GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

2025/Proj./PATNA-METRO/C-1/CORR.II/30/142 New Delhi, dated 05.08.2025

Managing Director,
Patna Metro Rail Corporation Limited (PMRCL),
Urban Development & Housing Department Vikas Bhawan,
New Secretariat,
Patna - 800015 (Bihar)

Sub: Approval of Annexure C-1 (Track Structure) for Patna Metro Rail Corporation Limited (PMRCL).

Ref: Documents uploaded by PMRCL on UT Online Portal on 16.05.2025 along with its compliance

Patna Metro Rail Corporation Limited (PMRCL)'s request for approval of Annexure C-1 (Track Structure) for Corridor -2 (From Malahi Pakri to New ISBT) of Patna Metro Rail Project has been examined in consultation with RDSO and approval of Railway Board is hereby conveyed for the same.

Accordingly, approved copy of Annexure C-1 (Track Structure) is enclosed.

Encl: As above

05.08.25

(**F. A. Ahmad**)
Director/Gati Shakti (Civil)-IV
Railway Board
Ph: 011-47845480
Email: dirgsc4@gmail.com

Copy to:

1. **Executive Director/UTHS**, RDSO, Manak Nagar, Lucknow w.r.t letter No. UT/125/ Patna Metro/Civil dated 27.05.2025

2. **OSD/UT & Ex-Officio Joint Secretary**, Ministry of Housing & Urban Affairs(MoHUA), Nirman Bhavan, New Delhi-110011

Annexure C-1

COMPLIANCE FOR STANDARDS FOR TRACK STRUCTURE AND SALIENT FEATURES OF TRACK STRUCTURE ADOPTED BY PATNA METRO RAIL CORPORATION FOR CORRIDOR- 2 (FROM MALAHI PAKRI TO NEW ISBT).

Part-A: Technical Standards of Track Structure for Metro Railways/MRTS

Standard Stipulated as per Annexure C-1 of Procedure of Safety Certification and Technical Clearance of Metro Systems	Comments/ Compliance
1. Scope: The Scope is to formulate the Track Structure Design Basis, with broad parameters for getting the Ministry of Railways approval for the stipulated and desirable technical standards / specifications for a Metro Rail.	**1.** Technical standard/ specification has been developed for Patna Metro Corridor-2 (from Malahi Pakri to New ISBT), including details of curvature, gradient, turnout etc. for use on Patna Metro Corridor-2(from Malahi Pakri to New ISBT).
2. Operating Environment: Track Structure should fulfill generally the following conditions:	
2.1 Gauge – Broad gauge- 1676/1673mm (nominal) and standard gauge – 1435mm.	**2.1** Standard Gauge-1435 mm
2.2 Rail Seat inclination (slope): 1 in 20	**2.2** 1 in 20
2.3 Speed potential – 110 kmph (max.)	**2.3** Track structure is fit for Design speed of 90 kmph and is fit for maximum operating speed of 80 kmph.
2.4 Static axle load -20 T (max.)	**2.4** 16 T (Max.)
2.5 Design rail temperature range – (-)10 degree Celsius to (+) 70 degree Celsius	**2.5** Complied; design rail temperature range lie between (-) 10 degree Celsius and (+) 70 degree Celsius.

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

2.6 Maximum Curvature and ruling gradient - As specified in SOD	**2.6** (i) Sharpest radius curve is 127.899 m on main line. (ii) Maximum ruling gradient provided is 2.5%.
3. Track Structure: **3.1 General:** The track structure should fulfill the following requirements: **3.1.1** The track structure should conform to/ satisfy Schedule of Dimension requirement and other maintenance instructions of Metro systems.	**3.1.1** Yes, conforming to/satisfying Schedule of Dimensions requirement and other maintenance instructions of Metro systems.
3.1.2 Ride comfort and running safety of track vehicle dynamics should be satisfied.	**3.1.2** Yes, complying.
3.1.3 The track structure should be designed with long welded / Continuously welded rail on main line track (For Both the Ballasted track as well as Ballast-less track).	**3.1.3** Yes, complying.
3.1.4 The horizontal alignment shall consist of a series of straights joined to circular curves generally with transition curves. Curvature and cant shall be calculated based on the train speed for each train type on the section. Compound and reverse curves are acceptable, provided they are connected by an adequate transition curve.	**3.1.4** Yes, Complied. (i) The maximum cant is 110 mm, (ii) Cant deficiency=85 mm. (iii) Cant gradient is 1 in 440 or Flatter. Adequate transition lengths are provided. (iv) Rate of change of cant & rate of change of cant deficiency Desirable 35 mm/sec.
3.1.5 The vertical alignment should be designed to achieve a smooth profile line with gradual changes. Changes in the profile should be connected by vertical curves, which shall be as generous in length as the location allows. Vertical curves including its transition shall not be located at stations within the length of platform. A vertical curve within the length of	**3.1.5** Yes, complying. The Vertical alignment has been designed to achieve a smooth profile with gradual changes. The changes in the profile are connected by vertical curves of adequate length available in the location. Vertical curves are not located at station within the length of platform. Vertical curves of radius 1500

Examined and found in order
Pradeep Kr. Mishra
ADG/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

transition and Turnouts is also not desirable. Vertical curve radius is constrained by the need to limit the vertical acceleration for passenger ride comfort.	meter or flatter as per SOD are being used which provide satisfactory riding comfort. Vertical curves are not falling within the length of transition and Turnouts.
3.2 The technical standards for Track structure deals with the following components- (i) Rail and Welding (ii) Sleeper and fastening for ballasted track (iii) Track slab for ballast-less track (iv) Fastening system for ballast-less track (v) Insulated Glued joint (vi) Turnout, scissors cross over (vii) Switch Expansion Joints (viii) Gradients	Commented in relevant para's.
4. Rails and Welding: **4.1 Rails:** **4.1.1 For Main line Track:** **4.1.1.1** The rail used on main line on curves and approaches of Stations shall be 60E1, 1080 grade Head Hardened. **4.1.1.2** At other locations on straight line of main line, the use of 60E1, 1080 grade HH / 60E1, 880 grade / 60E1, R260 grade rail shall be decided by Metro Railway depending upon speed, axle load and other factors pertaining to safety and life of rail. However, on curves with small straight track in between, the 60E1, 1080 grade Head hardened rail should be continued on straight patches also.	The rails on whole of the main lines are 60E1, 1080 Grade, Head Hardened. The maximum operating speed is 80 kmph.
4.1.1.3 It is essential to have preventive rail grinding arrangements in case 60E1, 1080 HH rails are used.	**4.1.1.3** Preventive rail grinding would essentially be done for 60EI, 1080 grade rails being used.
4.1.2 For Depot lines: The rail used on depot lines can be non- head hardened and shall be 60E1, 880 grade / 60E1, R260 grade.	**4.1.2** R-260 grade rails are being used in depot line.

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

4.1.3 Specification: **4.1.3.1** The rail shall be class 'A' rails as per IRS-T-12-2009 specification with latest amendments. However, any suitable length of rail more than 13 m considered appropriate by metro on consideration of transportation and handling can be adopted, provided the rails are ultimately welded into long welded rails.	**4.1.3.1** Rail is being used of Class 'A' category. Rail length for main line is 18m. Rail length for depot line is 13m.
4.1.3.2 The rail shall be manufactured and tested in accordance with IRS-T-12-2009 (with latest amendment). The chosen manufacturers shall be required to submit their inspection and test plan for approval by Metro railway as per IRS-T-12-2009. Metro railways will ensure that the inspection and test plan approved by them strictly conforms to the requirement of IRS specifications.	**4.1.3.2** 1. The approved ITP of followings items are enclosed herewith. **Appendix-C1/1a,1b,1c** 1. 1080 grade HH rails 2. R 260 grade rails 3. 60E1A1 rail used in switches 4. CMS crossing 2. Yes, complying with IRS-T-12-2009 with latest amendments.
4.2 Welding of rail: **4.2.1** The welding of rails should conform to Indian Railway specifications and technical instructions issued from time to time. **4.2.2** The present instructions are contained in following documents: **4.2.2.1 <u>Alumino Thermit Welding:</u>** (i) Indian Railway Standard specifications for Fusion Welding of Rails by Alumino-Thermic Process, IRST-19-2020, with latest amendments. (ii) Manual For Fusion Welding of Rails by the Alumino-Thermic Process: Revised-2012 with latest amendments	**4.2** 4.2.1 Yes, complying. (i) Complying with Indian Railway Standard specifications for Alumino Thermit Welding of rails (IRS-T-19-2020, with latest amendments). (ii) Complying with Manual for Fusion Welding of Rails by The Alumino-Thermic Process: Revised-2012 with latest amendments

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

(5)

4.2.2.2 Flash Butt Welding: Manual for Flash Butt Welding of Rails, (Revised January 2012), with latest amendments.	**4.2.2.2** 1. Yes, Complying with Flash Butt Manual 2012 with latest amendments.
4.2.2.3 Special attention is required by metros for provisions of these instructions regarding procurement, execution of works and areas requiring prior approval/ standardization by RDSO.	**4.2.2.3** Noted.
4.3 Ultrasonic Testing of Rail and Welds: The rails and welds shall be ultrasonically tested in field as per requirement of concerned specification/ manual/ instructions. The testing shall be ensured as per provisions of "Manual for Ultrasonic Testing of Rail and Welds- Revised 2012" with latest amendments. The provisions, as given in the "IRS specification for Ultrasonic testing of Rails/Welds, Revised-2020 (Document No. T-53)" shall also be followed.	**4.3.** Yes, complying. Complying with Document no: T-53 IRS specification for Ultrasonic testing of rails/welds, Version 4.0, Revised- 2020. Manual for Ultrasonic Testing of Rail and welds- with latest amendments will also be followed.
5. Sleeper and fastening for Ballasted track **5.1 Sleepers:** **5.1.1 Broad Gauge** The PSC sleepers shall be used in accordance with RDSO drawing no. T-2496 and specification IRS-T-39 (revised from time to time).	**5.1.1** Not applicable.

Examined and found in order
Pradeep Kr. Mishra
AD&U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

5.1.2 Standard Gauge PSC sleeper for standard gauge will be designed by Metro Railways following in principal guidelines of Indian Railway and the same shall be approved by Metro.	**5.1.2.** Approved drawing is enclosed at **"Appendix-C1/3."** Drawing No.- PT-08R-SLEEPER-001.
5.2 Fastening system: The elastic fastening system prevalent on Indian Railways shall be used duly ensuring the Inspection protocol for fastening components laid down for IR. In case of use of elastic fastening other than in use on IR, prior approval shall be obtained from Railways.	**5.2** Yes, complying. The fastening system 336 approved by MOR vide letter No.98/Proj. /DLI/30/1 (Vol. III) dated 24.1.2013 has been used. 336 fastening system is being used for turnouts.
6. Track slab for Ballastless track **6.1** Track shall be laid on cast in situ/precast reinforced plinth or slab, herein referred to as the 'track slab'. The track slab shall be designed as plinth beam or slab type ballastless track structure with derailment guards. It shall accommodate the base plates of the fastening system.	**6.1** Yes, complying. Track is laid on cast in situ plinth on main line and stations. The plinth beam and slab are designed as beam with derailment guard. The 336 fastening system is being used in the section. The track slab structural drawing is enclosed at **"Appendix-C1/4a,4b".**
6.2 In general, track slab (including sleeper, if any) on which the fastening and rail are to be fitted shall perform the following functions: i) Resist the track forces. (Static and dynamic)	**6.2** (i) Yes, complying
(ii) Have adequate edge distance of concrete beyond the anchor bolts to provide resistance against edge failure.	(ii) Yes, complying
iii) Provide a level base for uniform transmission of track/rail forces.	(iii) Yes, complying.
iv) Have geometrical accuracy and enable installation of track to the tolerances laid down.	(iv) Yes, complying.

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate Approved on 15/9/2025 Railway Board

(71)

v) Ensure drainage.	(v) Yes, provided.
vi) Resist weathering.	(vi) Resisting weather effect, as concrete structure is of M-35 with having clear cover to atmospheric exposure concrete surface is 50 mm.
vii) Be construction friendly, maintainable and quickly repairable in the event of a derailment. The 'Repair and Maintenance methods' shall be detailed in a Manual to be prepared and made available.	(vii) Yes, complying. Construction is friendly, maintainable, and quickly repairable in event of any accident. Repair and maintenance methods are detailed in the 'Track Maintenance Manual'.
viii) Ensure provision for electrical continuity between consecutive plinths/slabs by an appropriate design.	(viii) Yes, complying. Electrical continuity between consecutive plinths/slabs maintained by jumper plates.
ix) Plinth beam or slab of ballastless track should be suitable for embankment or viaduct or tunnel/Underground structure.	(ix) Yes, complying
x) Proper design of expansion joints suitable for joints of viaduct structure.	(x) Yes, design report of expansion joint is enclosed at **"Appendix-C1/5"**
xi) Design should be suitable for curves as per SOD of Metro system.	(xi) Yes, complying.
xii) Design of subgrade/embankment for slab should be furnished to ensure durability and functional stability in service.	(xii) Sub grade has been provided in ISBT Depot, Patna being at grade and speed is up to 25 kmph. Approved drawing is enclosed at **"Appendix-C1/6"**. Drawing No.- PMP-DP-TRCS-00-ACM-ST-DR-0551.
xiii) Design should be suitable and incorporate provision of utilities e.g. cable, wires, ducts, water channels, etc.	(xiii) Yes, Complying.
The detailed design calculations of track slab along with detailed structural drawings as approved by metro authorities shall be furnished for record.	Design Basis Report is enclosed at **"Appendix-C1/7".**

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

7. Check Rail / Restraining Rail: **7.1** Check rails/ Restraining Rails should be provided on curves on main line where radius is 218 m or less on Broad gauge and radius is 190 m or less on Standard gauge. The clearance of check rail/ restraining rails shall be suitably decided after requisite studies. The detailed design calculations/ studies in this regard shall be furnished for record.	**7.1** Yes, complying. 1. Check Rails have been provided on curves of radius ≤ 190 m. 2. Design of Check rails/restraining rail is enclosed at **"Appendix-C1/8".**
7.2 Check rails/ Restraining Rails shall not be mandatory for curves in depots, yards, and non-passenger lines where speed is not more than 25 kmph. However, decision in this regard may be taken by Metro itself, based on layout and maintenance requirement.	**7.2** Yes, complying.
8. Derailment Guards **8.1** The derailment guard should be provided inside/outside of running rail on viaduct as well as in tunnel having multiple tracks and at grade section locations specified by the Metro railway. For single track tunnel, location for providing derailment guard is given in note. In tunnels, the derailment guard should preferably be provided inside the track, so that it permits less sway of coach towards tunnel wall in case of derailment.	**8.1** Yes, complying. On tangent track and curve radius flatter than 190 m, Derailment guards have been provided inside of running rail. On turnouts and curve with radius equal to and sharper than 190 m, Derailment guards have been provided outside of running rail. The design calculation of derailment guard for Patna Metro is enclosed at **"Appendix-C1/9."**

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

NOTE: **Location for providing Derailment Guard in single track tunnel** 1. Entry of tunnel: 200 m from tunnel portal outside the tunnel to 50 m inside the tunnel. 2. Exit of tunnel: 50 m from inside of tunnel portal to 200 m outside the tunnel. 3. In curved track having radius 500 m or less including transition portion but excluding locations where check rail is provided. 4.Covering locations of all important installations e.g. Location of any sub-station or hazardous structures inside the tunnel, etc. damage to which in the assessment of metro rail administration can result into serious loss of life or/and infrastructure as a result of derailment in tunnel. The above is subject to the condition that metro railway shall carry out the risk assessment analysis for derailment in tunnels and ensure that the maintenance practices in the maintenance manual are as per the risk assessment mitigation plan.	Not applicable, as entire section is on viaduct.
8.2 The lateral clearance between the running rail and the derailment guard shall be 210 ±30 mm. It shall not be lower than 25 mm below the top of the running rail and should be clear of the rail fastenings to permit installation, replacement, and maintenance. Metro Administration should ensure that KE is not infringing the Structure Gauge, in case of derailment in single track tunnel, so long the wheels of any derailed vehicle are within the main rail and derailment guard. **Note:-**"In case of Double Resilient Base Plate Assembly Fastening System as approved by MoR, the lateral clearance between running rail	**8.2** Yes, Complying. The lateral clearance between running rail and derailment guard has been kept 212.5 mm (fastening 336). Derailment guard is not lower than 25 mm below the top of running rail and is clear of rail fastenings to permit installation, replacement, and maintenance.

Examined and found in order
Pradeep Kr. Mishra
ADG/L.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

(101)

and the derailment guard shall be 250±20mm. This fastening system, if used in tunnels having multiple tracks, Metro Administration should ensure that KE for adjacent track is not infringed so long as the wheel of any derailed vehicle are within the main rail and derailment guard."	
8.3 Derailment guard shall be designed such that in case of derailment: (i) The wheels of a derailed vehicle under crush load, moving at maximum speed are retained on the viaduct or tunnel. (ii) Damage to track and supporting structures is minimized. The detailed design calculations of derailment guards along with detailed structural drawings shall be furnished for record.	**8.3** Yes, Complying. The derailment guards have been designed such that in case of derailment: (i) The wheels of a derailment vehicle under crush load, moving at maximum speed are retained on the viaduct. (ii) Damage to track and supporting structure is minimum. The Design calculation of derailment guard for viaduct is enclosed at **"Appendix-C1/9."**
9. Glued Insulated Rail joint **9.1** Normally glued joint should be avoided. **9.2** Wherever inescapable, G3 (L) type of glued insulated rail joint shall be used as per RDSO drawing no. RDSO T-2572. The glued joints shall be manufactured and tested in accordance with RDSO's 'Manual for Glued Insulated Rail Joints-1998' with all amendments.	**9.1** Noted, Glued joints have not been provided as confirmed by the signaling department. **9.2** Not applicable
10. Turnouts, Scissors Crossover **10.1 Standards of Turnout:** **10.1.1 Main lines:** On main lines, the turnouts and diamond crossing shall be of the following standards:	**10.1.1** Complying.

Examined and found in order
Pradeep Kr. Mishra
ADGM.T.(C/W)L
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/12/2025
Railway Board

(41)

(i) Standard Gauge a) 1 in 9 type or flatter turnout (desirable) b) 1 in 7 type turnouts (minimum) c) Scissors cross-over of 1 in 9 / 1 in 7 types consisting of 4 turnouts and 1 diamond crossing	Turnouts being used in main line are: a) 1 in 9 type b) N/A c) Scissor crossover of 1 in 9 types consisting of 4 turnouts and 1 diamond crossing.
(ii) Broad Gauge a) 1 in 12 type turnouts b) 1 in 8.5 type turnout c) Scissors cross-over of 1 in 12 type consisting of 4 turnouts and 1 diamond crossing	Not Applicable
10.1.2 Depots and Non running lines: On depot and other non-running lines, the turnouts and diamond crossing shall be of the following standards:	**10.1.2** Turnouts being used are:
(i) Standard Gauge a) 1 in 7 type or flatter turnout	a) 1 in 7 type
b) Scissors crossover of 1 in 7 type consisting of 4 turnouts and 1 diamond crossing	b) Scissor crossover of 1 in 7 type consisting of 4 turnouts and 1 diamond crossing.
c) 1 in 7 derailing switches/1 in 7 type symmetrical split turnout	c) 1 in 7 derailing switches
(ii) Broad Gauge a) 1 in 8.5 type turnout b) Scissors crossover of 1 in 8.5 type consisting of 4 turnouts and 1 diamond crossing c) 1 in 8.5 derailing switches/1 in 8.5 type symmetrical split turnout	Not applicable

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
I.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2015
Railway Board

10.1.3 If any Metro railway decides to use sharper angle layout, they should establish the adequacy of the speed potential of the turnout for the purpose for which it is used and the negotiability of the turnout by the rolling stock with a safety margin.	Noted.
10.1.4 The requirement for turnouts as specified in the following clauses shall include switch devices, crossings and associated check and lead rails as appropriate.	**10.1.4** Noted for compliance.
(a) Turnouts (switches, lead, crossings, and associated closure & check rails) shall be suitable for installation on PSC sleepers for ballasted track or concrete slab for ballastless track.	a) Complying. Turnouts on Main line have been designed and installed on concrete slab for ballastless track. Turnouts in depots have been designed and installed on PSC sleeper on ballasted track.
(b) Turnouts shall be manufactured to allow for installation of continuously welded track.	b) Complying. Turnouts have been designed and manufactured for installation of continuously welded track.
(c) Turnout shall be compatible with proposed rolling stock and its operational characteristics.	c) Complying. Turnouts are compatible with the rolling stock and its operational characteristics.
(d) The assembly must ensure continuous electrical contact with the train and all the points shall be operated by electric motors.	d) Complying. The assembly ensures continuous electrical contact with the train and all the points are operated by electric motors.
(e) The CMS crossing to be used on mainline shall be subjected to explosive hardening.	e) Complying. The CMS crossing used on mainline are explosive hardened.
(f) All turnouts shall be laid with cant with a rail slope as that of main line towards center of track.	f) Complying. The turnouts have been laid with a rail slope of 1 in 20 towards center of track.

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

(g) All turnouts and their components shall be designed to minimize electrical leakage from running rails to the ground.	g) Complying. The turnouts and their components have been designed to minimize electrical leakage from running rails to the ground.
(h) Scissor crossover should be designed for Track centers not infringing SOD.	h) The Scissor crossover have been designed and installed for Track centers not infringing SOD.
10.2 Type and geometry of turnout Detailed design of all turnouts, scissors, and crossover should comply the following geometrical parameters. **(a) Standard Gauge** (i) 1 in 9 turnouts: The design shall be tangential with a switch angle not exceeding 0°20'00". It is desirable that the radius of lead rail of turnout is not less than 300m. Lead curve of 190 m radius may be laid as an exception. All clearances shall be in accordance with relevant provisions of SOD.	**10.2** Yes, Complying. The detailed design of all turnouts, scissors, crossovers comply the following geometrical parameters: (i) Yes, Complying (a) Switch Angle 0°8'12". (b) Radius of lead rail is 300 m. (c) All clearances in accordance with SOD are being complied.
(ii) 1 in 7 turnouts: The design shall be tangential with a switch angle not exceeding 0°20'00". It is desirable that the radius of lead rail of turnout is not less than 190m. Lead curve of 140 m radius may be laid as an exception. All clearances shall be in accordance with relevant provisions of SOD.	(ii) Yes, Complying. (a) Switch Angle 0° 8 '50" (b) Radius of Lead rail of turnout is 190 m (c) All clearances as per SOD have been incorporated.
(iii) Scissors Crossover: The basic geometry of the turnouts of scissors crossover shall be same as that of corresponding ordinary turnouts as mentioned in clause 10.2. (a). (i) & (ii) above.	(iii) Yes, Complying as mentioned in clause 10.2 (a). (i) & (ii) above.

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Approved on 05/8/2025

(b) Broad Gauge (i) 1 in 12 turnouts: The design shall be tangential with a switch angle not exceeding 0°20'00". The radius of lead rail of turnout is not less than 410m. Lead curve of 190 m radius may be laid as an exception. All clearances shall be in accordance with relevant provisions of SOD. (ii) 1 in 8.5 turnouts: The design shall be tangential with a switch angle not exceeding 0°20'00". The radius of lead rail of turnout is not less than 218m. All clearances shall be in accordance with relevant provisions of SOD. (iii) Scissors Crossover: The basic geometry of the turnouts of scissors crossover shall be same as that of corresponding ordinary turnouts as mentioned in clause 10.2. (b). (i) & (ii) above.	Not Applicable
10.3 Operating requirement of turnout, scissor crossover: Track layout design shall permit trains to operate at maximum capability wherever possible. Turnouts and crossover shall be selected such that they do not form a restriction to the operating speed on main line. Switches and crossings shall not be located on transition curves or vertical curves.	**10.3** Complying. The switches and crossings are not being located on transition curves or vertical curves.
10.3.1 Speed: The turnout shall be designed for the speed on mainline side equal to the speed as on mainline track. The minimum speed potential of the various turnouts and scissors crossover on the Turnout side should be as follows:	**10.3.1** Complying.

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/09/2025
Railway Board

10.3.1.1 Standard Gauge (i) 1 in 9 type turnouts with 300 m radius (speed potential of 45Kmph)	**10.3.1.1** (i) 1 in 9 (R=300 m) (speed potential of 45 kmph)
(ii) 1 in 7 / 1 in 9 type turnouts with 190 m radius (speed potential of 35 Kmph)	(ii) 1 in 7 (R=190 m) (Speed potential At Depot 25 kmph)
(iii) 1 in 7 type turnouts with 140 m radius (speed potential of 25 Kmph)	(iii) NA
(iv) Scissors crossover 1 in 9 type with 300 m radius (speed potential of 45 Kmph)	(iv) Scissors crossover 1 in 9 types with 300 m radius (speed potential of 45 Kmph)
(v) Scissors crossover 1 in 9/1 in 7 type with 190 m radius (speed potential of 35 Kmph)	(v)Scissor Crossover 1 in 7 (R=190m) (speed potential At Depot 25 kmph)
(vi) Scissors crossover 1 in 7 type with 140 m radius (speed potential of 25 Kmph)	(vi) NA
(vii) 1 in 7 type symmetrical split turnout (speed potential of 45Kmph)	(vii) NA
10.3.1.2 Broad Gauge	
(i) 1 in 12 type turnouts (speed potential of 50Kmph)	Not Applicable
(ii) 1 in 8.5 type turnouts (speed potential of 30 Kmph)	
(iii)Scissors crossover 1 in 12 types (speed potential of 50 Kmph)	
(iv) Scissors crossover 1 in 8.5 type (speed potential of 30 Kmph)	
(v) 1 in 8.5 type symmetrical split turnout (speed potential of 40 Kmph)	

Project Directorate Approved on 05/8/2025 Railway Board

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

10.4 Technical Specification **10.4.1 General** (a) All the points shall be capable of being Operated by electric motors in accordance with the signaling specification.	**10.4.1** a) Yes, Complied.
(b) The top surfaces of PSC sleeper/RCC slab supporting rail seat of turnouts and scissors crossover shall be flat without any cant/slope.	b) Yes, complying. Top surfaces of PSC sleeper/RCC plinths in turnouts are flat.
(c) The track form of the turnout shall have uniform resilience as that of the adjoining track form.	c) Yes, complying. The track form has uniform resilience as that of adjoining track form.
(d) The fixation of turnouts, scissor cross-over on track slab shall be through base plates/bearing plates.	d) Yes, complying. The turnouts/ scissor crossovers on track have been fixed through base plates/bearing plates.
10.4.2 Rails **1.** The rails used in turnouts shall be 1080 grade Head Hardened. However, rails used in turnouts on depot and other non-running lines may be of 880 grade.	**10.4.2** **1.** Rails of 1080 grade Head Hardened are being used in turnouts on main line. However, in depot turnouts 880 grade rails used.
2. The rails used for manufacturing of turnouts shall satisfy the following conditions:	**2.** The rails being used for turnouts are satisfying condition as following:
a. The rails shall be manufactured and tested in accordance with IRS/T-12-2009 with latest amendment.	a) Complying with IRS/T-12-2009 with latest amendment.
b. The section of rails shall be 60E1 for stock, lead and 60E1A1/60E1A4 for switch rail.	b) Complying. The section of rails being used is 60E1 for stock, lead and 60E1A1 for switches.
c. The rails shall qualify as Class 'A' rails as per IRS/T-12-2009.	c) Complying. The class 'A' rails as per IRST-12/2009 with latest amendments are being used.
d. The rails shall be with ends un-drilled.	d) The rails are with undrilled ends.
e. The rails shall be of grade 1080HH and be suitable for being welded by Alumino- thermic or flash butt welding technique.	e) The rails are of grade 1080HH and suitable for welding by A.T. welding process or Flash Butt welding technique.

Examined and found in order
Pradeep Kr. Mishra
ADE/A.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2015
Railway Board

(171)

10.4.3 Switches	10.4.3
1. Each switch device shall consist of two stock rails, one left hand and one right hand and two switch rails, one left hand and one right hand.	1. Complying.
2. The switch rail shall be one piece with no weld or joint within the switch rail length.	2. Complying. The switch rail is in one piece without any weld/ joint within the switch length.
3. The end of the asymmetrical switch rail shall be forged to 60E1 rail profile with minimum length of 500 mm. The forged switch rail end shall be suitable for welding or installation of insulated rail joint.	3. Complying. The end of switch rail is forged to 60E1 rail profile with minimum length of 500 mm. The forged switch rail end is suitable for welding or installation of insulated rail joint.
4. Slide chairs in the switch portion shall be coated with an appropriate special coating, so as to reduce the point operating force and to eliminate the requirement of lubrication of sliding surfaces during service.	4. Complying. Slide chairs in switch portion are coated with a special coating to reduce point operating force and to eliminate the requirement of lubrication of sliding surfaces during service. (Report on special coating on slide chair is not submitted by supplier because it is patent item.)
5. Switches shall provide suitable flange way clearance between the stock rail and the switch rail with the switch rail in open position (minimum 60mm). The 1 in 12 and 1 in 9 (with radius of 300 m) and flatter turnouts shall be provided with second drive or other suitable arrangement to ensure minimum gap of 60 mm at JOH as well as proper housing of switch rail with stock rail up to JoH. 1 in 8.5, 1 in 9 turnout (with radius of 190m) and 1 in 7 and sharper turnouts may not be provided with second drive arrangement, however minimum gap of 60 mm at JOH as well as proper housing of switch rail with stock rail up to JoH should be ensured. The normal opening of switch at toe of switch shall be kept as 160mm.	5. Yes, complying. 1 in 9 turnouts (with radius 300 m) is provided with second drive arrangement. The minimum clearance of 60 mm is ensured at JOH in open position of switch rail, in both 1 in 9 and 1 in 7 turnouts. The normal opening of switch at toe of switch is kept 160 mm.

Project Directorate Approved on 05/8/2023 Railway Board

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.B.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

6. The switch manufacturer shall include provision for all holes required to main drive machines, stretcher bars and detection equipment to suit the requirements of the signaling and switch operating system duly chamfered to avoid stress concentration at the edge of the holes.	**6.** Yes, complied
7. The switches shall be designed with an anti-creep device at the heel of switch to withstand thermal forces of the CWR track.	**7.** Yes, complied.
8. The switches and all slide chairs shall be same for ballasted and ballastless turnouts.	**8.** Yes, complied.
10.4.4 Crossings **1.** All crossings shall be cast manganese steel (CMS) crossings with weldable rails of minimum 1.2m length undrilled for welding into the overall turnout.	**10.4.4** **1.** Yes, complied.
2. The CMS crossings shall be manufactured from Austenitic Manganese steel as per UIC 866.	**2.** Yes, complied.
3. All CMS crossings shall have welded leg extensions of 60E1 rails. This shall be achieved by flash butt welding of buffer transition rail piece of suitable thickness to CMS crossings and rail leg extension.	**3.** Yes, complied.
4. All CMS crossings on main line shall have a minimum initial hardness of 340 BHN.	**4.** Yes, complied.
5. All CMS crossings and their welded leg extensions for all scissor crossovers shall be suitably dimensioned so as to eliminate the necessity of providing small cut rail pieces for the purpose of inter-connection. However, the need for providing insulated glued joints from	**5.** Complying. The CMS crossings and their welded leg extension for scissor crossovers are suitably designed and there is no necessity of providing small cut pieces for interconnections. No glued joint is being provided.

Examined and found in order
Pradeep Kr. Mishra
ADG/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

signaling requirement point of view shall be taken care of in the design, if required. **6.** The provision of rail cant shall be taken care of on the top surface of the CMS crossing and the bottom surface of all CMS crossing shall be flat.	 **6.** Yes, complied.
10.4.5 Check Rails **1.** The check rail section shall be 33C1 (UIC33) or similar without any direct connection with running rails. **2.** Check rails shall have the facility for the adjustment of check rail clearances up-to 10mm over and above the initial designed clearance. **3.** Each check rail end shall be flared by machining to have minimum clearance of 62 mm at end. **4.** The check rail connections in turnouts shall be through specially designed bearing plates / brackets. **5.** All the check rails shall be higher by 25 mm above running rails. The lengths and positions of the check rail in diamond crossings shall provide safety and be compatible with the overall track layout.	**10.4.5** **1.** The check rail section of 33C1 (UIC33) without any direct connection with running rails are used. **2.** Complied. **3.** Minimum check rail clearance at ends is 80 mm, its value is matching with the value given in part B Track (ii) Crossing S. No. 7, Drawing for T/O 1 in 9 (R 300 mm) & for T/O 1 in 7 (R 190 mm) is enclosed at **"Appendix-C1/10"** **4.** Complied. The check rail connection in turnouts is through specially designed bearing plates / brackets. **5.** Complied.
10.4.6 Sleeper for Turnouts, Scissor crossover (Ballasted Track) **10.4.6.1** Sleeper shall be of pre-stressed concrete, mono-block, suitable for installation in track both with and without signaling circuits and with and without electrification.	**10.4.6** **10.4.6.1** PSC sleepers have been used in maintenance depots only. Mono-block pre-stressed concrete sleepers suitable for installation in track both with and without signaling circuits and with or without electrification have been used.

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

10.4.6.2 Sleepers shall be designed to provide a minimum service life of fifty years under nominal axle load as that of main line for the Metro system. Rail seat pads and rail clip etc. shall be designed to provide a minimum service life of 15 years.	**10.4.6.2** Complied.
10.4.6.3 The sleeper base surface shall be rough cast while the top and side surface shall be smooth to prevent retention of moisture and foreign materials.	**10.4.6.3** Complied.
10.4.6.4 Sleepers must be suitable for installation by track laying machines and sleeper insertion equipment of a type used for isolated sleeper laying.	**10.4.6.4** The PSC sleepers have been used in maintenance depot only. However, the sleepers are suitable for installation by track laying machines and sleeper insertion equipment.
10.4.6.5 The sleeper must be able to transfer all the relevant track forces generated by train operations and the forces of rail expansion and contraction to the ballast.	**10.4.6.5** Complied.
10.4.6.6 Design Requirements for PSC Sleepers: **(A)** The sleepers should satisfy the following design requirement: **Design Parameters**	**10.4.6.6** **(A)** Satisfying with following parameters:
(i) Rail sleeper fastening – Elastic resilient type	(i) Complying. Elastic resilient type sleeper fastening is being used.
(ii) Spacing of sleepers – 600mm (max) for main line and 650 mm (max) for Depots and other non-running lines, except at few locations such as near point machine locations where it may be varied to meet the design requirements.	(ii) The maximum Spacing of sleepers is 600 mm on main line in elevated sections, 650 mm (max) in Depots except at point machine locations.
(iii) Ballast cushion – 300 mm for mainline and 250 mm for Depots and sidings	(iii) Complied
(iv) Ballast profile suitable for LWR/CWR.	(iv)The ballast profile is suitable for LWR/CWR

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Approved on 05/8/2025
Project Directorate
Railway Board

Specifications and Drawings (With latest amendment) (i) Special Cement for PSC sleeper-53-S grade OPC to BIS specification IS-269:2015 (ii) HTS wire plain and strand – BIS – 1785 (Pt-1) 1983 and BIS 6006 (iii) Polyethylene dowels – Provisional 1997 Drg. No. RDSO 3002, IRS Specification for Polyethylene dowels for concrete sleepers- Serial no. T-57:2020 (iv) IRS Specification for Turnout Sleeper T- 45 2021 (v) IRS Bridge code 1982 (vi) Code of Practice for Pre-stressed Concrete IS-1343	Yes, complied.
(B) The design should satisfy the following additional requirements-	**(B)** Yes, complying.
(i) The connections of the slide chairs and bearing plates/special bearing plates/brackets shall be designed for easy installation and maintenance. All the fittings shall be suitably designed to ensure full compatibility & also to ensure interchangeability of slide chairs between ballasted and ballastless turnouts.	(i) The connections of the slide chairs and bearing plates/special bearing plates/brackets are designed for easy installation and maintenance. All the fittings are suitably designed for full compatibility and interchangeability of slide chairs between ballasted and ballastless turnouts.
(ii) For attaining suitable cant of the rail, as provided on mainline, (excluding crossing and switch portion), suitably designed pads of appropriate material shall be provided between rail pad & PSC sleeper. Also fastening system should be designed to get the desired Toe Load.	(ii) Yes, complied.
(iii) The detailed design of Monoblock PSC sleepers for the turnouts along with structural drawings shall be checked and approved by metro railways.	(iii) Complied, the drawings have been checked & approved by Patna metro.

Examined and found in order
Pradeep Kr. Mishra
ADG/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

11. Switch Expansion Joint- 1. The SEJ for ballasted track shall be laid on PSC sleepers whereas the SEJs for ballastless track, if required, shall be laid on reinforced concrete slab. 2. The rail section for all SEJs shall be 60E1, 1080 HH grade as per IRS-T-12-2009. 3. The SEJ for ballasted track shall be designed for a maximum gap of 80 mm. 4. The SEJ for ballastless track should be designed for the maximum gap required as per design. 5. The ballasted SEJ shall be as per RDSO drawing T-6902 &T-6922. 6. The ballasted SEJ for BG shall be laid with PSC sleepers as per RDSO drawing T-4149. For Standard Gauge, PSC sleeper shall be designed such that SEJ to RDSO drawing along with its bearing plates/chairs may be accommodated for installation of SEJ. 7. Sleepers used for SEJs shall be flat and cant will be provided through CI chair. 8. The SEJ shall be suitable for two way directional traffic.	**11.** Not applicable, rail structure analysis report is enclosed at **"Appendix-C1/11"**
12. Fastening system for ballastless track: Provisions contained separately in "PERFORMANCE CRITERIA OF FASTENING SYSTEM FOR BALLASTLESS TRACK ON METRO RAILWAYS/MRTS SYSTEM" (Annexure C-2) be referred to.	**12.** Yes, complied.
13. Noise and Vibration Metro system shall be designed to ensure that noise emitted is well within the prescribed limits for the particular area. Each Metro system shall specify the prescribed limits of permissible Noise and vibration parameters as per legal and statutory requirement of India.	**13.** Complying, Patna Metro Corridor-2 has been designed to ensure that the noise emitted is within the statutory requirement for noise as per RDSO guidelines for noise and vibration, Sept. 2015 Cl 3.2.5 which are tabulated below:

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2015
Railway Board

	Recommended criteria for air borne noise: **Activity/ Area Category** / **Category of area/zone** / **Limits in dB (Leq)** A / Industrial area / 75 B / Commercial area / 65 C / Residential area / 55 D / Silence zone / 50 Patna metro lies predominantly in zone B & C. Ballastless track supported on two layers of rubber pads reduce track noise and ground vibration.
14. GRADIENTS **14.1** The maximum grade (compensated) shall be 4%. **Note:** (i) There will be no change of gradient in transition portion of curves. (ii) The gradient will be compensated for curvature at the rate of 0.04% per degree of curve. **14.2** Maximum permissible gradient on turnouts (i) On Ballasted Track 0.25% (ii) On Ballastless Track 3% Note: (i) There shall be no change of gradient (i.e. vertical curve) on and within 15.0 m (desirable)/3.0 m (minimum) of any turnout on ballastless track. In case of ballasted track, there shall be no change of gradient on and within 30 meters of any turnout. (ii) There shall be no horizontal curve within 15.0 m (desirable)/3.0 m (minimum) of any turnout on ballastless track and 30 meters of any turnout on ballasted track.	**14.1** Yes complying. The maximum grade (compensated) has been kept less than 4%. (i) There is no change of gradient in transition portion of curves. (ii) The gradient is compensated for curvature at the rate of 0.04% per degree of curve. **14.2** Yes, complied (i) Being complied. (ii) Being complied.

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Approved on 05/8/2025

(iii) Turnout shall be normally be installed on straight track. In exceptional situations, turnout may take off from curve provided that the radius of lead curve (main line as well as diversion line) is not less than 190 m. The negotiability of rolling stocks on such turnouts must be certified by rolling stock supplier and confirmed through oscillation trial and a suitable speed restriction should be imposed on main and/or diversion line based on track geometry and other considerations, if required. In case of turnout installed on curve track, the minimum distance for commencement of vertical curve or another horizontal curve shall be 15 m for ballastless track. Turnout shall not be laid on transition curve.	(iii) Yes, complied.
(iv) The limit of turnout for above purposes shall be taken from Stock Rail Joint (SRJ) to end (i.e. heal) of crossing for ballastless track. For ballasted track, it shall be from SRJ to last common sleeper behind end of crossing.	(iv) Yes, complied.
(v) Metro Authority need to ensure that the Rolling Stock is fit to negotiate the maximum permissible gradient on turnout considering the location of turnout with respect to vertical /horizontal curves in vicinity.	(v) Noted.
(vi) The above stipulations shall also be applicable for turnout to be laid outside station limit, if any.	(vi) Being complied.
14.3 TRACK GRADIENT IN PLATFORM (a) Desirable Gradient: Level (b) Maximum Gradient: 1 in 1200 (c) Exceptional Gradient: 1 in 400 **Note:** (i) Any gradient steeper than 1 in 1200 and up to Exceptional gradient of 1 in 400 shall be proposed by Civil Engineering Head and	**14.3** Complied; Track gradient at all platform is level. There is no change of gradient in platform track.

Examined and found in order
Pradeep Kr. Mishra
A.M.E./U.T.D./Vtl.
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Approved on 05/8/2025

approved by Managing Director in consultation with Head of safety nominated by Metro Rail Authority. (ii) There shall be no change of gradient in platform track.	

Examined and found in order
Pradeep Kr. Mishra
ADSE/J.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/8/2025
Railway Board

Part-B: Salient feature of Track Structure as adopted by Metro Railways		
(I) Track		
Sl. No.	Components / Items	Provisions / Reference
1	Gauge	Standard Gauge-1435 mm
2	Axle Load	16 T (maximum)
3	Design Speed	Track structure is fit for Design speed of 90 kmph and is fit for maximum operating speed of 80 kmph.
4	Rail Section and Grade	60E1, Grade 1080, Head Hardened for mainline. R-260 grade for Depot.
5	Rail Specifications	Rails as per IRST-12-2009 with latest amendments.
6	Ballasted or Ballastless	Main line: Ballast less, Depot: ballastless/ballasted
7	Rail inclination (Canting of Track)	1 in 20
8	Check Rails provision	Check rail has been provided on curves with radius equal to and sharper than 190 m.
9	Provision of Derailment upstand/Guard	Derailment guards have been provided as per clause No. 8 of Annexure C1
10	Horizontal Clearance of Derailment upstand	212.5 mm (fastening system 336)
11	Vertical location of Derailment upstand w.r.t. Rail plane	At Rail Level.
12	Glued Insulated Rail Joint provided? If yes, type of GIRJ	No
13	Welding Of Rail (LWR /CWR)	CWR
14	Whether SEJ provided? If Yes Type of SEJ	No
15	Type of welding	Main line by Flash Butt and Turnouts & scattered joints by AT

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/09/2023
Railway Board

(ii)Turnouts and switches:

S.N.	Components / Items	1	2	3
1	Type of turnout, scissors crossovers (crossing angle)	1 in 9	1 in 7	1 in 7 Scissors cross over
2	Canted or un-canted	Canted		
3	Radius (m)	300	190	190
4	Length of switch (mm)	13965	12648	12648
5	Type of Switch (Thick web or otherwise)	Thick web	Thick web	Thick web
6	Switch entry angle	0º-8'-12"	0º-8'50"	0º-8'50"
7	Speed potential (kmph)	45	25	25
8	Location of Use (Main line or Depot)	Main line	Depot	Depot
9	Rail Section used for switch	60E1A1		
10	Second drive provided	Yes	No	No

(iii) Crossing:

S. No.	Components / Items	Provisions / Reference
1	Crossing: Curved or straight	Curved
2	Crossing: Canted or un-canted	Canted on top
3	Length of Weldable length extension	1.2 m
4	Check Rail section	UIC33 (33 C1)
5	Height of Check rail above the rail plane	25 mm
6	Check Rail clearance at the middle	41 mm – 44 mm
7	Check Rail clearance at the end	80 mm

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.B.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
01/08/2023
Railway Board

Part-C: Check List of Submissions while submitting compliance			
S.No.	Doc. Number	Document Name	
1.	C 1.3.1	Compliance of Part-A	Yes, complying with Part-A.
2.	C 1.3.2	Design of subgrade/embankment for slab (Para 6 xii)	Approved drawing is enclosed at **"Appendix-C1/6".**
3.	C 1.3.3	Design calculations of track slab/plinth beam along with detailed structural drawings as approved by metro authorities. (Para 6)	Design basis report is enclosed at **"Appendix-C1/4a,4b."**
4.	C 1.3.4	Design calculations/studies with regard to clearance of Check rails/Restraining Rails. (Para 7.1)	Design report is enclosed at **"Appendix-C1/8."**
5.	C 1.3.5	Design calculations of derailment guards along with detailed structural drawings shall be furnished for record. (Para 8)	Report is enclosed at **"Appendix-C1/9."**

Examined and found in order
Pradeep Kr. Mishra
ADE/U.T./CIVIL
R.D.S.O. (Ministry of Railways)
Manak Nagar, Lucknow-11

Project Directorate
Approved on
05/09/2023
Railway Board