

**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)**

2023/Proj./PUNE/C1-C2/30/52

New Delhi, dated 22.07.2024

Managing Director,
Pune IT City Metro Rail Limited (PITCMRL)
9th Floor, Vikram Monarch
CTS No. 1115/A, Ganeshkhind Road,
Shivaji Nagar, Pune
Maharashtra – 411016

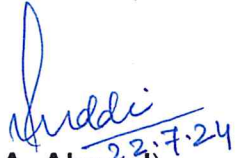
Sub: Approval of Track Structure (Annexure C-1), for Pune Metro Line-3 (Hinjewadi to Shivajinagar Corridor) of Pune IT City Metro Rail Limited (PITCMRL).

Ref: Track Structure (Annexure C-1) documents uploaded on RDSO's online portal by PITCMRL on 30.04.2024 and 17.06.2024 along with compliance

Pune IT City Metro Rail Limited (PITCMRL)'s request for approval of Track Structure (Annexure C-1) for Pune Metro Line-3 (Hinjewadi to Shivajinagar Corridor) of PITCMRL has been examined in consultation with RDSO and approval of Railway Board is hereby conveyed for the same.

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

Encl: Annexure C1 for Pune Metro Line-3, April 2024


(F. A. Ahmad)

Director/Gati Shakti (Civil)-IV
Railway Board
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Email: dirgsc4@gmail.com

Copy to:

1. **Executive Director/UTHS**, RDSO, Manak Nagar, Lucknow w.r.t letter No. UTHS/PUNE-IT/PICMRL/P01/112020 dated 27.06.2024
2. **OSD/UT & Ex-Officio Joint Secretary**, Ministry of Housing & Urban Affairs (MoHUA), Nirman Bhavan, New Delhi - 110011



**PUNE IT CITY METRO RAIL LIMITED
PUNE METRO LINE-3**

**HINJAWADI TO SHIVAJINAGAR CORRIDOR
PROJECT**

ANNEXURE C1 (Rev-01)

**TECHNICAL STANDARDS OF TRACK
STRUCTURE FOR PUNE METRO LINE -3
PROJECT**

Examined and found in order

Director/UT/Civil/RDSO

APRIL 2024

PUNE METRO LINE-3

Pune IT City Metro Rail Limited,
9th Floor, "Vikram Monarch" - CTS No. 1115/A,
Ganeshkhind Road, Shivajinagar,
Pune, Maharashtra, India-411 016



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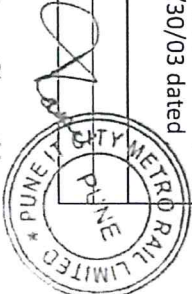
COMPLIANCE MATRIX FOR "TECHNICAL STANDARDS OF TRACK STRUCTURE FOR METRO RAILWAYS AS PER ANNEXURE C-1

Clause No.	Provision of the performance criterion to RDSO Annexure C-1	Compliance/Remarks with respect to Pune Metro Line 3
Part-A: Technical Standards of Track Structure for Pune Metro Line-3 (Compliance to be given & document to be uploaded on Portal as C1.1)		
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	Noted.
2	Operating Environment: Track Structure should fulfil generally the following conditions:	
2.1	Gauge – Broad gauge- 1676/1673mm (nominal) and standard gauge – 1435mm.	Complied. Standard gauge – 1435 mm.
2.2	Rail Seat inclination (slope): 1 in 20	Complied. 1 in 20.
2.3	Speed potential – 110 kmph (max.)	Complied and speed potential is as follows. Design Speed – 95 Kmph (Max). Operating Speed – 85 Kmph (Max).
2.4	Static axle load –20 T (max.)	Complied. 16 T Maximum axle load.
2.5	Design rail temperature range – (-)10 degree Celsius to (+) 70 degree Celsius.	Complied.
2.6	Maximum Curvature and ruling gradient - As specified in approved SOD of the Metro Rail.	Complied to requirements of SOD (approved by MoR vide 2019/Proj./PUNE/SOD/30/03 dated 09.11.2021).
3	Track Structure:	
3.1	General: The track structure should fulfil the following requirements:	Noted.



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3.1.1	The track structure should conform to/ satisfy Schedule of Dimension requirement and other maintenance instructions of Metro systems.	Complied.	
3.1.2	Ride comfort and running safety of track vehicle dynamics should be satisfied.	Complied.	
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 ballastless track).	Complied.	
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.	Complied.	
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 transition and Turnouts is also not desirable. Vertical curve radius is constrained by the need to limit the vertical acceleration for passenger ride comfort.	Complied.	
3.2	The technical standards for Track structure deals with the following components-	Noted.	
(i)	Rail and Welding	Complied as per relevant sections.	
(ii)	Sleeper and fastening for ballasted track	Complied as per relevant sections.	
(iii)	Track slab for ballastless track	Complied as per relevant sections.	
(iv)	Fastening system for ballastless track	Complied as per relevant sections.	
(v)	Insulated Glued joint	Complied as per relevant sections.	
(vi)	Turnout, scissors crossover	Complied as per relevant sections.	
(vii)	Switch Expansion Joints	Not applicable as there is no Switch Expansion Joint	
(viii)	Gradients	Complied as per relevant sections.	
4	Rails and Rail 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.	Complied.	
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	Complied.	

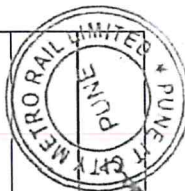


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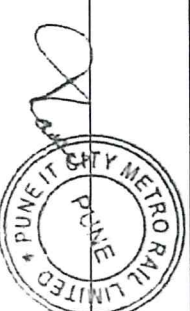


	speed, axle load and other factors pertaining to safety and life of rail. However, on curves with small straight track in between, the 60E1, 1080 grade Head hardened rail should be continued on straight patches also.	On Mainline – 1080 grade HH / 60 E1 Rails are provided.
4.1.1.3	It is essential to have preventive rail grinding arrangements in case 60E1, 1080 HH rails are used.	Preventive rail grinding arrangements will be made as and when required.
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.	Complied.
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.	Complied.
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.	Complied. Inspection and test plan of 880 grade rail and 1080 HH grade rail enclosed as Annexure-5.
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.	Complied.
4.2.2	The present instructions are contained in following documents:	Noted.
4.2.2.1	Alumino Thermic Welding:	
(i)	Indian Railway Standard specifications for fusion welding of rails by Alumino Thermic Process, IRST-19-2020, with latest amendments.	Complied.
(ii)	Manual For Fusion Welding of Rails by The Alumino-Thermic Process: Revised- 2012 with latest amendments.	Complied.
4.2.2.2	Flash Butt Welding: Manual for Flash Butt Welding of Rails, (revised January 2012), with latest amendments.	Complied. (QAP of Flash Butt Welding enclosed as Annexure-6)
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.	Complied.

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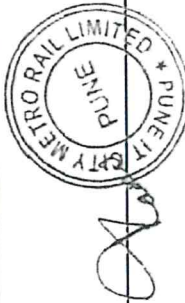
			Flash Butt Welding of 60 E1 1080 HH grade rails have been done using Flash butt welding machine No. TH30 having the approval of RDSO. Flash Butt Welding of 60E1 880 grade rails have been done using Flash butt welding machine No. AG 119 having the approval of RDSO.
4.3	Ultrasonic Testing of Rail and Welds: 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.		Complied.
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).		Not Applicable since Standard gauge is adopted.
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.		Complied.
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.		Complied. For depot lines elastic fastening system prevalent on Indian Railways is used. These fastenings are tested and certified by RDSO approved agencies.
	In case of use of elastic fastening other than in use on IR, prior approval shall be obtained from Railways.		For depot lines elastic fastenings are being followed as per RDSO specification.
6	Track Slab for Ballastless track		Complied.
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.		



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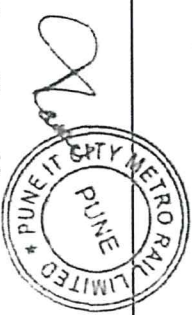


6.2	In general, track slab (including sleeper, if any) on which the fastening and rail are to be fitted shall perform the following functions:	Noted.
i)	Resist the track forces. (Static and dynamic).	Complied.
ii)	Have adequate edge distance of concrete beyond the anchor bolts to provide resistance against edge failure.	Complied.
iii)	Provide a level base for uniform transmission of track/rail forces.	Complied.
iv)	Have geometrical accuracy and enable installation of track to the tolerances laid down.	Complied.
v)	Ensure drainage.	Complied.
vi)	Resist weathering.	Complied.
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.	Complied.
viii)	Ensure provision for electrical continuity between consecutive plinths/slabs by an appropriate design.	Complied.
ix)	Plinth beam or slab of ballastless track should be suitable for embankment or viaduct or tunnel/Underground structure.	Complied.
x)	Proper design of expansion joints suitable for joints of viaduct structure.	Complied.
xi)	Design should be suitable for curves as per SOD of Metro system.	Complied.
xii)	Design of subgrade/embankment for slab should be furnished to ensure durability and functional stability in service.	Mainline on Viaduct. Hence not applicable.
xiii)	Design should be suitable and incorporate provision of utilities e.g. cable, wires, ducts, water channels, etc.	Complied.
	The detailed design calculations of track slab along with detailed structural drawings as approved by metro authorities shall be furnished for record.	Complied.
		The Detailed Design calculations of Track plinth are enclosed as Annexure - 2
		Structural Drawings are enclosed as Annexure-3 .
7	Checkrail / Restraining Rail:	
7.1	Check rails/ Restraining Rails should be provided on curves on main line where radius is 218m or less on Broad gauge and radius is 190m 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.	Complied. Calculation report enclosed as Annexure-4 .



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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.	Complied. Check Rails / Restraining Rails for curves in depots and non-passenger lines where speed is not more than 25 kmph have not been provided
8	Derailment Guards 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. 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.	Complied.
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.	Complied. Lateral clearance between running rail and derailment guard is 210 (+/-30 mm).



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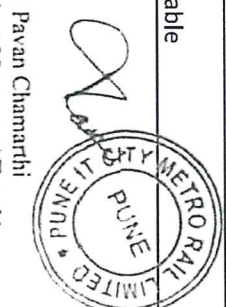


	Note:- "In case of Double Resilient Base Plate Assembly Fastening System as approved by MoR, the lateral clearance between running rail and the derailment guard shall be 250 +/- 20 mm. This fastening system, if used in tunnels having multiple tracks, Metro Administration should ensure that KE for adjacent track is not infringed so long as the wheels of any derailed vehicle are within the main rail and derailment guard."	
8.3	Derailment guard shall be designed such that in case of a derailment:	
(i)	The wheels of a derailed vehicle under crush load, moving at maximum speed are retained on the viaduct or tunnel.	Complied
(ii)	Damage to track and supporting structures is minimized.	Complied
	The detailed design calculations of derailment guards along with detailed structural drawings shall be furnished for record.	Enclosed as Annexure-2 and Annexure-3.
9	Glued Insulated Rail Joint	
9.1	Normally glued joint should be avoided.	Noted.
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.	Complied.
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:	Noted
	(i) Standard Gauge a) 1 in 9 type or flatter turnout (desirable)	a) Complied. (1 in 9 type turnouts are provided in mainline).
	b) 1 in 7 type turnouts (minimum)	b) Complied.
	c) Scissors cross-over of 1 in 9 / 1 in 7 type consisting of 4 turnouts and 1 diamond crossing	c) Not applicable – There is no scissors crossover in Pune Metro Line - 3.
	(ii) Broad Gauge a) 1 in 12 type turnouts	a) Not Applicable

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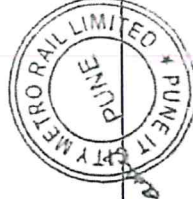
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	b) 1 in 8.5 type turnout c) Scissors cross-over of 1 in 12 types consisting of 4 turnouts and 1 diamond crossing	b) Not Applicable c) Not Applicable
10.1.2	Depots and Non running lines: On depot and other non-running lines, the turnouts and diamond crossing shall be of the following standards: (i) Standard Gauge a) 1 in 7 type or flatter turnout. b) Scissors 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. (ii) Broad Gauge a) 1 in 8.5 type turnout. b) Scissors cross-over 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.	a) Complied. (1 in 7 type turnouts are provided in depot). b) Not Applicable. c) Not Applicable. a) Not Applicable b) Not Applicable c) Not Applicable
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. (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. (b) Turnouts shall be manufactured to allow for installation of continuously welded track. (c) Turnout shall be compatible with proposed 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. (e) The CMS crossing to be used on mainline shall be subjected to explosive hardening.	a) Complied. b) Complied. c) Complied. d) Complied. e) Complied.



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	The design shall be tangential with a switch entry angle not exceeding 00° 20' 00". The radius of lead rail of turnout shall not be less than 410m. All clearances shall be in accordance with relevant provisions of SOD. (ii) 1 in 8.5 turnout: The design shall be tangential with a switch entry angle not exceeding 00° 20' 00". The radius of lead rail of turnout shall not be 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.	(ii) Not Applicable (iii) 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.	Complied & Noted.
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:	Complied.
10.3.1.1	Standard Gauge (i) 1 in 9 type turnout with 300 m radius (speed potential of 45Kmph) (ii) 1 in 7 / 1 in 9 type turnout with 190 m radius (speed potential of 35 Kmph) (iii) 1 in 7 type turnout with 140 m radius (speed potential of 25 Kmph) (iv) Scissors crossover 1 in 9 type 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) (vi) Scissors crossover 1 in 7 type with 140 m radius (speed potential of 25 Kmph) (vii) 1 in 7 type symmetrical split turnout (speed potential of 45 Kmph)	(i) Complied. (ii) Not Applicable (iii) Complied. (iv) Not Applicable (v) Not Applicable (vi) Not Applicable (iv) Not Applicable
10.3.1.2	Broad Gauge (i) 1 in 12 type turnout (speed potential of 50 Kmph) (ii) 1 in 8.5 type turnout (speed potential of 30 Kmph) (iii) Scissors crossover 1 in 12 type (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)	(i) Not Applicable (ii) Not Applicable (iii) Not Applicable (iv) Not Applicable (v) Not Applicable



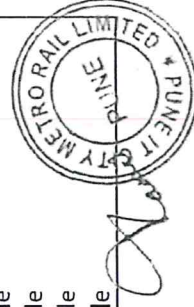
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10.4	Technical Specification	
10.4.1	General (a) All the points shall be capable of being operated by electric motors in accordance with the signalling specification. (b) The top surfaces of PSC sleeper/RCC slab supporting rail seat of turnouts and scissors crossover shall be flat without any cant/slope. (c) The track form of the turnout shall have uniform resilience as that of the adjoining track form. (d) The fixation of turnouts, scissor cross-over on track slab shall be through base plates/bearing plates.	(a) Complied. (b) Complied. (c) Complied. (d) Complied.
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. 2. The rails used for manufacturing of turnouts shall satisfy the following conditions: (a) The rails shall be manufactured and tested in accordance 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. (c) The rails shall qualify as Class 'A' rails as per IRS/T-12-2009. (d) The rails shall be with ends un-drilled. (e) The rails shall be of grade 1080H and be suitable for being welded by Alumino-thermic or flash butt welding technique.	Complied. (a) Complied. (b) Complied. (c) Complied. (d) Complied. (e) Complied.
10.4.3	Switches 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. 2. The switch rail shall be one piece with no weld or joint within the switch rail 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. 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.	(1) Complied. (2) Complied. (3) Complied. (4) Complied, with friction free type arrangement at slide chairs in the Switch portion.



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	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 mts) and flatter turnouts shall be provided with second drive or other suitable arrangement to ensure minimum gap of 60mm 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 60mm 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. 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 signalling and switch operating system duly chamfered to avoid stress concentration at the edge of the holes. 7. The switches shall be designed with an anti-creep device at the heel of switch to withstand thermal forces of the CWR track. 8. The switches and all slide chairs shall be same for ballasted and ballastless turnouts.	(5) Complied. (6) Complied. (7) Complied. (8) 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. (2) The CMS crossings shall be manufactured from Austenitic Manganese steel as per UIC 866. (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. (4) All CMS crossings on main line shall have a minimum initial hardness of 340 BHN. (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 signalling 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.		(1) Complied. (2) Complied. (3) Complied. (4) Complied. (5) Not Applicable. (6) Complied.



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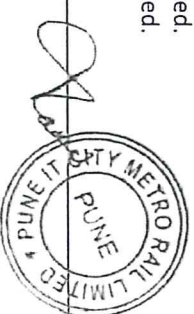
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10.4.5	Check Rails (1) The check rail section shall be 33C1 (UIC33) or similar without any direct connection with running rails. (2) Check rails shall have the facility for the adjustment of check rail clearances up-to 10mm over and above the initial designed clearance. (3) Each check rail end shall be flared by machining to have minimum clearance of 62mm 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 25mm 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.	(1) Complied. The Checkrail section 33C1 (UIC 33) is adopted. (2) Complied. (3) Complied. (4) Complied. (5) Complied.
10.4.6	Sleeper for Turnouts, Scissor crossover (Ballasted Track)	Ballasted Track in Depot only.
10.4.6.1	Sleeper shall be of pre-stressed concrete, mono-block, suitable for installation in track both with and without signalling circuits and with and without electrification.	Complied.
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.	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.	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.	Complied.
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.	Complied.
10.4.6.6	Design Requirements for PSC Sleepers: (A) The sleepers should satisfy the following design requirement: Design Parameters (i) Rail sleeper fastening – Elastic resilient type (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.	(i) Complied. (ii) Complied.



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	(iii) Ballast cushion – 300 mm for mainline and 250mm for Depots and sidings. (iv) Ballast profile suitable for LWR/CWR. 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 – Drg. No. RDSO/T-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	(iii) Complied. (iv) Complied. (i) Complied. (ii) Complied. (iii) Complied. (iv) Complied. (v) Complied. (vi) Complied.
	(B) The design should satisfy the following additional requirements: (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. (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. (iii) The detailed design of Monoblock PSC sleepers for the turnouts along with structural drawings shall be checked and approved by metro railways.	(i) Complied. (ii) Complied. (iii) Complied.
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.	Not applicable since SEJ is not required to be provided in Pune Metro Line - 3



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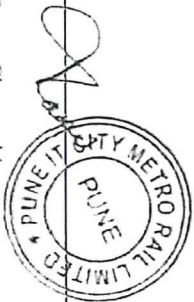


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	6. The ballasted SEJ for BG shall be laid with PSC sleepers as per RDSO drawing T-4149. For Standard Gauge, PSC sleeper shall be designed such that SEJ to RDSO drawing along with its bearing plates/chairs may be accommodated for installation of SEJ. 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.																					
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.	Complied. The elastic Fastening System 336iw used has the provisional approval of MoR vide letter 2023/Proj./PUNE/C1-C2/30/52 dated 21.12.2023 (enclosed as Annexure-1)																				
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.	Complied. Statutory requirement for noise is as per "The Noise Pollution (Regulation and Control) Rules, 2000". Ambience Air Quality Standards in respect of Noise <table><tr><th>Area Code</th><th>Category of Zone</th><th>Day (limit in dB (A) leg)</th><th>Night (limit in dB (A) leg)</th></tr><tr><td>A</td><td>Industrial Area</td><td>75</td><td>70</td></tr><tr><td>B</td><td>Commercial</td><td>65</td><td>55</td></tr><tr><td>C</td><td>Residential</td><td>55</td><td>45</td></tr><tr><td>D</td><td>Silence Zone</td><td>50</td><td>40</td></tr></table> 1. Day time means 6:00 AM to 10:00 PM. 2. Metro Corridor in PITCMRL is predominantly in Zone B & C. 3. During oscillation trail, if it is found that noise levels are exceeding the above limit, corrective action will be taken.	Area Code	Category of Zone	Day (limit in dB (A) leg)	Night (limit in dB (A) leg)	A	Industrial Area	75	70	B	Commercial	65	55	C	Residential	55	45	D	Silence Zone	50	40
Area Code	Category of Zone	Day (limit in dB (A) leg)	Night (limit in dB (A) leg)																			
A	Industrial Area	75	70																			
B	Commercial	65	55																			
C	Residential	55	45																			
D	Silence Zone	50	40																			





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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 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.	(a) Complied. (b) Complied. (c) Complied. Note: (i) Noted. (ii) Complied.
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Part-B: Salient features of Track Structure as adopted by Metro Railways.

(document to be uploaded on Portal as C1.2)

i) Track

S. N.	Components/Items	Provisions/Reference
1	Gauge	1435 mm
2	Axle Load	16 T
3	Design Speed	95 KMPH
4	Rail Section and Grade	Mainline- 60E1, 1080 grade head hardened. Depot- 60E1, 880 grade
5	Rail Specifications	IRS-T12-2009 with Latest Addendum/Corrigendum Issued
6	Ballasted or Ballastless	Mainline- Ballastless. Depot-Ballasted/Ballastless.
7	Rail Inclination (Canting of Track)	1 in 20
8	Check Rails Provision	On Mainline with curves 190 m & sharper.
9	Provision of Derailment upstand/guard	Provided in Mainline and depot entry lines on viaduct.
10	Horizontal Clearance of Derailment upstand	210 (+/-30mm)
11	Vertical location of Derailment upstand w.r.t. Rail plane	Not lower than 25mm from top of rail level.
12	Glued insulated Rail Joint provided? If Yes, type of GIRL	Yes. G3L as per RDSO drg. no. T-2572 are used for traction isolation at depot and non-passenger lines.
13	Welding of Rail (LWR/CWR)	CWR
14	Whether SEJ provided? If Yes Type of SEJ	No
15	Type of Welding	FBW (Flash Butt) & ATW (Alumino Themic)

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ii) Turnout & Switches

S. N.	Components/Items	1	2
1	Type of Turnout, scissors crossovers (crossing angle)	1 in 9	1 in 7
2	Canted or Un-canted	Canted (1 in 20)	Canted (1 in 20)
3	Radius	300 m	140 m
4	Length of Switch	14.390 m	11.460 m
5	Type of Switch (Thick web or otherwise)	60E1 – 60E1A1 Thick web	60E1 – 60E1A1 Thick web
6	Switch entry angle	0 deg. 9 min 15.59 sec	0 deg. 16 min 36.75 sec
7	Speed Potential	45 kmph	25 kmph
8	Location of use (mainline or depot)	Mainline	Depot
9	Rail section used for switch	60E1, IRS-T-12-2009, 1080 grade HH for stock rail & 60E1A1 for switch/tongue rail	60E1, IRS-T-12-2009, 880 grade for stock rail & 60E1A1 for switch/tongue rail
10	Second drive provided	Yes	No

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iii) Crossing

S. N.	Components/Items	Provisions / Reference
1	Crossing: Curved or Straight	On the mainline all crossings are curved In depot all the crossings are partially on curve
2	Crossing: Canted or un-canted	Canted
3	Length of Weldable length extension	1200 mm (minimum)
4	Check Rail section	33C1 (UIC 33)
5	Height of Check rail above the rail plane	25 mm
6	Check Rail clearance at the middle	37 mm to 42 mm
7	Check Rail clearance at the end	65 mm

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Part-C: Check List of submissions while submitting compliance:

(document to be uploaded on Portal as C1.3)

S.N.	Document Number	Document Name	
1	C1.3.1	Compliance of Part-A	Complied
2	C1.3.2	Design of subgrade/embankment for slab (Para 6.xii)	Not Applicable
3	C1.3.3	Design calculations of track slab /plinth beam along with detailed structural drawings as approved by metro authorities. (Para 6)	Complied Details are enclosed in Annexure – 2 and Annexure – 3
4	C1.3.4	Design calculations/ studies with regard to clearance of Check rails/ Restraining Rails. (Para 7.1)	Complied Details are enclosed in Annexure – 4
5	C1.3.5	Design calculations of derailment guards along with detailed structural drawings shall be furnished for record. (Para 8)	Complied Details are enclosed in Annexure – 2 and Annexure – 3



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