets condition, Type of assets, Rolling stock plying in the section etc.
- 4.5 The Firm is required to furnish the system of data acquisition, storage, analysis, processing, reporting and retrieval of data along with their offer.
- 4.6 The applicable manuals & codes are Indian Railway Permanent Manual, June'2020, Indian Railways Schedule of Dimensions (BG) 2004, General & Subsidiary Rules of East Coast Railway and other codes and manuals related to Indian Railway Track., Bridge etc with their update Correction slips.
- 4.7 Existing track structure of Indian Railways is consisting of 60 KG UIC rails laid on PSC sleepers on main line track, loop lines with rails of 52kg rail/60 KG UIC rails laid on PSC sleepers and turnouts laid with 60Kg/52 KG rail on PSC sleepers with elastic fastenings and ballast cushion of 350/250 mm on Broad gauge route.
- 4.8 The Firm (Applicant) is required to submit the details along with their offer in justifying his/their system through a cost benefit analysis as to how their system which is to be provided is capable of facilitating predictive maintenance of critical identified engineering assets and bringing down in overall saving in the maintenance cost by at least 10%.
- 4.9 The evaluation of the offers received will be based on the net savings that Railways will get due to adoption of AI based predictive maintenance system as compared to present system of maintenance

4.10 DISCLAIMER:

Expression of Interest (EOI) contains information considered relevant about the Project for exploring the technology for providing data to facilitate Predictive maintenance of identified engineering critical assets in nominated section in East Coast Railway with use of **Artificial Intelligence (AI) based system of the Firm.**

EOI received and selected shall neither be an agreement nor a contract.

Information provided in this EOI Document pertains to a wide range of subjects, some of which depend on interpretation of law.

Firms (Applicants) are advised to conduct their own independent assessments regarding requirement and analysis to gather adequate information, they consider relevant.

Furthermore, information provided herein is not intended to be an exhaustive account of statutory requirements and should not be regarded as a complete or authoritative statement of law.

ECoR has no liability under any law, statute or by any rule and/or regulation made there under, tort, equity, principles of restitution, unjust enrichment or otherwise for any loss, damage, costs or expenses which may arise from or be incurred or suffered on account of anything contained in this EOI Document or otherwise, including accuracy, adequacy, correctness, reliability or completeness of information in the EOI Document.

Any assessment, assumption, statement or information contained herein or deemed to form part of this EOI Document or arising in any way in this subject shall not create any liability on ECoR.

ECoR reserves the right to change any or all conditions or information in this EOI Document by way of revision, deletion, updation or annulment through issuance of appropriate corrigendums, deemed necessary to protect Railway interests without assigning any reason thereof.

ECoR will neither entertain nor be liable for any claim as to costs and expenses in relation to the preparation and submission of EOI applications in terms of this EOI Document.

Information contained in this EOI Document or subsequently provided to the prospective applicants, verbally or in documentary or any other form by an authorized representative of ECoR shall be treated as confidential and reproduction, dissemination or use for any other purpose is prohibited.

This EOI document is only a prospective exploration and does not bind on ECoR to select or short list applicants for a firm commitment at any time.

5. SUBMISSION OF OFFERS

- 5.1 The format for submission of offers and “**Functional Requirement System (FRS)** for providing data to facilitate predictive maintenance of engineering assets in the nominated section ” can be down loaded from ECoR website <https://eastcoastrail.indianrailways.gov.in> as per timings indicated in notice inviting EOI.
- 5.2 Only e applications on the official website from which EOI document is downloaded shall be entertained. No hard copies submitted through any other mode shall be entertained.
- 5.3 The EOI and all enclosed documents shall be typed and shall be signed by the Authorised Signatory of the applicant (Firm). The document to this effect shall necessarily be attached to the EOI.
- 5.4 **The complete application along with undertaking and other supporting documents as required in EOI shall be submitted to Dy CE/Track/ ECoR/BBS within 75 days from the date of publication of EOI.**
- 5.5 For any clarification, Dy CE/Track/ ECoR/BBS can be contacted in person or through e-mail at dyce_track@ecor.railnet.gov.in

Signature:
Name:
Designation:

FORMAT FOR LETTER OF RESPONSE

Respondents Ref No.:

Date:

Principal Chief Engineer,
Rail Sadan, North Block,
Bhubaneswar- 751017

Dear Sir,

Subject: RESPONSE TO EOI FOR PARTICIPATION _____

1. We, the undersigned, offer the following information in response to the Expression of Interest sought by you vide your Notification No._____, dated_____.
2. We are duly authorized to represent and act on behalf of____(Herein after the "Respondent")
3. We have examined and have no reservations to the EOI Document including Addenda No(s)_____.
4. We are attaching with this letter, the copies of original documents defining:-
 - a) the Respondent's legal status;
 - b) Its principal place of business;
 - c) Its place of incorporation (if respondents are corporations); or its place of registration (if respondents are cooperative institutions, partnerships or individually owned firms);
 - d) Self-certified financial statements of Last three years, clearly indicating the financial turn over and net worth .
 - e) Copies of any market research, business studies, feasibility reports and the like sponsored by the respondent, relevant to the project under consideration.
 - f) Copies of documents /other details in support of details required to be submitted along with the offer as mentioned in clause 3 and clause 4 of EOI.
5. We shall assist Railways and/or its authorized representatives to obtain further clarification from us, if needed.
 - a) Railways and/or its authorized representatives may contact the following nodal persons for further information on any aspects of the Response:

S. No.	Contact Name	Address	Telephone	E Mail

6. This application is made in the full understanding that:
 - a) Information furnished in response to EOI shall be used confidentially by Railways for the purpose of the project.

- b) Railways reserves the right to reject or accept any or all applications, cancel the EOI without any obligation to inform the respondent about the grounds of same
- c) We confirm that we are interested in participating in development of the project

7. We certify that our turnover and net worth in the last three years is as under:

Financial Year	Turn over	Net worth

- 8. In response to the EOI we hereby submit the following additional details annexed to this application.
 - 8.1 Details of customer(s) and supplies made in the field of item under EOI.
 - 8.2 Experience and expertise for the items proposed in EOI.
 - 8.3 The performance certificate related to the items proposed in EOI, issued by the user. This must be submitted to establish the effectiveness of technology. Test Certificate, if any should be provided along with detailed testing report.
 - 8.4 The detailed methodology of application and installing of the AI technology as given in EOI in field. The document should specifically mention about traffic block/ power block/speed restriction with duration, manpower required and operational requirement for installation of the proposed AI system. **Firm is required to submit the details showing the saving of 10 % in cost of Running track KM in maintenance of identified critical assets as envisaged the present EOT for the nominated section along with their offer failing which offer will not be considered for evaluation.**
 - 8.5 Detailed proposal for items proposed in EOI including alternative proposal, if any.
 - 8.6 Details of Intellectual Property Rights (IPR) held, patent filed/held and MoU/agreement signed.
 - 8.7 Details of ISO certification
 - 8.8 Undertaking as per Annexure-II:
- 9. The undersigned declare that the statements made and the information provided in the duly completed application are complete, true, and correct in every detail. We also understand that in the event of any information furnished by us being found later on to be incorrect or any material information having been suppressed, Railways may delete our name from the list of qualified Respondents. We further understand that Railways will give first preference to the applicants considered relevant for the purpose.
- 10. Our response is valid till (date in figures and words): _____

Yours sincerely,

(Sign)Name
 In the Capacity of
 Duly authorized to sign the response for and on behalf of date

(To be taken on non-judicial stamp paper of appropriate value as applicable in the respective state and duly notarised & witnessed)

UNDERTAKING

I, son of aged about Years resident of do hereby solemnly affirm as under–

1. That the deponent is the Authorised signatory of *(Name of the Sole Proprietorship Concern/ Partnership Firm/ Registered Company/ Joint Venture)*.

2. That the deponent declares on behalf of *(Name of the Sole Proprietorship Concern/Partnership Firm/ Registered Company/Joint Venture)* that:

a) In regard to matters relating to the security and integrity of the country, no charge sheet has been filed by an agency of the Government / conviction by a Court of Law for an offence committed by the -----(name of the entity) or by any sister concern of the -----(name of the entity) would result in disqualification.

b) In regard to matters other than the security and integrity of the country, ----- (name of the entity) has not been convicted by a Court of Law or indicted / passed any adverse order by a regulatory authority against it or it's any sister concern which relates to a grave offence, or would constitute disqualification. Grave offence is defined to be of such a nature that it outrages the moral sense of the community.

DEPONENT

VERIFICATION

I declare that the contents of para 1 to 2 above are true as per my knowledge and nothing has been hidden.

DEPONENT

**PROVIDING DATA TO FACILITATE PREDICTIVE MAINTAINANCE OF TRACK
BY ARTIFICIAL INTELLIGENCE**

1) Inspection and maintenance items of Points & Crossings:

S.No	Item	Limits
	Some of the important items as laid down in IRPWM to be inspected and maintained to the standards as given in the IPWM are given below.	
1	Maintenance—General	
2	There should be no junction fishplates at stock rail joints or at the heel of crossings	No junction fishplate at SRJ, heel of crossing. Para 429 (1) B of IRPWM-2020
3	At least one rail on either side of the Points and Crossings should have the same section as the Points and Crossings assembly rail section.	Layout should be of same section for one rail length on either side. Para 429 (1) C of IRPWM-2020
4	Welding of stock and lead joints on the Points and Crossings assembly (desirable)	SRJ and lead joints to be welded. Para 429 (1) D of IRPWM-2020
5	Availability of spherical washer in switch and crossings.(The use of spherical washer is necessary, where the shank of the bolt is not at right angles to the axis of the rail to obtain flush fit of the head of the nut of the bolt with the web of the rail. The spherical washers are used on skew side. the spherical washer should invariably be provided on the left side in switch assembly; as the orientation of fish-bolt hole is made accordingly. On crossing tapered washers are to be used on both sides.	Spherical washers should be provided on LH side of the assembly. Para 429 (1) E of IRPWM-2020.) Tapered washers: To provide On both side of crossing. Para 429 (1) F of IRPWM-2020
6	Correct spacing of sleepers should be ensured according to the standard layout drawings as per Annexure-4/2 of IRPWM	Para 429 (1) G of IRPWM-2020
7	The clearance, at the toe, heel of switch, at checkrail and wing rail must be maintained within the tolerances prescribed In the schedule of dimensions	<u>At Toe.</u> Minimum:95mm for existing works, 115mm for new works or alteration to existing works, 160mm for thick web switches Chapter –II para-16 of SOD <u>at Heel of Switch:</u> For 1 in 8½=182.5mm: For 1 in 12=175mm <u>Check Rail clearance:</u> 41mm to 45mm for PSC <i>Fan Shaped lay out with gauge 1673mm.</i> 44mm to 48mm for turn outs laid with 1676mm gauge. 41mm to 45mm for PSC <i>Fan Shaped lay out with gauge 1673mm.</i> 44mm to 48mm for turn outs laid with 1676mm gauge (Chapter –II para 12 & 13 of SOD)
8	The chairs and fastenings and all other fittings must he properly secured.	No loose and missing fittings Para 429 (1) J of IRPWM-2020

S.No	Item	Limits
9	Packing under the sleepers must not be loose/ defective especially under crossing and the switch	Para 429 (1) K of IRPWM-2020
10	Cess should be low enough to permit efficient drainage and adequate depth of ballast cushion should be provided. In case creep is observed at such layouts, the condition of elastic fastenings may be examined and suitable action be taken.	Efficient drainage and no stagnation of water. Gap between rail bottom and ballast top = 50 mm minimum Creep not permitted. Para 429 (1L of IRPWM-2020
	Maintenance of switches.	
11	To ensure that stock rail and Tongue rails do have proper curvature. In case of Turn out taking off from curve suitable curvature as per resultant lead radius to be provided both in Stock Rail and Tongue Rail.	Taking off from St. Versine Stock Rail: 1 in 12: At Centre:40 mm , Qtr Pt; 30 mm 1 in 8.5: At Centre:69 mm , Qtr Pt; 52 mm SER CE circular Tongue Rail: 1 in 12: At Centre:43 mm, Qtr Pt; 32 mm 1 in 8.5 At Centre:76 mm , Qtr Pt; 57 mm. For taking off from Curves: Resultant Radius: Contrary Flexure: $R = \frac{R1 \times R2}{R1 - R2}$ Similar Flexure : $R = \frac{R1 \times R2}{R1 + R2}$
12	The condition of stock & tongue rails should be. Carefully examined and badly worn and damaged stock and tongue rails should be replaced. A tongue rail may be classified as worn/ damaged when-	Para 429 (2) (C) of IRPWM-2020
13	-it is chipped/cracked over small lengths aggregating to 200 mm within a distance of 1000 mm from its toe. Chipped length will be the portion where tongue rail has worn out for a depth of more than 10 mm over a continuous length of 10 mm.(The tongue rail can, however, be reused after reconditioning of the broken/worn/ damaged tip by welding)	Aggregate 200mm within 1000mm Minimum chipped length of 10mm depth over 10mm length. 429 (2) (C) (i) of IRPWM-2020
14	-it is badly twisted or bent .and does not house properly against the stock rail causing a gap of 5 mm or more at the toe, the limit described in the IRSEM.	Gap between TR and SR in closed position ≤ 5 mm at the toe. 429 (2) (C) (ii) of IRPWM-2020
15	wear on stock rail shall not exceed the limits laid down in <i>Para 702 (1) b of IRPWM</i> <i>vertical wear – 60kg -13 mm m, 52 kg- 8 mm,</i> <i>Lateral wear- on curves of A and B route-8mm, C and D route – 10 mm.</i> <i>On Straight- A an B route – 6 mm, C and D route- 8 mm</i>	Limit: vertical wear – 60kg -13 mm , 52 kg- 8 mm, Lateral wear- on curves of A and B route-8mm, C and D route – 10 mm. On Straight- A an B route – 6 mm, C and D route- 8 mm 429 (2) (C) (iii) of IRPWM-2020
16	However, proper housing of tongue rails is to be ensured. Burred stock rail likely to obstruct the lock bar, should be replaced, if necessary.	Minimum housing of 6 Sleepers to be ensured 429 (2) (C) (iii) of IRPWM-2020
17	Rail Gauge ties, rodding etc. hinder proper packing and hence at the time of packing points and crossing the signal staff should take out the rods and stretcher bars etc.to facilitate proper tamping.	429 (2) (d) of IRPWM-2020
18	To check the housing of the tongue rail and also the throw of the switch, all non—interlocked points should be operated by hand lever and other Points from the signal frame, when traffic permits doing so.	Throw of Switch: Minimum: 95mm for existing works, 115 mm for new works or alteration to existing works, 16 0mm for thick web switches 429 (2) (e) of IRPWM-2020

S.No	Item	Limits				
19	Tongue rail should, preferably bear evenly on all the slide chairs.	No Gap between Rail bottom and Slide Chair. 429 (2) (g) of IRPWM-2020				
20	When the tongue rail is in closed position, it must bear evenly against slide blocks.	No Gap between Tongue Rail and Side Blocks. 429 (2) (h) of IRPWM-2020				
21	<i>Maintenance of Crossings-</i>					
22	If any damage to the nose of crossing is noticed, its cause must be traced, which might be due to tight gauge or due to excessive clearance at the checkrail. 429 (3) (a) of IRPWM-2020	clearance at the checkrail : <table border="1"> <tr> <td>41mm to 45mm</td> <td>for PSC Fan Shaped lay out as the gauge is 1673mm.</td> </tr> <tr> <td>44mm to 48mm</td> <td>for turn outs laid with 1676mm gauge.</td> </tr> </table> (Chapter –II para 12 & 13 of SOD)	41mm to 45mm	for PSC Fan Shaped lay out as the gauge is 1673mm.	44mm to 48mm	for turn outs laid with 1676mm gauge.
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23	To avoid hitting of nose, it shall be ensured that the checkrail clearance should be between 41 to 45 mm for fan-shaped turnout. 429 (3) (b) of IRPWM-2020	clearance at the checkrail : <table border="1"> <tr> <td>41mm to 45mm</td> <td>for PSC Fan Shaped lay out as the gauge is 1673mm.</td> </tr> <tr> <td>44mm to 48mm</td> <td>for turn outs laid with 1676mm gauge.</td> </tr> </table> (Chapter –II para 12 & 13 of SOD)	41mm to 45mm	for PSC Fan Shaped lay out as the gauge is 1673mm.	44mm to 48mm	for turn outs laid with 1676mm gauge.
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24	Maximum permissible vertical wear on wing rails or nose of crossing shall be 10mm. However, on Rajdhani/ Shatabdi routes, as a good maintenance practice, crossing and the wing rails should be planned for reconditioning/resurfacing by welding on reaching the following wear limits Built up/Welded Crossing 6 mm CMS crossings 8 mm	permissible vertical wear on wing rails or nose of crossing : Maximum : 10 mm. Rajdhani Route: 8 mm – CMS : 6mm – Builtup/Welded 429 (3) (e) of IRPWM-2020				
25	<i>In case of CMS crossings, following dimensions should be deducted (to account for slope in casting of wing rails to 1 in 20 cant) from the wear measurements to find out the actual wear of wing rails and nose of crossing.</i> (a) for 52 kg section — 2.0 mm. (h) for 60 kg section — 2.5 mm. (c) for heat-treated welded crossing — 3.5 mm.	Note of Para 429 (3) (e) of IRPWM-2020				
44.	<i>Maintenance of lead portion and turn-in curve—</i>					
26	To ensure the correct sleeper spacing to achieve correct alignment of the lead curve. During maintenance, stations at 3.0 m intervals should be marked, versines checked, and track attended as necessary. The versine at each station in lead curve and turn in curve should not be beyond 3 mm, from its design value, as a good maintenance practice. Para 429 (4) (a) of IRPWM-2020	Versine at each stn: 3 mm. max deviation from design value Stn to Stn versine variation = 4 mm (max)				
27	The versines of turn-in curves on loops should be recorded at stations at 3.0 m intervals on 6.0 m chord length during the inspection of points and crossings to check the sharpness of the curve and rectified as necessary. Para 429 (4) (b) of IRPWM-2020					
28	The turn-in curve should also be checked for condition of sleepers and fastenings Para 429 (4) (C) of IRPWM-2020	No Loose and Missing Fittings.				

S.No	Item	Limits																						
29	<p><i>Gauge and Super-elevation in Turnout</i> Para 429 (8) (a) of IRPWM-2020: Gauge at various portions of turnout during new laying/renewal and maintenance shall be as given in <i>Para 520 (3) (a) & Para 525 (1)</i> of IRPWM.</p> <p>Para 525 (1) of IRPWM-2020: The Gauge and Twist values for manual measurement in floating</p> <table border="1"> <tr> <td>On straight track</td> <td>- 6mm to + 6 mm</td> </tr> <tr> <td>On curves with radius 440m or more</td> <td>- 6mm to + 15 mm</td> </tr> <tr> <td>On curves with radius less than 440 m</td> <td>upto + 20 mm</td> </tr> </table> <p>conditions are as under</p> <p>Para 526 of IRPWM-2020 for slower speeds: For guidance of field officials, following track Parameters are stipulated in floating conditions, for maintenance of tracks where speeds are low such as worksite, yard line, etc.</p> <table border="1"> <thead> <tr> <th>Speed (in Kmph)</th> <th>Peak value of UN (on 3.6 m chord) in mm</th> <th>Peak value of twist (on 3.0 m chord) in mm</th> <th>Permissible gauge range</th> </tr> </thead> <tbody> <tr> <td>Up to 45</td> <td>22</td> <td>18</td> <td>-10 to +27 mm</td> </tr> <tr> <td>Up to 30</td> <td>24</td> <td>21</td> <td>-10 to +27 mm</td> </tr> <tr> <td>Up to 15</td> <td>33</td> <td>25</td> <td>-12 to +27 mm</td> </tr> </tbody> </table>	On straight track	- 6mm to + 6 mm	On curves with radius 440m or more	- 6mm to + 15 mm	On curves with radius less than 440 m	upto + 20 mm	Speed (in Kmph)	Peak value of UN (on 3.6 m chord) in mm	Peak value of twist (on 3.0 m chord) in mm	Permissible gauge range	Up to 45	22	18	-10 to +27 mm	Up to 30	24	21	-10 to +27 mm	Up to 15	33	25	-12 to +27 mm	
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Up to 30	24	21	-10 to +27 mm																					
Up to 15	33	25	-12 to +27 mm																					
30	<p>The gauge in crossing portion shall be 0 mm to 4 mm with respect to gauge prescribed in standard drawing, i.e., 1673 mm, both in case of New Laying/ Renewal and during service. Para 429 (8) (b) of IRPWM-2020</p>	1673mm +0 to +4 mm																						
31	<p>If gauge of track on either side of the points and crossings is maintained wider/tighter than the gauge on the points and crossings, the gauge on either side of the track should be brought to same gauge as in the points and crossings, as a good maintenance practice. Para 429 (8) (c) of IRPWM-2020</p>																							
32	<p>Super-elevation on turnouts with curve of similar or contrary flexure should be provided in accordance with <i>Para 411 & 412</i> Para 429 (8) (d) of IRPWM-2020</p>	<p>Para 411 of IRPWM-2020: Curves of Contrary Flexure: - On the main line curve from which a curve of contrary flexure takes off, the cant of the main line (which is the negative Super-elevation on the turnout), should be calculated from the formula : $GV^2/127R$ The permissible speed on the main line is determined from the allowable cant deficiency and cant on the main line. The speed so determined shall be subject to limitations governed by the standard of interlocking and the sectional speed. Para 412 of IRPWM-2020 Curves of Similar Flexure:- (1) <i>Not followed by reverse curves</i> – On a main line curve from which a curve of similar flexure takes off, not followed immediately by a reverse curve, the turnout curve shall have the same cant as the main line curve. (2) <i>Followed by reverse curves</i> – A change of cant on the turnout may be permitted starting behind the crossing (after the last exit sleeper) and being run out at a rate not</p>																						

S.No	Item	Limits
		steeper than 2.8 mm per metre and subject to the maximum cant on the main line turnout being limited to 65 mm. The permissible speed on the main line is then determined from the allowable cant-deficiency and subject to limitations governed by the standard of interlocking and the
	Inspection of points and crossing :	
33	The details of inspection of various items of points and crossings be entered as per format given in IRPWM annexure 4/3, 4/3A, 4/4, 4/4A, 4/4B. Para 429 (5) (a) of IRPWM-2020	
34	Acceleration peaks both vertical and lateral (OMS reading)	For speed > 110 kmph: All peaks greater than 0.15g to be considered for recording. For speed <110kmph: All peaks greater than 0.20g to be considered for recording. Para 515 of IRPWM-2020
35	For speed upto 110 kmph	Urgent maintenance limit: 0.30g Para 522 (1) of IRPWM-2020
36	For speed above 110 and upto 130 Kmph	urgent maintenance limit is 0.25g Para 522 (2) of IRPWM-2020
37	For speed above 130 and upto 160 Kmph	urgent maintenance limit is 0.20g Para 522 (3) of IRPWM-2020

2. Inspection and maintenance items of Level Crossing:

Level crossings:

- 1) Para 908: Type of signals for road users – Preferably, electric signals should be provided at gates to give correct indication to road users. As an alternative, Gate lamp along with blinders may be mounted preferably in rectangular sockets over gates so as to give correct indication to road users vide item 6 of Annexure - 9/1. The lamp should be lighted by the Gateman at sunset and remain lighted till sunrise.
- 2) Para 910(4) : At every Level Crossing there should be distinct indication at 600 m and 1200 m on Broad Gauge on either side to guide the Gateman for placing the detonators in case of obstruction at the level crossing. Indicator posts should be provided with one dot and three dots at these distances to indicate the number of detonators to be placed. Arrangements for exhibiting the danger signal at a distance of 5 meters during emergency should be made at each level crossing.
- 3) Para 910 (5) (C)Height Gauges should be located at a minimum distance of 8 meter from gate posts.
- 4) Para 648. Trees and bushes that interfere or tend to interfere with the view from a train or trolley, of signals or level crossings or along the inside of curves, shall be cut. When cut, it should be ensured that they do not foul the track.
- 5) Para 913 (1) (b) : Inspection and Maintenance of LCs – (i) Level crossings laid with PSC sleepers should be overhauled with each cycle of machine packing or more frequently as warranted by condition and in no case shall opening be delayed by more than two years.
Para 913(1)(c) Checking equipment and examination of Gateman in rules – (i) The equipment with the Gateman shall be checked by JE/SSE/P.Way once in a month by rotation.
Para 913 (2) By ADEN – ADEN should inspect the equipment at every manned level crossing on the subdivision once in six months, and examine the Gateman in rules during his inspection.
- 6) Para 915: Level Crossing indicators: At the approaches of all level crossings, bilingual whistle boards as per design (Annexure - 9/4) should be erected at 600 m along the track from the level crossing to enjoin the Drivers of approaching trains to give audible warning of the approach of a train to the road users.

- 7) Para 916(1): Provision of Speed Breakers on the Approaches of Level Crossing –
One speed breaker should be provided on either approach of level crossings at a Page 334 of 417 distance of about 20 m from the gate post of the Level Crossing, covering full width of the road including berms as per Annexure - 9/5.
- 8) Para 917(1) Periodical census of traffic at all level crossings shall be taken once every three years.
- 9) Para 918
- 1) Rail joints should be avoided in check rails and on the running rails, within the level crossings and three m on either side from the end of level crossing.
 - 2) In the case of SWR, the short-welded panel may be continued through the level crossing, avoiding fish plated joint on the level crossing and within 6 m from the end of level crossing.
 - 3) The level crossing should not fall within the breathing length of LWR.
 - 4) Concrete sleepers to relevant RDSO drawings along with fittings should be provided at LC Gate.

10) Annexure 9/1 of IRPWM

S.No	Item	Limits
1	Minimum width of gates at right angles to the centre line of the road (Old standards)	a) Special LC: 7.5m b) A-Class: 5.5m c) B-Class : 5.5m d) C-Class : 5.5m
2	New standards for new LCS constructed or old one altered	a) Across class-I roads = 9m or X +2.5m whichever is more b) Across class-II roads = 7.5m or X +2.5m whichever is more c) Across class-III roads = 5m or X +2.5m whichever is more d) Across class-IV roads = suitable width subjected to 2.0m being the min.
3	Minimum length of check rail	2.0m more than that of gate width
4	Angle of crossing between centre line of road and railway	Not less than 45°
5	Provision of wicket gates for foot passengers and to prevent tress passing by cattle	a) Special LC: To be provided except where FOB are provided b) A-Class: To be provided except where FOB are provided c) B-Class : To be provided except where FOB are provided d) C-Class : To be provided on need basis
6	Minimum distance of gate posts from centre line of track	3.0 m.
7	Minimum length of fencing parallel to track	15m
8	Minimum width of metalling between gates	a) For Social, A & B class: Same as that of the width of gates. b) For C class: Same as that of the width of gates or the width between gate posts where gate leaves are not provided

S.No	Item	Limits
9	Minimum width of metalling outside gates:	<ul style="list-style-type: none"> a) Class-I road: 7.0m or the width of existing carriage way whichever is greater. b) Class-II roads: 5.5m or the width of existing carriage way whichever is greater c) Class-III roads: 3.78m or the width of existing carriage way whichever is greater d) Class IV roads: suitable width subjected to 2m being the minimum
10	Type of pavement between gates	Not be inferior to the approach road
11	Type of pavement outside gates	Same standard as that of the road surface out side the Railway boundary.
12	Minimum width of road formation outside the gates for a distance of 30m beyond the gate	<ul style="list-style-type: none"> a) New standard: width of metalling just outside the gate+5.0m for Class-I, Class-II , Class-III roads) and minimum 3.0m for class IV road. b) Old standard: <ul style="list-style-type: none"> i) Spl class: same as that of the road outside the railway boundary. ii) A class: 4m wider than metalling iii) B class: 3.0m wider than metalling. iv) C class: 2.0m wider than metaling.
13	Maximum gradient between gates	Level
14	Minimum level length of road on gates	<ul style="list-style-type: none"> i) New standards: <ul style="list-style-type: none"> a) Class-I roads: in between gates and upto 15m beyond gate. b) Class-II roads: In between gates and upto 8.0m beyond gate. c) Class-III roads: in between gates and upto 8.0m beyond. d) Class –IV roads: In between gates. ii) Old standards: <ul style="list-style-type: none"> a) Class-I roads: in between gates and upto 8m beyond gate. b) Class-II roads: In between gates and upto 6.0m beyond gate. c) Class-III roads: in between gates and upto 6.0m beyond. d) Class –IV roads: In between gates and upto 6.0m beyond
15	Maximum gradient beyond level portion of the road at LC approach	<ul style="list-style-type: none"> i) New standards: <ul style="list-style-type: none"> a) Class-I roads: Not steeper than 1 in 40 b) Class-II roads: Not steeper than 1 in 30 c) Class-III roads: Not steeper than 1 in 20 d) Class –IV roads: Not steeper than 1 in 15. ii) Old standards: <ul style="list-style-type: none"> a) Class-I roads: Not steeper than 1 in 40 b) Class-II roads: Not steeper than 1 in 30 c) Class-III roads: Not steeper than 1 in 30 d) Class –IV roads: Not steeper than 1 in 20.

16	Minimum radius of centre line of road on curved approaches	<p>New Standards:</p> <p>a) For National Highway / state high ways:</p> <p>i) In plains: 250metres</p> <p>ii) In hilly terrain: 90metres.</p> <p>b) Other roads: best possible radius having regards to safety of road traffic.</p> <p>Old standards:</p> <p>a) Special class: 60m</p> <p>b) A class: 45m</p> <p>c) B Class: 30m</p> <p>d) C class: 21m</p>
17	Desirable & Minimum straight length of road outside the gate.	<p>a) New standards:</p> <p>i) Class-I roads: Desirable 30m & minimum 15m</p> <p>ii) Class-II roads: Desirable 22.5m & min 9m</p> <p>iii) Class-III roads: Desirable 15m & min 4.5m</p> <p>iv) Class –IV roads: Desirable & min</p> <p>b) Old standards:</p> <p>i) Spl class: 12m</p> <p>ii) A class: 9m</p> <p>iii) B class: 6m</p> <p>iv) C class: 3m</p>
18	Minimum sight distance of level crossing gate from road in the vicinity of level crossing	<p>i) Class-I roads: 120m for plains & 60m for hilly country.</p> <p>ii) Class-II roads: 60-90mm for plains & 40 to 50m for hilly country.</p> <p>iii) Class-III roads: 40m for plains & 30m for hilly country</p>
19	Warning to road traffic of proximity of level crossing: Distance of road sign posts fro level crossing	<p>i) Class-I roads: 120m for plains & 60m for hilly country.</p> <p>ii) Class-II roads: 60-90mm for plains & 40 to 50m for hilly country.</p> <p>iii) Class-III roads: 40m for plains & 30m for hilly country.</p>
20	Min clearance of check rail at a level crossing	51 mm (IRSOD Chapter-1 Para-5)
21	Max clearance of check rail at a level crossing	57mm (IRSOD Chapter-1 Para-5)
22	Min depth of space for wheel flange from rail level	38mm (IRSOD Chapter-1 Para-5)

3. Inspection and maintenance of Curves:

A) Realignment criteria for Curves:- (Para 524 OF IRPWM)

The running over a curve depends not only on the difference between the actual versine and the designed versine but also on the station to station variation of the actual versine values, which determine the rate of change of lateral acceleration, on which depends the riding comfort.

Sl. No.	Speed on curve	Limits of Station to Station Variation of Versine (mm)
1	160 Kmph and up to 110 Kmph	10 mm (15 mm for speed of 110 Kmph); or 20% of average Versine on circular portion, whichever is more.
2	Below 110 Kmph and up to 50 Kmph	20 mm; or 20% of average Versine on circular portion, whichever is more.
3	Below 50 Kmph	40 mm; or 20% of average Versine on circular portion, whichever is more.

B) Check rail clearance

Minimum clearance of check rails for a curve	44mm	IRSOD Chapter-1 Para-4
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C) Joints on Curves (IRPWM PARA-422):

- (1) It must be ensured that fish plated rail joints are square at beginning and at the end of the curve.
- (2) On the sharp curves less than 400 m the rail joints may be staggered, where elbows/kinks are likely to develop if rail joints are laid square.

D) Indicators/Boards Provided in Curves to be checked during inspection: (Para 407 of IRPWM)

- 1) *Curve Board*—Each approach of a curve should be provided with a curve board at the tangent point fixed on the outside of the curve. This Board should indicate the radius of the curve, the length of the curve, length of transition in metres and the max cant provided on the circular portion of curve in mm.
- 2) *Rail Posts Indicating Tangent Points*— On the inside of the curve, rail posts should be erected on each approach of the curve, to indicate the positions of the beginning and end of transition curves. These rail posts may be painted in red and white colours respectively. In the case of non-transitioned curve, similar rail post should be erected on the tangent track and on the circular curve over which the cant is run out, indicating the beginning and end of the virtual transition.
- (3) *Indication of cant on track – Super-elevation* or cant should be indicated by painting its value on the inside face of the web of the inner rail of the curve and at every versine station, beginning with zero at the commencement of the transition curve.
The value of cant should be indicated on the circular curve at its beginning and at the end. In the case of long circular curve, the cant value should be indicated at intermediate stations at a distant not exceeding 250 metres.
- (4) When curves are realigned, the repositioning of the curve boards and posts and repainting of values of Super-elevation at intermediate points should be done, as required.
No Change of Super-elevation over Turnouts:-There should be no change of cant between points 20 metres outside the toe of the switch and the nose of the crossing except in cases where points and crossings have to be taken off from the transitioned portion of a curve.
Normally, turnouts should not be taken off the transitioned portion of a main line curve. However, in exceptional cases, when such a course is unavoidable a specific relaxation may be given by the Chief Track Engineer of the Railway.

4. Inspection and maintenance of SEJs & LWRs

IRPWM Para 301: Gaps at SEJ:

Gaps at SEJ shall be adjusted at the time of de-stressing of LWR/ CWR as under

Rail section laid	Gap to be provided at 't _d '
52 kg/m 60 kg/m	40 mm

Para 338 (2)(a) In service, the change in gap at SEJ due to rail temperature variations is in the form of a Hysteresis Curve. Therefore, for any given rail temperature, the measured gap at the SEJ may fall within the range defined by the Hysteresis curve.

Para 338 (2) (b) The gaps between the reference mark and tongue rail tip/stock rail corner, which is attached to the LWR/CWR side at various rail temperatures, shall not differ by more than ± 10 mm from the theoretical range as shown in *Annexure - 3/9*.

Para 338 (2) (c) Where fish-plated or SWR track is joined on one side of SEJ, the gap between the reference mark and tongue rail tip/stock rail corner on SWR/Fish plated track side shall not be measured.

Gaps at SEJ for various Rail Temperatures and PSC Track IRPWM Annexure - 3/9

ZONE-II

Rail	60 kg/m		52 kg/m	
Sleeper Density	1660	1540	1660	1540
Ballast Resistance	13.74 kg/cm/rail	13.28 kg/cm/rail	13.74 kg/cm/rail	13.28 kg/cm/rail
t _d + 25°	-	-	-	-
t _d + 20°	17	17	17	17
t _d + 15°	17 to 19	17 to 19	17 to 19	17 to 19
t _d + 10°	17 to 21	17 to 21	18 to 21	18 to 21
t _d + 05°	18 to 23	18 to 23	18 to 23	18 to 23
t _d	18 to 25	18 to 25	19 to 24	19 to 24
t _d - 05°	19 to 26	19 to 27	19 to 25	19 to 26
t _d - 10°	20 to 28	20 to 28	20 to 27	20 to 27
t _d - 15°	22 to 29	22 to 29	21 to 27	22 to 28
t _d - 20°	23 to 30	23 to 30	23 to 28	23 to 29
t _d - 25°	25 to 30	25 to 31	24 to 29	24 to 29
t _d - 30°	27 to 31	27 to 31	26 to 29	26 to 30
t _d - 35°	29 to 31	29 to 31	28 to 30	28 to 30
t _d - 40°	31	32	30	30
t _d - 45°	-	-	-	-

Note: The above values have been calculated with initial setting of gaps at SEJ as 40 mm. Where SEJs had initially been set with a gap of 60 mm, 10 mm should be added to each of above values for comparison of gaps at site.

GAPS AT SEJ FOR VARIOUS RAIL TEMPERATURES AND PSC TRACK

ZONE-III

Rail	60 kg/m		52 kg/m	
Sleeper Density	1660	1540	1660	1540
Ballast Resistance	13.74 kg/cm/rail	13.28 kg/cm/rail	13.74 kg/cm/rail	13.28 kg/cm/rail
$t_d + 25^\circ$	15	15	16	16
$t_d + 20^\circ$	15 to 18	15 to 18	16 to 18	16 to 18
$t_d + 15^\circ$	15 to 20	15 to 20	16 to 20	16 to 20
$t_d + 10^\circ$	16 to 23	16 to 23	17 to 22	16 to 22
$t_d + 05^\circ$	17 to 25	16 to 25	17 to 24	17 to 24
t_d	18 to 27	17 to 27	18 to 26	18 to 26
$t_d - 05^\circ$	19 to 28	19 to 28	19 to 27	19 to 27
$t_d - 10^\circ$	20 to 30	20 to 30	20 to 28	20 to 29
$t_d - 15^\circ$	21 to 31	21 to 31	21 to 29	21 to 30
$t_d - 20^\circ$	23 to 32	23 to 32	23 to 30	23 to 31
$t_d - 25^\circ$	25 to 33	25 to 33	24 to 31	24 to 32
$t_d - 30^\circ$	27 to 34	27 to 34	26 to 32	26 to 32
$t_d - 35^\circ$	29 to 34	30 to 35	28 to 32	28 to 33
$t_d - 40^\circ$	32 to 34	32 to 35	30 to 32	31 to 33
$t_d - 45^\circ$	35	35	33	33

Note: The above values have been calculated with initial setting of gaps at SEJ as 40 mm. Where SEJs had initially been set with a gap of 60 mm, 10 mm should be added to each of above values for comparison of gaps at site.

GAPS AT SEJ PROVIDED AT THE FAR END APPROACH OF BRIDGE USING RAIL FREE FASTENINGS OVER GIRDER BRIDGE FOR VARIOUS RAIL TEMPERATURES IN MM

Zone-II								
	60 kg/m				52 kg/m			
Sleeper Density	1660		1540		1660		1540	
Ballast Resistance	13.74 kg/cm/rail		13.28 kg/cm/rail		13.74 kg/cm/rail		13.28 kg/cm/rail	
Initial gap at SEJ (mm)	65	40	65	40	65	40	65	40
$t_d + 30^\circ$	(-13)-(-20)	(-1)-6	(-13)-(-20)	(-2)-6	(-12)-(-18)	1-7	(-12)-(-10)	0-7
$t_d + 25^\circ$	(-4)-(-11)	3-10	(-4)-(-11)	2-9	(-3)-(-9)	4-10	(-3)-(-10)	4-10
$t_d + 20^\circ$	(-2)-5	6-13	(-2)-5	6-13	(-1)-5	8-13	(-1)-5	7-13
$t_d + 15^\circ$	7-13	10-16	7-13	10-16	8-13	11-16	8-13	11-16
$t_d + 10^\circ$	16-22	14-19	16-22	14-19	16-21	14-19	16-21	14-19
$t_d + 05^\circ$	25-30	18-22	25-30	18-22	25-29	18-22	25-29	18-22
t_d	34-37	21-25	34-38	21-25	34-37	21-24	34-37	21-24
$t_d - 05^\circ$	43-45	25-27	43-45	25-28	42-44	25-26	42-44	25-27
$t_d - 10^\circ$	52-52	29-30	52-53	29-30	51-51	28-29	51-52	28-29
$t_d - 15^\circ$	60-61	32-33	60-61	32-33	59-59	30-31	59-60	31-32
$t_d - 20^\circ$	67-70	33-36	67-70	34-37	65-68	32-35	66-68	33-35
$t_d - 25^\circ$	74-78	35-40	74-79	35-41	72-76	34-38	73-77	34-38
$t_d - 30^\circ$	80-87	37-44	81-88	37-44	79-85	35-41	79-85	36-42
$t_d - 35^\circ$	87-96	38-47	87-97	38-48	85-93	36-45	86-94	37-45

GAPS AT SEJ PROVIDED AT THE FAR END APPROACH OF BRIDGE USING RAIL FREE FASTENINGS OVER GIRDER BRIDGE FOR VARIOUS RAIL TEMPERATURES IN MM

Zone-III				
	60 kg/m		52 kg/m	
Sleeper Density	1660	1540	1660	1540
Fast Resistance	kg/cm/rail	8 kg/cm/rail	kg/cm/rail	8 kg/cm/rail
gap at SEJ (mm)	70	70	70	70
$t_d + 35^\circ$	(-3)-(-3)	(-3)-(-3)	(-2)-(-2)	(-2)-(-2)
$t_d + 30^\circ$	1-4	1-4	2-5	2-5
$t_d + 25^\circ$	5-11	5-11	7-11	6-11
$t_d + 20^\circ$	10-17	10-17	11-17	11-17
$t_d + 15^\circ$	15-24	14-24	16-24	16-24
$t_d + 10^\circ$	20-30	19-30	21-29	20-29
$t_d + 05^\circ$	25-36	25-36	26-35	25-35
t_d	30-41	30-42	31-40	31-41
$t_d - 05^\circ$	36-47	36-47	36-46	36-46
$t_d - 10^\circ$	41-52	41-53	42-51	42-51
$t_d - 15^\circ$	47-57	47-58	47-56	47-56
$t_d - 20^\circ$	53-62	54-63	53-61	53-61
$t_d - 25^\circ$	60-67	60-67	59-65	59-66
$t_d - 30^\circ$	66-72	67-72	65-70	65-70
$t_d - 35^\circ$	73-76	73-76	72-74	72-75
$t_d - 40^\circ$	80-80	80-80	78-78	78-79

5. Inspection and maintenance of Glued joint/Insulated Joints:

- 1) The sleeper spacing under glued joint shall be the same as that of the intermediate sleepers (Para 4.1.1 of manual for glued insulated rail joints(1998)
- 2) G3(L) type glued joints are for use in LWR/CWR track in all the temperature zones and G3(S) type joints are for use in fish plated track as well as in SWR track (Para 0.5 of manual for glued insulated rail joints-1998).
- 3) Life cycle of Glued Insulated Rail Joints is tentatively fixed at 200 Gross Million Tonnes of traffic (Para 4.5 of manual for glued insulated rail joints-1998).
- 4) The metal burrs/flow at the ends of the rails shall be removed from time to time to avoid short-circuiting. The burrs / flow shall be removed skillfully avoiding damage to the end-post. (Para 4.3.4 of manual for glued insulated rail joints-1998).
- 5) Normally no relative movement shall occur between rails and fishplates at the glued joint. In case, failure of the joint occurs by separation of the rail/fishplates surfaces with consequent relative movement, the damaged glued joint may be replaced as early as possible by a new joint (Para 4.3.6 of manual for glued insulated rail joints-1998).
- 6) The ballast used in track in the vicinity of glued insulated joints shall be clean to ensure efficient packing and drainage.
- 7) Care should be taken to see that the ballast is clear of rails and rail fastenings.

6. Inspection and maintenance items of Track:

The track should be maintained with the objective of restoring it to best possible condition consistent with its maintainability.

Gauging :-

(i) Preservation of gauge is an important part of track maintenance especially through points and crossings. For good riding, the basic requirement is uniform gauge over a continuous stretch of track and such gauge should be allowed to continue so long as it is within the permissible limits of tightness or slackness.

(ii) While it is desirable to maintain correct gauge, it may not be possible to maintain correct gauge due to age and condition of sleeper. It is good practice to work within the following tolerances of gauge, provided generally uniform gauge can be maintained over long lengths:

Cross level:

It is the level difference between two rails, on a sleeper, of a track. For the measurement of cross level, one of the rails is taken as reference to define the level of other rail.

No	Item to check/ see	Limits as per manual	Ref:
TRACK PARAMETERS:			
1	Track parameters in floating condition		
	a) Gauge on floating condition		IRPWM Para 525(1)
	i) On straight track	-6mm to +6mm	
	i) On curves with radius 440 m or more	-6mm to 15mm	
	ii) On curves with radius less than 440 m	Upto +20mm	IRPWM Para 525(1)
	j) Twist on 3.0m base		
	i) On straight and curve track, other than transition	3.5mm/m	
ii) On transition of curve (Local defects above Designed value)	2.1mm/m		
2	Track parameters for low speeds		
	a) Speeds up to 45kmph		IRPWM Para 526)
	i) Unevenness	22mm	
	ii) Twist	18mm	
	iii) Gauge	-10 to +27mm	
	b) Speeds upto 30kmph		IRPWM-2020 Para 526
	i) Unevenness	24mm	
	ii) Twist	21mm	
	ii) Gauge	-10 to +27mm	IRPWM-2020 Para 526
	c) Speeds upto 15kmph		
	iii) Unevenness	33	
	iv) Twist	25	
v) Gauge	-12 to +27mm		
3	Limiting loss of rail section		
	i) 52 kg rails	6%	IRPWM -2020 Para 702 (1)(b)(i)
	ii) 60kg rails	7%	
4	Maximum Corrosion in the web or foot of the rail	1.5mm	IRPWM -2020 Para 702(1) (b) (ii)
5	Limits of vertical wear		
	i) 60 kg rail	13mm	IRPWM-2020 Para 702 (1) (b)(iii)
	ii) 52kg rail	8mm	
6	Limits of lateral wear		
	a) For curves		IRPWM-2020 Para 702 (1) (b)(iv)
	i) For A & B routes	8mm	
	ii) For C & D routes	10mm	
	b) For straight track		
	i) For A & B routes	6mm	
	iii) For C & D routes	8mm	

Planning for maintenance of track as per TRC results:

For planning/taking up maintenance of track in respect of Alignment, Unevenness, Gauge and Twist Parameters based on TRC results, track shall be categorized under following three categories.

- (1) Track requiring planned maintenance.
- (2) Track requiring need based maintenance.
- (3) Track requiring urgent maintenance.

(a) Planned Maintenance Limit (PML):

(i) These tolerances provide a guidance to plan through maintenance of track in a complete block section. These Limits, if exceeded, require that track geometry condition be analyzed and considered for planned maintenance operations.

(ii) The Planned Maintenance Limits (PML) for Unevenness and Alignment are based on Standard Deviation (SD) values, as these Parameters affect Ride quality.

(iii) Peak based limits are not stipulated for unevenness and alignment for planned maintenance as the planned maintenance is to be carried out by track machines for which the planning will be based on standard deviation values only.

(b) Need Based Maintenance Limit (NBML):

(i) These limits are defined for applying timely correction before the defects size grows to the level of Urgent Maintenance Limit (UML); requiring traffic slow down. Allowable time for attention to defects exceeding the NBML would depend upon the magnitude of the defects and various factors affecting track geometry deterioration such as sectional speed, axle load, traffic volume etc.

(ii) The Need Based Maintenance Limits (NBML) are based on Standard Deviation and Peak Values for Unevenness and Alignment. For Gauge and Twist, these limits are based on Peak Values.

(c) Urgent Maintenance Limits (UML):

(i) These limits are so specified that upon their exceedences, the permitted speed should be reduced; which can be restored only after attending the track.

(ii) These are laid in terms of acceleration limits on comfort consideration and peak values for Gauge and Twist.

Maintenance limits for different speed bands: Based on TRC and OMS results, various limits of PML NBML and UML for Unevenness, Alignment, Gauge and Twist Parameters for different speed bands are stipulated as under.

(1) For Speeds upto 100 Kmph:

SN	Parameter	Planned Maintenance Limit (PML)	Need Based Maintenance Limit (NBML)	Urgent Maintenance Limit (UML)
1	Unevenness			Vertical and lateral acceleration peak of 0.30g
1.1	UN-1	SD-5.0 mm	SD-6.8 mm Peak-20 mm	
1.2	UN-2	-	-	
2	Alignment			
2.1	AL-1	SD-3.3 mm	SD-4.9 mm Peak -15 mm	
2.2	AL-2	-	-	
3	Gauge			
3.1	Mean gauge over 200 m section over nominal gauge			
(a)	Straight	-	-8 mm to +10 mm	-10 mm to + 12 mm
(b)	Curve with radius 440 m or more	-	-5 mm to +14 mm	-7 mm to +17 mm
(c)	Curve with radius less than 440 m (Permissible speed as per relevant Para of IRPWM)	-	-5 mm to +18 mm	-7 mm to +20 mm
3.2	Isolated defects –Nominal track gauge to peak value			
(a)	Straight	-	-10 mm to +12 mm	-12 mm to + 15 mm
(b)	Curve with radius 440 m or more	-	-7 mm to +17 mm	-11 mm to +20 mm

(c)	Curve with radius less than 440 m (Permissible speed as per relevant Para of IRPWM)	-	-6 mm to +22 mm	-8 mm to +25 mm
4	Twist (TW-1)		5 mm/m	7 mm/m

(2) For Speeds above 100 Km/h and up to 110 Km/h:

SN	Parameter	Planned Maintenance Limit (PML)	Need Based Maintenance Limit (NBML)	Urgent Maintenance Limit (UML)
1	Unevenness			Vertical and lateral acceleration peak of 0.30 g
1.1	UN-1	SD-3.8 mm	SD-5.5 mm Peak-17 mm	
1.2	UN-2	SD-5.4 mm	SD-7.5 mm Peak-23 mm	
2	Alignment			
2.1	AL-1	SD-2.5 mm	SD-3.9 mm Peak -12 mm	
2.2	AL-2	SD-4.1 mm	SD-6.7 mm Peak-20 mm	
3	Gauge			
3.1	Mean gauge over 200 m section over nominal gauge			
(a)	Straight	-	-8 mm to +10 mm	-10 mm to + 12 mm
(b)	Curve with radius 440 m or more	-	-5 mm to +14 mm	-7 mm to +17 mm
(c)	Curve with radius less than 440 m (Permissible speed as per relevant Para of IRPWM)	-	-5 mm to +18 mm	-7 mm to +20 mm
3.2	Isolated defects –Nominal track gauge to peak value			
(a)	Straight	-	-10 mm to +12 mm	-12 mm to + 15 mm
(b)	Curve with radius 440 m or more	-	-7 mm to +17 mm	-11 mm to +20 mm
(c)	Curve with radius less than 440 m (Permissible speed as per relevant Para of IRPWM).	-	-6 mm to +22 mm	-8 mm to +25 mm
4	Twist (TW-1)		4 mm/m	7 mm/m

Note: In case of curve, the limits for alignment prescribed are above average versine

(3) For Speeds above 110 Km/h and up to 130 Km/h:

SN	Parameter	Planned Maintenance Limit (PML)	Need Based Maintenance Limit (NBML)	Urgent Maintenance Limit (UML)
1	Unevenness			Vertical and lateral acceleration peak of 0.25 g
1.1	UN-1	SD-3.3 mm	SD-4.9 mm Peak-15 mm	
1.2	UN-2	SD-5.1 mm	SD-7.4 mm Peak-22 mm	
2	Alignment			
2.1	AL-1	SD-2.5 mm	SD-3.6 mm Peak -11 mm	
2.2	AL-2	SD-3.5 mm	SD-5.3 mm Peak-16 mm	
3	Gauge			
3.1	Mean gauge over 200 m section over nominal gauge			
(a)	Straight	-	-8 mm to +10 mm	-10 mm to + 12 mm
(b)	Curve with radius 440 m or more	-	-5 mm to +14 mm	-7 mm to +17 mm
(c)	Curve with radius less than 440 m (Permissible speed as per relevant Para of IRPWM)	-	-5 mm to +18 mm	-7 mm to +20 mm

3.2	Isolated defects –Nominal track gauge to peak value			
(a)	Straight	-	-10 mm to +12 mm	-12 mm to + 15 mm
(b)	Curve with radius 440 m or more	-	-7 mm to +17 mm	-11 mm to +20 mm
(c)	Curve with radius less than 440 m (Permissible speed as per relevant Para of IRPWM)	-	-6 mm to +22 mm	-8 mm to +25 mm
4	Twist (TW-1)		4 mm/m	6 mm/m

Note: In case of curve, the limits for alignment prescribed are above average versine

For Speeds above 130 Kmph and up to 160 Kmph:

	Parameter	Planned Maintenance Limit (PML)	Need Based Maintenance Limit (NBML)	Urgent Maintenance Limit (UML)
	Unevenness			Vertical and lateral acceleration peak of 0.20 g
	UN-1	SD-2.9 mm	SD-4.4 mm Peak-13 mm	
	UN-2	SD-4.4 mm	SD-6.6 mm Peak-20 mm	
	Alignment			
		9 mm	6 mm -11 mm	
		5 mm	9 mm -15 mm	
	Gauge			
	Mean gauge over 200 m section over nominal gauge			
	Straight	-	-6 mm to +10 mm	-8 mm to + 12 mm
	Curve with radius 440 m or more	-	-5 mm to +13 mm	-7 mm to +15 mm
	Curve with radius less than 440 m (Permissible speed as per relevant Para of IRPWM)	-	-5 mm to +18 mm	-7 mm to +20 mm

Isolated defects –Nominal track gauge to peak value				
	Straight	-	$\frac{-8 \text{ mm}}{2} \text{ to } \frac{+1 \text{ mm}}{2}$	-10 mm to + 15 mm
	Curve with radius 440 m or more	-	$\frac{-6 \text{ mm}}{6} \text{ to } \frac{+1 \text{ mm}}{6}$	-9 mm to +20 mm
	Curve with radius less than 440 m (Permissible speed as per relevant Para of IRPWM)	-	$\frac{-6 \text{ mm}}{2} \text{ to } \frac{+2 \text{ mm}}{2}$	-8 mm to +25 mm
	Twist (TW-1)		3.5 mm/m	5 mm/m

Note: In case of curve, the limits for alignment prescribed are above average versine.

8. Inspection and maintenance items of Major Bridges:

S.No	Item	Limits
1	Bed block inspection:	<ul style="list-style-type: none"> Crack, displacement uneven settlement, spalling etc. Crack above 5mm needs physical attention of Bed Block. Settlement of Bed Block more than 10 mm needs immediate attention for repair / replacement.
2	Bearing Inspection:	
i).	Centralized Bearing:	<ul style="list-style-type: none"> Lateral & Longitudinal movement. {Lateral Limit = 5 mm and Longitudinal Limit = 25 mm}. Greasing, worn out of shoe plate , crack (Limit = 1 mm.) and Distortion. Missing fittings & tightening of holding down bolt. <p>Note : (Though nothing like this mentioned in Manuals)</p>
ii)	Oil Bath Bearings:	<ul style="list-style-type: none"> Oil level check. (Yearly Top UP) 15 days limit can be fixed. Condition of roller and fittings. <p>Note : (Though nothing like this mentioned in Manuals)</p>
iii)	Elastomeric Bearing:	<ul style="list-style-type: none"> Distortion and cracks. (Physical Check necessary). Bearing seating
iv)	POT PTFE Bearing	<ul style="list-style-type: none"> Collar gap check on all side. Stud bolt & fitting check. Bearing seating horizontal plane check.
v)	Roller Rocker Bearing	<ul style="list-style-type: none"> Verticality of tooth bar and linking of link bar. Condition of holding down bolt and saddle bolt. Observation of longitudinal, traverse and rotational movement under load. Alignment of roller and rocker. Condition of bearing seating and greasing. Worn out of roller at contact.
3.	Super Structure:	
i).	Plate girder:	<ul style="list-style-type: none"> Condition of Painting. Corrosion and Pitting. Condition of splice joint and end stiffener. Residual Verticality of web. Creep (Limit :10 mm.) and traverse displacement(Limit : 5 mm.) of girders . Rivet testing/HSFG Bolt check and its soundness. Weld testing for crack.
ii)	TOWG:	<ul style="list-style-type: none"> Measurement of camber. Rivet testing.

		<ul style="list-style-type: none"> • Weld testing. • Condition of splice joint including soundness of rivets. • Creep (Limit : 10 mm.) and traverse displacement(Limit : 5mm.) of girders. • Verticality of girder post and diagonal. • Observation of stress members of top chord under load. • Condition of floor system. • Condition of joint rivets between cross girder and rail bearer. <p>Note : (Though nothing like this mentioned in Manuals)</p>
iii)	Composite Girder:	<ul style="list-style-type: none"> • Condition of end diaphragm. • Condition of shear connector. • Observation of gap/displacement of deck slab and top flange girder. • Condition of deck slab. • Condition of wearing course. • Function of drainage system. • Rivet/HSFG bolt testing. • Weld testing.
iv)	PSC Girder:	<ul style="list-style-type: none"> • Observation of crack at bearing area. • Observation of vertical crack on web and horizontal cracks deck slab/bottom slab. • Condition of anchorage and strand. • Condition of wearing course. • Function of drainage system. • Measurement of camber.

No	Item to check/ see	Limits as per manual	Ref:
Steel girder bridges:			
1	Maximum centre-to-centre sleeper spacing	600mm	IRPWM Para 227(2)
2	The clear distance between joint sleepers should not be more than	200mm	IRPWM Para 227(2)
3	Clearance between guard rail and running rail of bridge	250+/- 50mm	IRPWM Para 228(2)
4	The top table of the guardrail should not be lower than that of the running rail	by more than 25 mm	IRPWM Para 228(2)
5	Rail joints over the Bridge	In the case of small bridge openings less than 6.1 m, rail joints should be avoided. For other spans, the preferred position of the rail joint is at 1/3 the span from either end.	IRPWM Para 226(2)
6	Condition & square ness of sleepers	Should be square and good condition	IRBM Para 1107 (7)(b)
7	Hook bolts condition	Should have firm grip with girder and position of arrows on top of the bolts should be at right angles to the rails and pointed towards rail. No missing / loose.	IRBM Para 1107 (7)(c)
8	Creep & joint gaps of rails	Within permissible limits	IRBM Para 1107 (7)(d)
9	Guard rail bolts, check rail bolts (for curved track)	No missing and should not be loose.	
10	Correct Flaring and burial at the ends of guard rails should be examined		IRBM Para 1107 (7)(e)(iii)
11	Wooden block provided at the ends of guard rails at burial point should be sound.		IRBM Para 1107 (7)(e)(iv)
12	it should be checked whether angle iron/tie bar runners and foot walk are provided and fixed properly.		IRBM Para 1107 (7)(e)(v)
13	Track parameters	As same as that of normal track parameters in floating condition	
14	Water on the deck bridges should not allow to stagnate or retained in the ballast.		Para 210 (5) of IRBM

Assets of CTC-BBS section (km 437.680 to Km 407.688 from Howrah)

Sl No	Asset	Quantity in CTC-BBS section		
		Main line	Loop lines	Total
1	Track (Kms)	67.64	10.70	78.34
2	Points & Crossing (Nos)	84	46	130
3	Curves-Total (Nos)	76	-	76
a	0-2 Deg (Nos)	66	-	66
b	Above 2 Deg (Nos)	10	-	10
4	SEJ (Nos)	49	8	57
5	Level Crossing (Nos)	-	-	7
6	Major Bridges - Track & Appr (Nos)	15	-	15
	Major Bridges - Girder			
7	Minor bridges	79	-	79

C) Inspection & Maintenance charges of Assets:

Sl No.	Item	Amount incurred in 2020-21 (in crores)
i)	Asset maintenance charges through agencies	3.2072
ii)	Departmental maintenance charges	6.30
iii)	Inspection charges	0.4015
	Total charges for main line including loop lines.	9.9087
iv)	Charges per Track Kilometre	0.1265