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

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EF No. 2022/CE-II/CS/IRPWM2020 New Delhi, dated 07.11.2022

The General Managers (Engg.)- CR, ER, ECR, ECoR, NR, NCR, NER, NFR, NWR, SR, SCR, SER, SECR, SWR, WR, WCR and Metro Railway/Kolkata.
The General Manager (Const.), N.F. Railway, Guwahati.
The General Manager/CORE/Prayagraj

Principal Financial Advisor, All Indian Railways
The CAO/Const. All Indian Railways.
The General Managers (Engg.) – ICF/Chennai, RCF/Kapurthla, BLW/Varanasi, CLW/Chittranjan, Rail Wheel Factory /Yelahanka, Bangalore & PLW/Patiala.

The Director General (Track), RDSO/Alambagh, Lucknow.
Chief Commissioner of Railway Safety, Lucknow.

Managing Director, IRCON, New Delhi.
Managing Director, RITES Bhawan, 1, Leisure Valley Rd, Sector 29, Gurugram, Haryana
Managing Director, DMRC, Metro Bhawan, Barakhamba lane, New Delhi.
Managing Director, CONCOR, New Delhi.
Managing Director, RVNL, August Kranti Bhawan, Bhikaji Cama Place, New Delhi.
Managing Director, DFCCIL, Pragati Maidan, Metro Station, New Delhi.
Managing Director, PIPAVAV Railway Corp. Ltd., 14th Floor, B-Wing, Statesman House 148, Barakhamba Road, Canaught Place New Delhi Central Delhi
Managing Director, MRVC, Church Gate station Building 2nd Floor, Mumbai – 400020.
Managing Director, RLDA, Unit No.702-B, 7th Floor, Konnectus Tower-2, DMRC Building, Ajmeri Gate Delhi 110002
Managing Director, Konkan Railway Corporation Ltd, Belapur Bhawan, Sector-11, CBD Belapur. Mumbai. Pin - 400614.

Director General, IRICEN, Pune.
Director General, IRIEEN, Nasik.
Director, IRISET, Secunderabad.
Director, IRIMEE, Jamalpur.
Director General, IRITM, Vill. Kanausi, Hardoi, Manik Nagar, Lucknow.
Director General, NAIR, Vadodara.
Genl. Secretaries, AIRF, NFIR, IRPOF, FROA, DAI (Railways) Rail Bhawan, New Delhi.

Sub: Correction Slip No.10 to the Indian Railways Permanent Way Manual 2020.

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Ministry of Railways (Railway Board) has decided that correction/addition as indicated in the enclosed Correction Slip No.10 dated 07.11.2022, to relevant para of IRPWM-2020 be made.

Receipt of this letter may please be acknowledged.

7/11/22

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

EF No. 2022/CE-II/CS/IRPWM2020 New Delhi, dated 07.11.2022

Copy to:-

Sr. PPS/PS to CRB & CEO, MF, MI, M(T&RS), M(O&BD), Secretary.
AM(CE), AM(Works), AM(Budget), AM(Traction), AM(Fin.), AM(Sig.), AM(Plg.), AM(Mech.Engg.), AM(PU.), AM(Tele.), AM(Traffic), AM(M&BD), AM(T&C), AM(Comml.).

PED(Bridge), PED(Vigilance), PED(Safety), PED(Staff), PEDCE(P), PEDTT(M), EDTK(M&MC), EDCE(G), EDCE(B&S), ED(L&A), ED/SD & Transf., ED/GS(Civil)-II, EDV(E), ED/GS(Civil)-I, ED(Safety), EDF(X)I, EDF(X)II, DTK(MC), DTK(M), DTK(P&P), DCE(B&S), Dir./GS(C)-III, Dir./GS(Civil)-I, DVE-I & DVE-II,

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INDIAN RAILWAYS PERMANENT WAY MANUAL, 2020
ADDENDUM AND CORRIGENDUM SLIP NO.10 DATED 07.11.2022

(A) The existing **Para** 404(1)(d) of IRPWM,2020 shall be replaced by new Para 404(1)(d) of IRPWM, 2020 as under:

Para 404 (1) (d)

(d) ***Maximum design cant on curved track shall be as under-***

(i) *Broad Gauge- Group 'A'& 'B' routes-:185 mm*

Note1: On existing track of Group A and B routes, maximum cant of 185 mm to be considered on case-to-case basis with the approval of Chief Track Engineer based on clearance study and feasibility of increasing the transition length with/without acquisition of land.

Note 2: On new lines/diversions/multi tracking works on A and B routes, exceptional cases of not achieving full speed potential due to non-exploitation of permitted cant should be submitted to Principal Chief Engineer for approval with justification.

(ii) *Broad Gauge- Other routes:* *165 mm*

Note: On all routes, maximum design cant to be limited to 140 mm on track with turnouts.

(B) The existing **Para** 404(2) of IRPWM,2020 shall be replaced by new Para 404(2) of IRPWM, 2020 as under:

Para 404(2)

(2) ***Cant Deficiency***– Maximum value of cant deficiency:

(a) For '*nominated*' rolling stocks - 100 mm/150 mm

Note1: For rolling stocks permitted with 150 mm cant deficiency, cant deficiency to be limited to 115 mm on track with turnout with crossing on outer rail and on track with expansion device.

Note 2: *Nominated stock* shall be permitted cant deficiency of 100 mm/115 mm/150 mm after found satisfactory during oscillation trial and specified as such in Speed Certificate issued by RDSO.

(b) For other rolling stocks not covered above- 75 mm

(C) The existing Para 405 (1), 405 (3), 405(5), 405(8) & 405(9)(a) of IRPWM, 2020 shall be replaced by new Para 405 (1), 405 (3), 405(5), 405(8) & 405(9)(a) of IRPWM, 2020 as under:

Para 405: Length of Transition Curve and Setting-out Transitions–

(1) The desirable length of transition 'L' shall be maximum of the following three values–

(a) $L = 0.0056\ C_a \times V_m$

(b) $L = 0.0056\ C_d \times V_m$

(c) $L = 0.72 \times Ca$

Where,

L = length of transition in metres.

V_m= max. permissible speed in km/h.

C_d= cant deficiency in mm.

C_a= ~~actual Super-elevation on curve in mm~~.

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The formula (a) and (b) are based on rate of change of cant and of cant deficiency of 50 mm per second. The formula (c) is based on the maximum cant gradient of 1 in 720 or 1.4 mm per metre. The length of transition so calculated should be rounded off to the next higher value in multiple of 10 m.

Note: For non transitioned curve (designed with virtual transition), the rate of change of cant and cant deficiency shall be taken as 35 mm/s while cant gradient to be taken as 1 in 720. The formula (a) above therefore shall be L= 0.008 $C_a \times V_m$ and formula (b) above shall be L= 0.008 $C_d \times V_m$. Formula (c) shall remain same as above.

(3) In cases where ground conditions do not permit provision of the desirable transition length in accordance with the above, the length may be reduced to a minimum of 5/6 of the desirable length as worked out on the basis of formula (a) and (b) above or ½ of the desirable length as worked out on the basis of (c) above, whichever is greater, with approval of Chief Track Engineer. This is based on the assumption that a rate of change of cant/cant deficiency will not exceed 60 mm per second and the maximum cant gradient will be limited to 2.8 mm per metre or Maximum upto 1 in 360.

Note: For non transitioned curve (designed with virtual transition), in exceptional cases and with the approval of Chief Track Engineer, the rate of change of cant and cant deficiency may be taken as 55 mm/s and cant gradient as 1 in 360. The length of transition therefore may be reduced to a minimum of 2/3 of the desirable length as worked out on the basis of formula (a) and (b) of note of Sub-para (1) above or ½ of the desirable length as worked out on the basis of formula (c) above, whichever is greater.

(5) In case of doubling and New lines, if a curve is not possible to be designed for 160 kmph for Group 'A' and 130 kmph for Group 'B' routes, approval of PCE shall be obtained.

An example is illustrated with calculations below–

A curve of 600 metres radius has a limited transition of 40 metres length, the calculation of maximum permissible speed and super-elevation is as follows–

Speed on transition curve = Speed on circular curve

$$\frac{\text{(Rate of change of cant)} \times L \times 3.6}{C_a} = 0.27\sqrt{R} \times (Ca + Cd)$$

(3.6 is a factor used for converting m/sec to kmph)

Best values of speed are obtained when $C_a = C_d$

Adopting the same units and the maximum value of rate of change of cant of 60 mm per second for Broad Gauge–

$$\frac{60 \times 40 \times 3.6}{C_a} = 0.27\sqrt{600} \times 2C_a$$

Solving C_a = 94.85 or 95mm

Limiting the value of C_d to 75 mm

Maximum speed $= 0.27\sqrt{R} \times (Ca + Cd)$

$= 0.27\sqrt{600} \times (95 + 75)$

= 86.23 or 85 Kmph

Cant gradient = (95/40000) = 1/421, which is within the permissible limits

The rate of change of cant at 85 km/h works out to 56.07 mm/second, which is also within the permissible limits.

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(8) *Compound curves*– In case of a compound curve, which is formed, by two circular curves of different radii but curving in the same direction, common transition curve may be provided between the circular curves. Assuming that such compound curve is to be traversed at uniform speed, the length of the transition connecting the two circular curves can be obtained from–

(a) $L = 0.0056 (C_{a1} - C_{a2}) xV_m$

(b) $L = 0.0056 (C_{d1} - C_{d2}) xV_m$

Whichever is greater.

Where, C_{a1} and C_{d1} are cant and cant deficiency for curve No.1 in mm;

C_{a2} and C_{d2} are cant and cant deficiency for curve No.2 in mm;

L is length of transition in metres; and

V_m is max. permissible speed in kmph.

The Cant gradient should be within the permissible limits as stated in sub para (1) & (3) above. Common transition may be provided when the length of common transition as worked out above is more than the length of virtual transition as specified in **Para 403 (2).**

(9) *Reverse Curves*–

(a) In case of a reverse curve, which is formed by two circular curves in opposite directions, common transition curve may be provided between circular curves. The total length of common transition, i.e., from first circular curve to second circular curve, may be obtained from–

(i) $L = 0.0056 (C_{a1} + C_{a2}) \times V_m$

(ii) $L = 0.0056 (C_{d1} + C_{d2}) xV_m$

Whichever, is greater.

Where,

Ca_1 and C_{d1} are cant and cant deficiency for curve No.1 in mm;

C_{a2} and C_{d2} are cant and cant deficiency for curve No.2 in mm;

L is length of transition in metres; and

V_m is max. permissible speed in km/h.

Cant gradient should be within the permissible limits as stated in *Sub Para (1) & (3)*above.

(D) The existing **Para 407 (1)** of IRPWM, 2020 shall be replaced by new Para 407 (1) of IRPWM, 2020 as under:

Para 407 (1)

(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 maximum cant provided on the circular portion of curve in millimetres.

Note: Separate speed restriction boards for *'nominated'* stock and other stock (Goods/normal) respectively as defined in para 404 (2) to be provided on each such curves where restriction is to be imposed.

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(E) The existing **Para 202** of IRPWM, 2020 shall be replaced by new Para 202 of IRPWM, 2020 as under:

Para 202

202 Track Structure: - The track structure for operation of Passenger train for speeds beyond 110 Kmph and up to 160 Kmph on Indian Railway routes is given as under:

Track Structure for speeds beyond 110 Kmph of Passenger carrying train on BG IR

Speed	**Speed above 110 Kmph and up to 130 Kmph**	**Speed above 130 Kmph and up to 160 Kmph**
Rails	60 kg 90 UTS	60 kg 90 UTS
Sleeper/ Sleeper Density	PSC at 1660	PSC at 1660*
*Note - * Wider and Heavier PSC sleeper shall be used during renewals*		
Ballast Cushion in mm	Total 300 clean 150	Total 350 clean 150
Turnouts		
Switch	Thick Web Switches on all turnouts	Thick Web Switches on all turnouts
Crossing	CMS	Weldable CMS
SEJ	Improved Type	Improved Type
Bridge Sleepers	H – Beam Sleepers/Composite sleepers	
Level Crossings	Interlocked	No Level crossing
Fencing	All along the track	All along the track
Curves	All the curves shall be suitably realigned and proper transition lengths shall be provided. Maximum permissible cant of 185 mm can be provided in the section so that speed potential on curves is fully exploited, however, this shall be subject to the consideration of maximum cant excess for the slowest moving train. This will require survey of each curve including the fixed installation and thereafter realignment should be undertaken keeping all the constraints in view. With a cant deficiency of 150 mm, the maximum permissible speed on 1.3 degree curve and 2.2 degree curve works out to be 160 kmph and 130 kmph respectively for 185 mm cant (corresponding to Goods train speed of 65 kmph).	

Note – In case track structure does not fulfill the above requirement, relevant instructions of Railway Board would be referred.

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