

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

2019/Proj./MPMRCL/SoD/Bhopal-Indore/30/14

New Delhi, dated 23.02.2023

**Managing Director,**

Madhya Pradesh Metro Rail Corporation Limited, (MPMRCL),  
2<sup>nd</sup> Floor, Smart City Development Corporation Office Building,  
Kalibadi Road, BHEL, Sector-A, Berkheda,  
Bhopal-462 022 (Madhya Pradesh)


**Sub: Approval of Schedule of Dimension (SoD) for Bhopal and Indore Metro Rail Projects of Madhya Pradesh Metro Rail Corporation Limited (MPMRCL).**

Ref: SoD uploaded on RDSO's online portal by MPMRCL on 03.01.2023

The Schedule of Dimensions (SoD), Standard Gauge (1435mm) for At-Grade, Elevated and Underground Sections (December, 2022) for Bhopal and Indore Metro Rail Projects of Madhya Pradesh Metro Rail Corporation Limited (MPMRCL) has been examined in consultation with RDSO and approval of Railway Board is hereby conveyed for the same.

Accordingly, approved copy of SoD is enclosed.

Encl: As above

  
23.02.23

(F.A. Ahmad)

Director/Gati Shakti (Civil)-IV

Railway Board

Ph. 011-47845480

Copy to:

1. **Executive Director/UTHS**, RDSO, Manak Nagar, Lucknow-226011 w.r.t RDSO's letter No. UTHS/MPMRCL/BMRC/P01/112020 dated 24.01.2023
2. **OSD/UT & Ex-Officio Joint Secretary**, Ministry of Housing & Urban Affairs (MoHUA), Nirman Bhawan, New Delhi-110011



**MPMETRO**

**SCHEDULE OF DIMENSIONS (SOD)  
FOR  
STANDARD GAUGE (1435 mm)  
FOR AT-GRADE, ELEVATED AND UNDERGROUND SECTIONS**

**BHOPAL AND INDORE METRO RAIL SYSTEM**

**December 2022**



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**Madhya Pradesh Metro Rail Corporation Limited (MPMRCL)**

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**Document Control**

Document Name: Schedule of Dimensions (SOD) for Standard Gauge (1435mm)  
At-Grade, Elevated and Underground section  
Document Reference: B001-BIG-GNS-RPT-00010  
Release Date: 2022-12-23  
Version: 08

Version	Issue Date	Details
01	2019-05-28	First issue
02	2021-01-21	Second issue
03	2021-06-23	Third issue
04	2021-11-08	Fourth issue
05	2022-01-19	Fifth issue
06	2022-09-15	Sixth issue
07	2022-11-17	Seventh issue
08	2022-12-23	Eight issue

Version 08 is the current version of the document

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**SCHEDULE OF DIMENSIONS (SOD)  
STANDARD GAUGE (1435 mm)**

**PREAMBLE**

The Schedule of Dimensions (SOD) has been prepared for the Bhopal and Indore Metro Rail Projects having Standard Gauge (1435mm) with a third rail bottom current collection using 750V DC Traction system and end to end evacuation.

This SOD has been prepared based on following guidelines:

1. The SOD has been developed assuming certain coach dimensions and design characteristics, as well as track and coach maintenance tolerances. Whenever, a new stock is introduced the track and coach maintenance tolerances should be laid down. The suitability of the Rolling Stock for operation with these maintenance tolerances should be established and sanction shall be obtained from the competent authority before the operation of the Rolling Stock.
2. The Kinematic Envelope has been developed for 2900 mm wide and 4120 mm high Rolling Stock. The Kinematic Envelope has been developed taking into account the entire Track and the Rolling Stock Maintenance Tolerances.
3. The clearances are based on assumption that windows are sealed and doors are closed during movement.
4. Track and Rolling stock shall be maintained to the tolerances considered for calculation of Kinematic Envelope.
5. The Structure Gauge indicated in SOD shall not be violated under any circumstances except for platform coping, designated operational structures such as platform screen door/gate structures including structural support, hand railing in back-of-house, platform edge, track access gates, the third rail conductor with its feeding arrangement, and support structure for third rail and platform screen doors/gates etc.
6. The vehicle Kinematic Envelope at wind speed of 70 kmph shall be applied for the platform area on At-Grade, Elevated stations and 42 kmph\* wind speed for Underground stations within the confines of stations. At all other locations, the Kinematic Envelope corresponding to 100 kmph wind speed shall be used for determining the Structure Gauge for Elevated and At-Grade sections (outside the station area) and 42 kmph wind speed for underground sections (outside the station area). (\*42kmph side wind represents 100 Pa gauge pressure considered as buffeting effect.)
7. The speed of trains at platform on Elevated or At Grade Station shall be restricted to 40 KMPH when wind speed is more than 70 KMPH but less than 90 KMPH. Metro operation shall be stopped when wind speed reaches 90 KMPH or more. Continuous recording of wind speed shall be done at critical locations defined by the Metro administration.
8. Maximum design speed is 90 KMPH and operating speed shall be 80 KMPH (except at stations). Operating speed at stations shall be 70 KMPH. Operating speed in depot shall be 25 Kmph.

The operating speed on diversion lines at turnouts having:

- (i) Weldable CMS crossing (1 in 9) and thick web switch with 300 m radius of lead curve rail shall be 45 kmph.
- (ii) Weldable CMS crossing (1 in 9) and thick web switch with 190 m radius of lead curve

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- rail shall be 35 kmph.
- (iii) Weldable CMS crossing (1 in 7) and thick web switch with 190 m radius of lead curve rail shall be 35 kmph.
  - (iv) Weldable CMS crossing (1 in 7) and thick web switch with 140 m radius of lead curve rail shall be 25 kmph."
9. The Kinematic Envelope of Rolling Stock should not infringe under any circumstance. And any infringement to SOD should be condoned by Railway Board.
  10. No work/workmen/equipment are allowed between Vehicle and Structure gauge during operation of trains.
  11. Electrical Clearances should be measured from Kinematic Envelope of rolling stock.
  12. The train operation will be stopped in affected section by central control if any one of the trains in UP or DN direction derails. The operation will remain suspended till the clearance given by Accident site Manager from the site by exchange of private number with Central control.

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### SCHEDULE OF DIMENSIONS (1435 mm STANADARD GAUGE)

#### INTRODUCTION

1. The dimensions given in this Schedule of Dimensions (SOD) are to be observed in all works on 1435 mm Standard Gauge unless prior sanction has been obtained from the Railway Board through the Commissioner of Metro Rail Safety (CMRS) to execute works which infringe this SOD.
2. Any condonation in SOD parameters will require approval by Railway Board through the Chief Commissioner of Railway Safety (CCRS).
3. The dimensions given in this SOD are applicable to At-grade, Elevated and Underground sections of the Bhopal and Indore Metro Rail Projects, which will have a 750Volts DC Traction system with Third rail bottom current collection and track rail return current. The Rolling Stock shall be 2900mm wide and 4120 mm maximum height with sealed windows and sliding doors, which shall all remain closed when the train is in motion.
4. The Underground sections may be with Circular Tunnel or Rectangular Box or open cut (at ramps) or of any other suitable shape. The Elevated sections shall be above ground structures such as Viaducts. Both Underground and Elevated sections shall have suitably designed ballastless track, Direct Fixation Fastening (DFF) type. The At-Grade section and the Depot area may be with ballasted or ballastless track.
5. The Schedule of Dimensions (SOD) has been divided into five chapters as under:

Sr. No	Description	Remarks
1	Chapter-1	General
2	Chapter-2	Stations
3	Chapter-3	Rolling Stock
4	Chapter-4	Electric Traction
5	Chapter-5	Platform Screen Doors / Gates

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1. CHAPTER-I: GENERAL

1.1 SPACING OF TRACKS:

1.1.1 Minimum distance, centre to centre of tracks without any structure in between, for Tangent (Straight) tracks for:

- |                                                      |   |         |
|------------------------------------------------------|---|---------|
| a) Underground section                               | : | 3650 mm |
| b) Elevated section                                  | : | 3750 mm |
| c) Surface (At-Grade) sections (Ballasted section)   | : | 3800 mm |
| d) Surface (At-Grade) sections (Ballastless section) | : | 3750 mm |

Note: For minimum track centres distance on curves, refer Appendix-1 at Page no. 32

1.2 CURVES:

1.2.1 Minimum radius of curvature (Horizontal)

- |                                                |          |
|------------------------------------------------|----------|
| a) On main running lines, other than stations: |          |
| i) Underground section:                        | : 200 m  |
| ii) At-Grade and Elevated sections:            | : 120 m  |
| b) Depot, Yard and other non-passenger Lines:  | : 100 m  |
| c) At Station Passenger Platforms              | : 1000 m |

1.2.1.1 The minimum transition length - 15m

1.2.1.2 Length of straight between two transition curves should be minimum 25 m on passenger lines and at locations where 25 m is not possible, common tangent point shall be provided.

1.2.2 Check Rail / Restraining Rail:

- |                                                                                                                                                                                                                                                        |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| a) Check rail/Restraining Rail shall be provided on curves on main line where radius is 190 m (for SG) or less. Check rail/Restraining Rail shall not be mandatory for curves in depots, yards and non-passenger lines where speed is less than 25Kmph |  |
| b) The clearance between check/restraining rail and running rail shall be suitably decided by metro depending upon study of track vehicle interaction.                                                                                                 |  |

1.2.3 Cant & Cant Deficiency

- |                                              |   |                        |
|----------------------------------------------|---|------------------------|
| a) Maximum permissible Cant (Ca)             | : | 125 mm                 |
| b) Maximum desirable Cant (Ca)               | : | 110 mm                 |
| c) Maximum permissible Cant deficiency (Cd)  | : | 100 mm                 |
| d) Maximum desirable Cant deficiency (Cd)    | : | 85 mm                  |
| e) Maximum Cant Gradient                     | : | 1 in 440               |
| f) Maximum Cant Excess (Ce)                  | : | 75mm                   |
| g) Maximum rate of change of cant            | : | 55mm/sec               |
| h) Maximum rate of change of cant deficiency | : | 55mm/sec               |
| i) Maximum lateral acceleration              | : | 0.55m/sec <sup>2</sup> |



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1.2.4 Vertical Curve

- a) Minimum radius : 1500 m  
b) Minimum length of vertical curve : 20m

Note: No Vertical curve shall be provided in Platform area

1.3 GRADIENTS:

1.3.1 Maximum Permissible Gradient on mid-section (compensated) shall be 4%

Notes:

- i) There shall be no change of gradient in transition portion of horizontal curves.  
ii) The grade compensation for curvature shall be considered at the rate of 0.04% per Degree of curve.

1.4 BUILDINGS AND STRUCTURES

The minimum horizontal distance from the centre of the track to any structure (except for a passenger platform and the Third Rail) for heights above Rail Level on tangent track on level or constant grade shall be as below:

1.4.1 Underground Sections

1. Circular Tunnel

Sr.no.	Height from Rail Level	Horizontal Distance from C/L of track
i.	Up to Rail 348 mm	1680 mm
ii.	At 348 mm	1554 mm
iii.	348 mm to 679 mm	1554 mm increasing to 1638 mm
iv.	679 mm to 885 mm	1638 mm increasing to 1676 mm
v.	885 mm to 2884 mm	1676 mm increasing to 1729 mm
vi.	2884 mm to 3320 mm	1729 mm
vii.	3320 mm to 4064 mm	1729 mm decreasing to 1170mm
viii.	4064mm to 4246 mm	1170 mm decreasing to 1040mm
ix.	4246 mm to 4300 mm	1040 mm decreasing to 833 mm

Refer Drawing no. MPMRCL/GEN/SOD/UND-01 at Page no. 54

2. Rectangular Box Tunnel

Sr.no.	Height from Rail Level	Horizontal Distance from C/L of track
i.	Up to Rail 348 mm	1680 mm
ii.	At 348 mm	1554 mm
iii.	348 mm to 679 mm	1554 mm increasing to 1638 mm

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Sr.no.	Height from Rail Level	Horizontal Distance from C/L of track
iv.	679 mm to 885 mm	1638 mm increasing to 1676 mm
v.	885 mm to 2884 mm	1676 mm increasing to 1729 mm
vi.	2884 mm to 3320 mm	1729 mm
vii.	3320 mm to 4064 mm	1729 mm decreasing to 1170mm
viii.	4064 mm to 4246 mm	1170 mm decreasing to 1040mm
ix.	4246 mm to 4300 mm	1040 mm decreasing to 833 mm

Refer Drawing no. MPMRCL/GEN/SOD/UND-03 at Page no. 55

1.4.2 Elevated and Surface (At-Grade) Sections (Ballastless Track)

Sr. no.	Height from Rail Level	Horizontal Distance from C/L of track
i.	From Rail Level to 348 mm	1730 mm
ii.	At 348 mm	1730 mm decreasing to 1607 mm
iii.	348 mm to 666 mm	1607 mm increasing to 1696 mm
iv.	666 mm to 879 mm	1696 mm increasing to 1736 mm
v.	879 mm to 2874 mm	1736 mm increasing to 1808 mm
vi.	2874 mm to 3338 mm	1808 mm
vii.	3338 mm to 4058 mm	1808 mm decreasing to 1374 mm
viii.	4058 mm to 4350 mm	1374 mm decreasing to 1366 mm

Refer Drawing no. MPMRCL/GEN/SOD/ELE-02 at Page no. 53

1.4.3 Surface (At-Grade) Sections (Ballasted Track)

Sr. no.	Height from Rail Level	Horizontal Distance from C/L of track
i.	From Rail Level to 348 mm	1742 mm
ii.	348mm to 899 mm	1742 mm increasing to 1765 mm
iii.	899mm to 2031 mm	1765 mm increasing to 1833mm
iv.	2031mm to 3356 mm	1833 mm increasing to 1834 mm
v.	3356mm to 4060 mm	1834 mm decreasing to 1374 mm
vi.	4060mm to 4350mm	1374 mm decreasing to 1366 mm

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Refer Drawing no. MPMRCL/GEN/SOD/ATG-02 at Page no. 56

Notes for 1.4.1, 1.4.2 and 1.4.3:

- i) Extra clearance shall be provided for curves as laid down at Para 1.7.
- ii) The term 'Structure' covers any item including light ones like ladders, isolated posts, cable etc. erected alongside the track.
- iii) For passenger platform refer to para 2.2.1 to 2.2.3 of chapter 2.

**1.5 KINEMATIC ENVELOPE (KE):**

- a) For a Kinematic Envelope for level or constant grade (tangent track) outside Platform area, refer to:
  - Drawing no. MPMRCL/GEN/SOD/ELE-01 at Page no. 48
  - Drawing no. MPMRCL/GEN/SOD/UND-02 at Page no. 49
  - Drawing no. MPMRCL/GEN/SOD/ATG-01 at Page no. 50
- b) For Kinematic Envelope for level or constant grade (tangent track) in Platform area for Elevated At-Grade, refer to - Drawing no. MPMRCL/GEN/SOD/ELE - 70 kmph at Page no. 51 and for Underground Platform, refer to Drawing no. MPMRCL/GEN/SOD/UND - 70 kmph at Page no. 52.

**1.6 STRUCTURE GAUGE (Except for Passenger Platforms):**

**1.6.1 Underground sections:**

The Structure Gauge (Fixed Structure Line) outside platform area has been arrived at by allowing minimum clearance of 100 mm to Kinematic Envelope for Underground sections.

- a) For Structure Gauge on Underground Sections (Circular Tunnel) with Ballastless track for level and constant grade (tangent track). Refer drawing no. MPMRCL/GEN/SOD/UND-01 at Page no. 54.
- b) For Structure Gauge on Underground Sections by cut and cover Tunnel or ramp with Ballastless Track for level and constant grade (tangent track) Refer drawing MPMRCL/GEN/SOD/UND-03 at Page no. 55.

Note: Extra allowance shall be provided for curves as laid down at Para 1.7

**1.6.2 Elevated and At-Grade sections with Ballastless Track.**

The Structure Gauge (Fixed Structure Line) has been arrived at by allowing a minimum clearance of 150 mm to Kinematic Envelope for Elevated and At-Grade sections.

- a) For Structure Gauge on Elevated Sections and At-Grade sections outside stations with Ballastless Track for level or constant grade (tangent track) refer to drawing number MPMRCL/GEN/SOD/ELE-02 at Page no. 53.

Note: Extra clearances shall be provided for curves as laid down at Para 1.7.

**1.6.3 Surface (At-Grade) section with Ballasted Track.**

The Structure Gauge (Fixed Structure Line) has been arrived at by allowing a minimum clearance of 150 mm to Kinematic Envelope.

For Structure Gauge on At-Grade sections (outside stations) with ballasted track for level and constant grade (tangent track). Refer to drawing no.



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MPMRCL/GEN/SOD/ATG - 02 at Page no. 56.

Note: Extra allowance shall be provided for curves as laid down at Para 1.7.

1.7 EXTRA CLEARANCES ON CURVES:

Following are the extra allowances considered for Curves.

Abbreviations used in Para 1.7 :

- 'C' is the distance between centres of bogies in metres.
- 'C<sub>1</sub>' is the coach length in 'metres'
- 'R' is the radius of curve vertical or horizontal in metres
- 'C<sub>a</sub>' is the Cant provided in 'mm'
- 'h' is the height from Rail Level in 'mm' and
- 'G' is the distance between centres of heads of rails in 'mm'. this value shall be taken as 1507 mm.

1.7.1 Inside of Curve:

A. Curvature effect:

- a) Mid throw at the centre of the Vehicle = V (in mm) =  $125 C^2 / R$
- b) Lateral shift due to gauge widening on curves, is 9 mm for curves sharper than 500m radius and 5 mm for curves of radius 500m to 1000m.
- c) Lateral shift for nosing is 28mm for ballasted track and ballastless track.

For values of curvature effect,

- i) For At-Grade (Surface) Sections – Ballasted Track refer Appendix – 2A at Page no. 33 and Appendix – 2B at Page no. 34.
- ii) For Tunnel, Elevated and At-Grade (Surface) Sections – Ballastless Track refer Appendix – 2C at Page no. 35 and Appendix – 2D at Page no. 36.

Notes:

- i) Underground, Elevated, At-Grade Ballastless and At-Grade Ballasted sections:

Lateral shift of 28 mm due to nosing is included in Kinematic Envelope for Underground, Elevated and At-Grade Sections with ballastless track for tangent track (and as a result, also included in Structure Gauge) which shall be subtracted from the total extra allowance worked out as at Para 1.7.1(A) above if the value of mid throw (V) is equal to or greater than 28 mm. However, if the value of mid throw (V) is less than 28 mm, the curvature effect shall be due to widening of the gauge only (mid throw minus 28 mm shall be taken as zero).

B. Clearance for Cant:

- a. Underground (box structures), Elevated and At-grade sections:

The lean 'L' due to Cant at any point at height 'h' above Rail Level is given by:

$$L = C_a \times h / G \text{ (all in mm).}$$

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Where,  $G = 1435 + c = 1507 \text{ mm}$

'c' being the rail head width, and 'Cs' being the Cant.

Values of Cant effect on Structure Gauge for inside of a curve with only the Cant effect, as shown in MPMRCL/GEN/SOD/GEN-01 at Page no. 45 is as under:

- i) For At-Grade (Surface) Sections - Ballasted Track refer Appendix - 3A at Page no. 37.
- ii) For Elevated and At-Grade (Surface) Sections- Ballastless Track refer Appendix - 3B at Page no. 38.
- iii) For Box Structures of Underground Sections- Ballastless Track refer Appendix - 3C at Page no. 39.

**b. Circular Tunnels:**

In the case of Circular Tunnel, the Cant is provided by raising the outer rail and suitably shifting the centre of the Circular Tunnel towards inside of curve and upwards. This has the same effect as assuming rotation of the Circular Tunnel about midpoint of top inner rail resulting in shift of Tunnel centre laterally towards inside of curve and also vertically upwards.

For values of horizontal and vertical shifts of centre of Circular Tunnel for different values of Cant, refer to Appendix - 4 at Page no. 43 and drawing no. MPMRCL/GEN/SOD/UND-04 at Page no. 57.

**c. Clearance for Vertical Curve (Vertical Throw):**

- a) Vertical Throw V1 and V2 (in mm) for vertical curves shall be calculated as below:

V1 (with vehicle centre in sag or vehicle end on summit)

$$= 125 \times C^2 / R$$

V2 (with vehicle centre on summit or vehicle end in sag)

$$= [125 \times C_1^2 / R] - [125 \times C^2 / R]$$

- b) Values of Vertical Throw V1 and V2 due to vertical curves of different radii are shown in drawing no. MPMRCL/GEN/SOD/GEN-02 at Page no. 46.

**1.7.2 Outside of Curve:**

**A. Curvature effect:**

- a) End throw at the end of vehicle =  $V_e$  (in mm)  
 $= [125 \times C_1^2 / R] - [125 \times C^2 / R]$
- b) Clearance due to gauge widening on curves is 9 mm for curves sharper than 500 m radius and 5 mm for curves of radius between 500 m up to 1000 m.
- c) Additional clearance due to nosing, due to gauge widening to be considered for curves sharper than 1000 m radius.
- d) For values of curvature effect, refer to:

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- i) For At-Grade (Surface) Sections – Ballasted Track refer Appendix – 2A at Page no. 33 and Appendix – 2B at Page no. 34.
- ii) For Underground, Elevated and At-Grade (Surface) Sections – Ballastless Track refer Appendix – 2C at Page no. 35 and Appendix – 2D at Page no. 36.

**B. Clearance for Cant:**

a) Underground (Box Structure), Elevated and At-Grade (Surface) Sections

The lean 'L' due to Cant at any point at height 'h' above Rail Level is given by:

$L = (-) C_a \times h/G$  (all in mm), where  $G = 1435 + c$ ,  $c$  being the rail head width (negative sign indicates relief due to Cant or reduction in clearance required)

**Note:**

Full relief for lean due to cant ( $C_a$ ) is to be taken into account only for calculation of track spacing without any structure between tracks. In case there is a structure adjacent to track, relief for lean is to be taken into account only if the cant provided is greater than 50mm and shall be limited to a value =  $(C_a - 50) \times h/g$ .

Values of cant effect on Structure Gauge on inside and outside of curve with only the cant effect as shown in drawing no. MPMRCL/GEN/SOD/GEN-01 at Page no. 45.

- i) For Ballasted Track sections refer Appendix – 3A at Page no. 37.
- ii) For Elevated and At-Grade (Surface) sections (Ballastless Track) refer Appendix – 3B at Page no. 38.
- iii) For Box structures of Underground sections (Ballastless Track) refer Appendix – 3C at Page no. 39.

b) Circular Tunnels

In the case of Circular Tunnel, the cant is provided by raising the outer rail and suitably shifting the centre of the Circular Tunnel towards inside of curve and upwards. This has same effect as assuming rotation of the Circular Tunnel about mid-point of top of inner rail resulting in shift of Tunnel centre laterally towards inside of curve and also vertically upwards.

For values of horizontal and vertical shifts of centre of Circular Tunnel for different Values of cant, refer to Appendix - 4 at Page no. 43 and MPMRCL/GEN/SOD/UND-04 at Page no. 57.

**C. Clearance for Vertical curve (Vertical Throw):**

The provision at Para 1.7.1 (C) above shall be applicable in this case also.

**1.8 MINIMUM TRACK SPACING ON CURVES:**

**Underground, Elevated and At-Grade (Surface) Sections**

The worst case will be when the end of a bogie carriage on the inner track is opposite the centre of a similar carriage on the outer track.



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1.8.1 Without any structure between tracks:

The minimum track spacing on curves without any structure between tracks shall be the sum of the following:

- a) (E+F)

Where, E is the horizontal distance from vertical axis of centre line of canted track to canted Kinematic Envelope on inside of curve at a height 'h' (from Rail Level) for a given cant

F is the horizontal distance from vertical axis of centre line of canted track to canted Kinematic Envelope on outside of curve at a height 'h' (from Rail Level) for a given cant,

Refer Drawing no. MPMRCL/GEN/SOD/GEN-03 at Page no. 47.

- b) T1 (Extra lateral clearance due to curvature on inside of curve)  
c) T2 (Extra lateral clearance due to curvature on Outside of curve)

Minimum clearance between adjacent Kinematic Envelopes is stipulated as below:

- i) 300 mm for Under-Ground Sections  
ii) 300 mm for Elevated Sections  
iii) 300 mm for Surface (At-Grade) sections

Notes:

- i) The value of 'F', calculated from the formula is at drawing no. MPMRCL/GEN/SOD/GEN-03 at Page no. 47 includes full relief due to Cant.  
ii) The sum of 'E' and 'F' for same height (which are with cant effect only), shall be the maximum of values calculated for various heights from Rail Level.

For values of E, F, T1 and T2, refer to the Appendices as shown below.

Sr. no.	Sections	For E & F	For T1 & T2
1	Elevated, Underground & At-Grade (Ballastless)	Appendix 3E at Page no. 41	Appendix 2C at Page no. 35 Appendix 2D at Page no. 36
2	Surface (At-Grade) Ballasted Section	Appendix 3D at Page no. 40	Appendix 2A at Page no. 33 Appendix 2B at Page no. 34

1.8.2 With a Structure between adjacent tracks

The minimum track spacing on curves with a structure between tracks shall be the sum of the following:

- a) (E1+ T1) Minimum clearance to the structure from centre line of track on inside of curve (for outer track)

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- b) (F1 + T2) Minimum clearance to the structure from centre line of track on outside of curve (for inner track)
- c) Width of structure between adjacent tracks (measured across the tracks).

Where, E1 is the horizontal distance from vertical axis of centre line of canted track to canted Structure Gauge on inside of curve for a given Cant,

F1 is the horizontal distance from vertical axis of centre line of canted track to canted Structure Gauge on outside of curve for a given Cant,

T1 is extra lateral allowance due to curvature on inside of curve.

T2 is extra lateral allowance due to curvature on outside of curve.

**Notes:**

- i. The values of E1 and F1 for a given Cant  $C_n$ , shall each be the maximum of values at different heights of structure from Rail Level. In case the cant provided is greater than 50mm on inner track, the value of F1 shall be for the cant of  $(C_n - 50)$  mm. In case the cant provided is 50mm or less on inner track, the value of F1 shall be for ZERO Cant.
- ii. Minimum track spacing, so worked out with a structure between the adjacent tracks shall not be less than that calculated as per Para 1.8.1 for tracks without any structure between adjacent tracks.

For values of E1, F1, T1 and T2, refer to the Appendices as shown below.

Sr. no.	Sections	For E1 & F1	For T1 & T2
1	Underground Rectangular Box Tunnels (Ballastless)	Appendix 3C at Page no. 39	Appendix 2C at Page no. 35 Appendix 2D at Page no. 36
2	Elevated & At-Grade (Ballastless)	Appendix 3B at Page no. 38	Appendix 2C at Page no. 35 Appendix 2D at Page no. 36
3	Surface (At-Grade) Ballasted Section	Appendix 3A at Page no. 37	Appendix 2A at Page no. 33 Appendix 2B at Page no. 34

**1.9 WALKWAYS (UG section)**

Minimum clear Width of Walkway	:	610 mm
Minimum Height of Walkway	:	1000 mm
Maximum Height of Walkway	:	1200 mm

**Note:** Extra clearance to walkway shall be provided for curves, as laid down at Para 1.7

- i) Walkway shall not infringe the Structure gauge.
- ii) Maximum and minimum heights of walkway on curves are above inner rail.
- iii) No structure, other than signalling and minor signalling telecom equipment post, shall be permitted within the minimum width of walkway.
- iv) Minimum clearance to walkway at the nearest edge from kinetic envelope shall



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be of 100 mm for underground section.

**1.10 DERAILMENT GUARDS:**

1.10.1 Derailment Guard should be provided on inside/outside of running rail on viaduct as well as in tunnel and at grade section at locations specified by the Metro Railway. In tunnel, 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;

- i) Entry of tunnel: 200 m from tunnel portal outside the tunnel to 50 m inside the tunnel.
- ii) Exit of tunnel: 50 m from inside of tunnel portal to 200 m outside the tunnel.
- iii) In curved track having radius of 500m or less including transition portion but excluding locations where check rail is provided.
- iv) 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.
- v) 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.

1.10.2 The lateral clearance between the running rail and the derailment guard shall be  $210 \pm 30$  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.

**Note:**

In case of Double Resilient Base Plate Assembly fastening system as approved by Ministry of Railways (MoR), the lateral clearance between a running rail and the derailment guard shall be  $250 \pm 20$  mm. This fastening system, if used in tunnel having multiple tracks, KE of adjacent tracks is not to be infringed so long as the Wheels of any derailed vehicles are within the main rail and the derailment guard.

1.10.3 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 minimum.

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2 CHAPTER – II: STATIONS

2.1 SPACING OF TRACKS AT STATIONS:

Minimum Spacing of tracks at station on straight and on curve of radius of 1000 m and flatter, without any structure between adjoining tracks for:

- a) Under Ground Section : 3650 mm
- b) Elevated Section : 3750 mm
- c) At-Grade Section (Ballasted Track) : 3800 mm
- d) At-Grade Section (Ballastless Track) : 3750 mm

2.2 PLATFORMS:

2.2.1 Minimum horizontal distance from centre of track to face of passenger Platform coping (ballastless track):

- a) Under Ground Station : 1516 mm
  - b) Elevated Station/At-Grade : 1530 mm
- } (A)

2.2.2 Maximum horizontal distance from centre of track to face of passenger Platform coping (ballastless track):

- a) Under Ground Station : 1525 mm
  - b) Elevated Station/At-Grade : 1540 mm
- } (B)

Notes:

- i) Platform faces shall be flared away smoothly from the centre line of the track at either end for a distance of 1500 mm so as to give from centre of track a dimension:
  - 1575 ± 5 for Under Ground and Elevated Stations.
  - 1590 ± 5 for Surface (At-Grade) Stations.
- ii) For additional clearance for platforms on curves, refer to Para 2.7.
- iii) Minimum and Maximum distances specified at Para 2.2.1 and 2.2.2 are for 2900 mm wide Rolling Stock. The distances (A) and (B) shall be adjusted with the variation in width of Rolling Stock.

2.2.3 Height above Rail Level for passenger platform.:

	Maximum	Minimum
a) At Grade	1085 mm	1075 mm
b) Elevated/Underground	1095 mm	1085 mm

2.2.4 Horizontal distance

- a) Minimum horizontal distance of any 'isolated' structure on a passenger Platform from the edge of coping with/without platform screen door/gate. : 2500 mm



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- b) Minimum horizontal distance of any 'continuous' Structure on a passenger platform from the edge of coping with/without platform screen door/gate. : 3500 mm

**Note:**

- i) The structure on the platform is treated as 'isolated' if the length of structure along the platform is 2000 mm or less. Any structure having a length exceeding 2000 mm is treated as 'continuous structure' except for platform screen doors and its supports.
- ii) The clocks/mirrors/ CCTV/ LED/LCD Screens/PIDS (passenger information Display System) etc. shall not be considered structures and shall be located at a minimum horizontal distance of 1000 mm from platform edge/coping with minimum height of 2500 mm from top of platform. CCTV/LED/LCD, PIDS etc. suspended from the Roof of Station shall to be adequately secured and a safety loop is to be provided for taking care of incidences of failure of hanging arrangement.
- iii) No fixed structure should infringe the Structure Gauge except for designated railway operational structure. Designated railway operational structures include platform coping, platform gates, hand railing in back-of-house platform edge, track access gates. Such designated railway operational structures should not infringe the Kinematic Envelope under any circumstances.
- iv) The Platform Screen Gates/Doors (PSG/PSD) may be installed at platform as per design of Original Equipment Manufacturer (OEM) of PSG/PSD but shall have a minimum clearance of 10 mm from Kinematic Envelope.
- v) For platform structure setting-out dimension at stations, refer to;  
Figure No: MPMRCL/GEN/SOD/ELE-03 at Page no. 58 and MPMRCL/GEN/SOD/ELE-05 at Page no. 60 for Elevated/At-Grade Stations with side platform without and with Platform Screen Gates respectively.  
Figure No: MPMRCL/GEN/SOD/ELE-04 at Page no. 59 and MPMRCL/GEN/SOD/ELE-06 at Page no. 61 for Elevated/At-Grade Stations with Island platform without and with Platform Screen Gates respectively.  
Figure No: MPMRCL/GEN/SOD/UND-05 at Page no. 62 and MPMRCL/GEN/SOD/UND-07 at Page no. 64 for Underground Stations with side platform without and with Platform Screen Doors respectively.  
Figure -No: MPMRCL/GEN/SOD/UND-06 at Page no. 63 and MPMRCL/GEN/SOD/UND-08 at Page no. 65 for Underground Stations with Island platform without and with Platform Screen Doors respectively.
- vi) There shall be no super elevation and gauge widening on passenger platform lines.

2.2.5 For Structure Gauge at stations, refer to Figures as under;

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a)	For Elevated and At-Grade Stations (Side platform) with/without platform screen gate	Drawing no. MPMRCL/GEN/SOD/ELE-03 at Page no. 58 and ELE-05 at Page no. 60
b)	For Elevated and At-Grade Stations (Island platform) with/without platform screen gate.	Drawing no. MPMRCL/GEN/SOD/ELE-04 at Page no. 59 and ELE-06 at Page no.61
c)	For Underground Stations (Side platform) with/without platform screen door	Drawing no. MPMRCL/GEN/SOD/UND-05 at Page no. 62 and UND-07 at Page no. 64
d)	For Underground Stations (Island platform) with/without platform screen door	Drawing no. MPMRCL/GEN/SOD/UND-06 at Page no. 63 and UND-08 at Page no. 65

2.2.6 For Kinematic Envelope on platform at station, refer for Elevated / At-Grade, Drawing No. MPMRCL/GEN/SOD/ELE - 70 kmph at Page no. 51, for Underground drawing No. MPMRCL/GEN/SOD/UND - 70 kmph at Page no. 52.

2.3 TRACK GRADIENTS IN PLATFORMS:

2.3.1 Track gradient in platform

- |    |                      |   |           |
|----|----------------------|---|-----------|
| a) | Maximum Gradient     | : | 1 in 1200 |
| b) | Desirable            | : | Level     |
| c) | Exceptional Gradient | : | 1 in 400  |

Note:

1. There shall be no change of grade in platform track.
2. Any steeper gradient than 1 in 1200 and up to Exceptional gradient of 1 in 400 shall be proposed by the Civil Engineering Head and Approved by Managing Director in consultation with the Head of Safety Nominated by Metro Rail Authority.

2.3.2 Maximum permissible gradient on turnouts.

- |    |                      |   |       |
|----|----------------------|---|-------|
| a) | On Ballasted Track   | : | 0.25% |
| b) | On Ballastless Track | : | 3.00% |

Note:

- i) There shall be no change of gradient (i.e. vertical curve) on and within 15 m (desirable) and 3 m (minimum) of any turnout on Ballastless track. In case of Ballasted track, there shall be no change of gradient on and within 30 m of any turnout.
- ii) There shall be no horizontal curve within 15 m (desirable) and 3 m (minimum) of any turnout on Ballastless Track and 30 m of any turnout on Ballasted Track.
- iii) Turnouts shall normally be installed on straight track. In exceptional situations, turnout may take off from a curve provided that the radius of the



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lead curve (main line as well as diverging line) is not less than 190 m. The negotiability of rolling stock on such turnouts must be certified by the rolling stock supplier and confirmed through oscillation trials, and a suitable speed restriction should be imposed on the main and / or diverging line based on track geometry and other considerations, if required. In case of turnout installed on curved 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.

- iv) The limit of turnout for the above purposes shall be taken from the Stock Rail Joint (SRJ) to end (i.e. heel) of the crossing for Ballastless track. For Ballasted track, it shall be from the SRJ to the last common sleeper behind end of the crossing.
- v) The maximum permissible gradient on turnout and the location of turnout with respect to vertical/horizontal curves in vicinity shall be ensured by Metro Authority that the Rolling Stock is fit to negotiate these gradients.
- vi) The above stipulations shall also be applicable for the turnout to be laid outside station limit, if any.

**2.4 INTERLOCKING AND SIGNAL GEAR:**

Maximum height above Rail Level of any part of interlocking or signal gear on either side of centre of track falling within the structure gauge limits shall be as under, subject to the restrictions as per Note below:

a)	<u>In Under Ground Stations</u>	
	From centre of track to 1610 mm	0 mm
	Beyond 1610 mm from centre of track up to 1705 mm	250 mm
b)	<u>In Elevated Stations</u>	
	From centre of track up to 1610 mm	0 mm
	Beyond 1610 mm from centre of track up to 1755 mm	250 mm
c)	<u>In At-Grade/ Surface Stations</u>	
	From centre of track up to 1610 mm	0 mm
	Beyond 1610 mm from centre of track up to 1680 mm	250 mm

Note: Except for check rails of ordinary and diamond crossings, or wing rails and point rails of crossings leading to snag dead ends, or such parts of signalling gear as are required to be actuated by the wheels, no gear or track fittings shall project above rail level for a distance of 1150 mm on either side of centre of track.

**2.5 Points and Crossing:**

- 2.5.1 Maximum clearance of check rail opposite nose of crossing : 42 mm

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- 2.5.2 Minimum clearance of check rail opposite nose of crossings : 36 mm
- 2.5.3 Maximum clearance of wing rail at nose of crossing : 43 mm
- 2.5.4 Minimum clearance of wing rail at nose of crossings : 41 mm
- 2.5.5 Minimum clearance between toe of open switch and stock rail : 160 mm
- 2.5.6 On passenger lines, minimum radius of lead curve for slip points, turnouts and diamond crossings shall be of the following types.
- a) 1 in 9 turnouts : 190 m radius
  - b) 1 in 7 turnouts : 140 m radius
  - c) Scissors cross-over of 1 in 9 type consisting of 4 turnouts and 1 diamond crossing
  - d) Scissors cross-over of 1 in 7 type consisting of 4 turnouts and 1 diamond crossing.
- 2.5.7 On Depot lines and other non-passenger lines the turnouts and diamond crossings shall be of the following types or flatter:
- Minimum angle of crossing (ordinary):
- a) 1 in 7 type turnouts : 140 m radius
  - b) Scissors cross-over of 1 in 7 type consisting of 4 turnouts and 1 diamond crossing
  - c) 1 in 7 derailing switches : 140 m radius
- 2.5.8 Diamond crossings not to be flatter than 1 in 4.5
- Note:** The above restrictions shall not apply to moveable diamond crossings
- 2.5.9 Minimum length of tongue rail : 10,000 mm.
- 2.6 **SUPER ELEVATION AND SPEED ON CURVES WITH TURNOUTS OF CONTRARY AND SIMILAR FLEXURE:**
- 2.6.1 **Main Line:**
- Subject to the permissible run through speed based on the standard of interlocking, the equilibrium super elevation, calculated for the speed of the fastest train may be reduced by a maximum amount of Cant Deficiency permitted without reducing speed on the main line.
- 2.6.2 **Turnouts:**
- a) **Curves of contrary flexure:**  
The equilibrium super elevation (s) in mm should be =  $\{(1435 + c) / 127\} (V/2 R)$   
Where, c = Rail head width, R = radius of turnout in metres and V is speed on turnout in kmph. The permissible negative super elevation on the turnout (which is also the actual super elevation of the main line) may then be = (Cant deficiency - 's') in mm.
  - b) **Curves of Similar flexure:**  
The question of reduction or otherwise of super elevation on the main line in order to keep the cant deficiency on turnout track within limits for the speed



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permitted on turnout track must be determined by the administration concerned. In the case of a reverse curve close behind the crossing of a turnout, the super elevation may be run out at the maximum of 1 mm in 440 mm.

**2.7 ADDITIONAL CLEARANCE FOR PLATFORMS ON CURVES:**

The additional clearance for platforms on curves is to be provided as under:

- On inside of curve : Mid Throw
- On outside of curve : End Throw

The additional clearance for platforms on curves is shown in Appendix - 5 at Page no. 44.

**Note:**

- (i) As the minimum radius of horizontal curves for station passenger platforms line is 1000 metre, there will be no super elevation and gauge widening at stations on passenger platform lines.
- (ii) Platforms located in curve shall be fitted with a gap filler wherever necessary to maintain the Maximum stepping distance (between platform and car body floor) at platform as 75 mm in Horizontal direction and 50 mm in Vertical direction. The gap filler shall be of elastic nature and flexible to allow train contact without any adverse effect on passenger safety and stability of trains.

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### 3 CHAPTER - III: ROLLING STOCK

#### 3.1 PASSENGER ELECTRIC MULTIPLE UNITS:

##### 3.1.1 Coach Dimensions:

- |    |                                                        |          |
|----|--------------------------------------------------------|----------|
| a) | Maximum Length of Coach body (including end fairings): | 21965 mm |
| b) | Maximum length over couplers :                         | 22600 mm |
| c) | Maximum width of the vehicle :                         | 2900 mm  |
| d) | Maximum Height of the Coach body :                     | 4120mm   |

- |       |                                                   |                 |
|-------|---------------------------------------------------|-----------------|
| 3.1.2 | Distance between Bogie centres :                  | 14800 ± 200 mm  |
| a)    | Length of rigid Wheel base for single bogie. :    | 2200 to 2600 mm |
| b)    | Maximum distance between any two adjacent axles : | 12800 mm        |

##### 3.1.3 Kinematic Envelope:

##### 3.1.3.1 Kinematic Envelope for level tangent track except for passenger platform:

- For underground ballastless track, refer drawing no. MPMRCL/GEN/SOD/UND-02 at Page no. 49.
- For At- Grade & elevated sections, ballastless track, refer drawing no. MPMRCL/GEN/SOD/ELE-1 at Page no. 48.

##### 3.1.3.2 Kinematic Envelope for level tangent track passenger platform (for Underground, At-Grade and Elevated sections, ballastless track) refer drawing no. MPMRCL/GEN/SOD/UND - 70 kmph at Page no. 52 and MPMRCL/GEN/SOD/ELE - 70 kmph at Page no. 51.

- 3.1.4 Net Minimum Clearance above Rail Level under dynamic condition of fully loaded vehicle under worst condition\*\* for bogie and axle mounted equipment excluding Current Collection Device (CCD) and Obstacle Detection Device (ODD) after considering up to 25mm projection of Check rails, wing-rails and upstand above Rail Level.

:50 mm \*



##### Note:

\* The Current Collection Device (CCD) in worst condition (with the deflection of primary springs and with maximum tread wear) in retracted position shall have a net minimum clearance of 25 mm above Rail Level.

\*\* The 'worst condition' means that it is with maximum deflection of Primary suspension with Maximum tread wear.

- 3.1.5 Minimum Clearance above Rail Level under dynamic condition of fully loaded vehicle under

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- a) Maximum Height of coupler above Rail Level, for an unloaded vehicle. : 815 mm
- b) Minimum Height of coupler above Rail Level, for a loaded vehicle. : 740 mm

3.2 LOCOMOTIVES AND ENGINEERING SERVICE VEHICLES

Other items of rolling stock, viz. shunting locomotives, inspection cars, emergency re-railing van, track machines, etc., used on this Metro System (running lines) will conform at their maximum operational speed with the Kinematic Envelope of the Passenger Electric Multiple Units as shown in:

For Underground refer drawing no. MPMRCL/GEN/SOD/UND-02 at Page no. 49.

For At-Grade and elevated sections refer drawing no. MPMRCL/GEN/SOD/ELE-01 at Page no. 48.

For Surface (At-Grade) sections for ballasted track refer drawing no. MPMRCL/GEN/SOD/ATG - 01 at Page no. 50.

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**APPENDIX -1**  
**PERMISSIBLE SPEED, CANT AND MINIMUM SPACING ON CURVES**  
**BALLASTLESS TRACK ON UNDERGROUND (TUNNELS) &**  
**ELEVATED SECTIONS AND BALLASTED TRACK ON AT-GRADE**  
**SECTIONS**  
(REFERENCE PARA 1.1)

Radius of Curve	Cant	Max Perm Speed	Minimum distance between adjacent tracks		
			Ballastless		Ballasted
			Underground	Elevated & At-	At-Grade
m	mm	kmph	mm	mm	mm
≥ 3000	15	80	3700	3800	3850
2800	15	80	3700	3800	3850
2600	15	80	3700	3800	3850
2400	20	80	3700	3800	3850
2200	20	80	3700	3800	3850
2000	20	80	3700	3800	3850
1900	20	80	3700	3800	3850
1800	25	80	3700	3800	3850
1700	25	80	3700	3800	3850
1600	25	80	3700	3800	3850
1500	30	80	3700	3800	3850
1400	30	80	3700	3800	3850
1300	30	80	3700	3800	3850
1200	35	80	3700	3800	3850
1100	35	80	3700	3800	3850
1000	40	80	3700	3800	3850
950	40	80	3700	3800	3850
900	45	80	3700	3800	3850
850	45	80	3700	3800	3850
800	55	80	3700	3800	3850
750	55	80	3700	3800	3850
700	55	80	3700	3800	3850
650	85	80	3700	3800	3850
600	85	80	3700	3800	3850
550	85	80	3750	3800	3850
500	85	80	3750	3850	3900
450	95	80	3750	3900	3950
400	105	80	3800	3900	3950
350	125	80	3800	3900	3950
300	125	75	3850	3950	4000
250	125	65	3900	4000	4050
200	125	60	3950	4050	4100
175	125	55	NA	4100	4150
150	125	50	NA	4150	4150
120	125	45	NA	4150	4150
100	125	40	NA	4250	4250

**Notes:**

1. The track spacing shown in the table above is without any column/structure between two tracks and is with equal cant both for outer and inner tracks.
2. The table above is not applicable to Platform tracks.
3. Figure for any intermediate radius of curvature may be obtained by adopting the value for sharper curve.



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#### 4 CHAPTER - IV: ELECTRIC TRACTION

- 4.1 Electric Traction - 750 V DC Third Rail with bottom current collection:
- 4.1.1 Electrical Clearances for At-grade, Elevated and Underground section:
- a) Minimum height from Rail Level to current collecting surface of the Conductor rail. : 148 mm
  - b) Maximum height from Rail Level to current collecting surface of the Conductor rail including worn-out condition. : 164 mm
- 4.1.2
- a) Distance of centre line of the Conductor rail from the track centre : 1445 - 1490 mm (Designed value +/- 5 mm)
- 4.1.3 Minimum clearance between the bottom of the shroud and the bottom of the Conductor Rail. : 19 mm
- 4.1.4 Maximum distance between the centre line of the Conductor Rail and the outer edge of the shroud structure. : 91 mm
- 4.1.5
- a) Minimum clearance between live parts of third rail and the structure in static and dynamic conditions. : 25 mm
  - b) Minimum clearance between live parts of Conductor Rail and vehicle body. : 25 mm

**Note:** General arrangement drawing for 'Third Rail Current Collection arrangement' indicating all the clearances mentioned in Chapter-4 need to be attached for reference as shown in Fig No MPMRCL/GEN/SOD/TR-01 at Page no. 70 of 70.

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**5 CHAPTER – V: PLATFORM SCREEN DOORS / GATES**

- 5.1 Platform Screen Doors and Gates setting out:**
- 5.1.1 Minimum Platform Screen Door width : 2000 mm
  - 5.1.2 Minimum Platform Screen Door height from Platform level : 2150 mm
  - 5.1.3 Minimum Platform Screen Gate height from Platform level : 1500 mm
  - 5.1.4
    - a) Minimum Platform Screen Door/Gate panel offset from tangent track centre line : 1600 mm
    - b) Minimum Platform Screen Door/Gate threshold offset from track centre line
      - i) Underground station : 1555 mm
      - ii) Elevated Station/At-Grade : 1570 mm
  - 5.1.5 Station Platform (Finished Floor Level) height from Rail Level
    - Ballastless Track : 1090 ± 5 mm
- Note:
- i) Assumed +/- 300 mm Stopping accuracy
  - ii) Platform Screen Doors at station on curves shall be considered separately taking into account the additional clearance as per Appendix-5.
  - iii) Platform screen doors are considered as designated railway operational structures. Therefore, Platform Screen Doors may infringe the structure gauge, but does not infringe the kinematic envelope over platform line and having minimum clearance of 10 mm from Kinematic Envelope to Platform Screen Door.
  - iv) The deflector (if provided) attached to the bottom of the sliding door shall be designed in order not to protrude beyond the door threshold.
- 5.1.6 For static and Kinematic Envelope for station in Underground section with Platform Screen Door, refer Drawing no. MPMRCL/GEN/SOD/PSD - 01 at Page no. 66.
- 5.1.7 For Static and Kinematic Envelope for Elevated and At-grade stations with Platform Screen Gate, refer Drawing no. MPMRCL/GEN/SOD/PSD - 02 at Page no. 67.

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**APPENDIX -1**  
**PERMISSIBLE SPEED, CANT AND MINIMUM SPACING ON CURVES**  
**BALLASTLESS TRACK ON UNDERGROUND (TUNNELS) &**  
**ELEVATED SECTIONS AND BALLASTED TRACK ON AT-GRADE**  
**SECTIONS**  
(REFERENCE PARA 1.1)

Radius of Curve	Cant	Max Perm Speed	Minimum distance between adjacent tracks		
			Ballastless		Ballasted
			Underground	Elevated & At-	At-Grade
m	mm	kmph	mm	mm	mm
≥ 3000	15	80	3700	3800	3850
2800	15	80	3700	3800	3850
2600	15	80	3700	3800	3850
2400	20	80	3700	3800	3850
2200	20	80	3700	3800	3850
2000	20	80	3700	3800	3850
1900	20	80	3700	3800	3850
1800	25	80	3700	3800	3850
1700	25	80	3700	3800	3850
1600	25	80	3700	3800	3850
1500	30	80	3700	3800	3850
1400	30	80	3700	3800	3850
1300	30	80	3700	3800	3850
1200	35	80	3700	3800	3850
1100	35	80	3700	3800	3850
1000	40	80	3700	3800	3850
950	40	80	3700	3800	3850
900	45	80	3700	3800	3850
850	45	80	3700	3800	3850
800	55	80	3700	3800	3850
750	55	80	3700	3800	3850
700	55	80	3700	3800	3850
650	85	80	3700	3800	3850
600	85	80	3700	3800	3850
550	85	80	3750	3800	3850
500	85	80	3750	3850	3900
450	95	80	3750	3900	3950
400	105	80	3800	3900	3950
350	125	80	3800	3900	3950
300	125	75	3850	3950	4000
250	125	65	3900	4000	4050
200	125	60	3950	4050	4100
175	125	55	NA	4100	4150
150	125	50	NA	4150	4150
120	125	45	NA	4150	4150
100	125	40	NA	4250	4250

**Notes:**

1. The track spacing shown in the table above is without any column/structure between two tracks and is with equal cant both for outer and inner tracks.
2. The table above is not applicable to Platform tracks.
3. Figure for any intermediate radius of curvature may be obtained by adopting the value for sharper curve.



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APPENDIX -2A					
EXTRA HORIZONTAL CLEARANCE ON CURVES (CURVATURE EFFECT)					
AT-GRADE (SURFACE) SECTIONS (BALLASTED TRACK)					
INSIDE OF CURVE					
(REFERENCE PARAs 1.7.1A, 1.8.1 & 1.8.2)					
Radius	Mid throw	Nosing Included in KE/Structure Gauge for Tangent Track	Gauge Widening on curves	Extra Horizontal Clearance	Remarks
R	28125/R	N	G	T1	
m	mm	mm	mm	mm	
3000	9.4	28	0	0	GAUGE WIDENING ON CURVES: is 9 mm for Curves sharper than 500m radius. is 5 mm for Curves of radius from 500m to 1000m and is 0 mm for Curves with radius 1000m and above.
2800	10.0	26	0	0	
2600	10.8	25	0	0	
2400	11.7	28	0	0	
2200	12.8	26	0	0	
2000	14.1	26	0	0	
1900	14.8	26	0	0	
1800	15.6	28	0	0	
1700	16.5	28	0	0	
1600	17.6	28	0	0	
1500	18.8	26	0	0	
1400	20.1	28	0	0	
1300	21.6	28	0	0	
1200	23.4	28	0	0	
1100	25.6	28	0	0	
1000	28.1	28	0	0	
950	29.6	28	5	7	
900	31.3	28	5	8	
850	33.1	28	5	10	
800	35.2	28	5	12	
750	37.5	28	5	15	
700	40.2	28	5	17	
650	43.3	28	5	20	
600	46.9	28	5	24	
550	51.1	28	5	28	
500	56.3	28	5	33	
450	62.5	28	9	44	
400	70.3	28	9	51	
350	80.4	28	9	61	
300	93.8	28	9	75	
250	112.5	28	9	94	
200	140.6	28	9	122	
175	160.7	28	9	142	
150	187.5	28	9	169	
120	234.4	28	9	215	
100	281.3	28	9	262	

T1 = V-N+G For V equal to or greater than N  
 T1 = G for V < N



Mid throw (in mm)  $V = 125 C^2 / R = 28125 / R$   
 Where 'C' is the distance between bogies centres = 14800+200 = 15000 mm OR 14800-200 = 14600 mm  
 The worst case will be with C = 15000 mm  
 R is the radius of curve in metres

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APPENDIX -2B					
EXTRA HORIZONTAL CLEARANCE ON CURVES (CURVATURE EFFECT)					
AT GRADE (SURFACE) SECTIONS (BALLASTED TRACK)					
OUTSIDE OF CURVE					
(REFERENCE PARAS 1.7.1A, 1.8.1 & 1.8.2)					
Radius R	End throw, V0 34020 / R	Gauge Widening on curves, G	Noising due to Gauge widening, EN = Gx0.219723183	Extra Horizontal Clearance, T2 = V0+G+EN	Remarks
m	mm	mm	mm	mm	
3000	11.3	0	0.0	11	
2800	12.2	0	0.0	12	
2600	13.1	0	0.0	13	
2400	14.2	0	0.0	14	
2200	15.5	0	0.0	15	
2000	17.0	0	0.0	17	
1900	17.9	0	0.0	18	
1800	18.9	0	0.0	19	
1700	20.0	0	0.0	20	
1600	21.3	0	0.0	21	
1500	22.7	0	0.0	23	
1400	24.3	0	0.0	24	
1300	26.2	0	0.0	26	
1200	28.4	0	0.0	28	
1100	30.9	0	0.0	31	
1000	34.0	0	0.0	34	
950	35.8	5	1.1	42	
900	37.8	5	1.1	44	
850	40.0	5	1.1	46	
800	42.5	5	1.1	49	
750	45.4	5	1.1	51	
700	48.6	5	1.1	55	
650	52.3	5	1.1	58	
600	56.7	5	1.1	63	
550	61.9	5	1.1	68	
500	68.0	5	1.1	74	
450	75.6	9	2.0	87	
400	85.1	9	2.0	96	
350	97.2	9	2.0	108	
300	113.4	9	2.0	124	
250	138.1	9	2.0	147	
200	170.1	9	2.0	181	
175	194.4	9	2.0	205	
150	226.8	9	2.0	238	
120	283.5	9	2.0	294	
100	340.2	9	2.0	351	

GAUGE WIDENING ON CURVES:  
is 8mm for Curves sharper than 500m radius.  
is 5mm for Curves of radius from 500m to 1000m and  
is 0mm for Curves with radius 1000m and above.

End throw (in mm)  $V0 = (125 C^2) / R - (125 \times C^2) / R = 34020 / R$

Where 'C' is the distance between bogies centres = 14800+200 = 15000mm or 14800-200 = 14600 mm  
The worst case will with C = 14800 mm

'C' is the length of coach in metres = 22.030 m and R is the radius of curve in metres

COACH LENGTH = 21900 mm  
FOR DMC IT CAN INCREASE TO = 21995 mm  
DIFFERENCE IN LENGTH = 95 mm: (THIS INCREASE WILL BE ON ONE SIDE FOR DRIVING CAB)

HALF LENGTH FROM CENTRE OF TWO BOGIES = ((21900 / 2)+95) = 11015 mm  
LENGTH FOR CALCULATION OF END THROW = 22030 mm  
(2 x HALF LENGTH FROM CENTRE OF 2 BOGIES)

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**APPENDIX -2C**  
**EXTRA HORIZONTAL CLEARANCE ON CURVES (CURVATURE EFFECT)**  
**TUNNEL/ELEVATED/AT-GRADE (SURFACE) SECTIONS (BALLASTLESS TRACK)**  
**INSIDE OF CURVE**  
(REFERENCE PARAs 1.7.1A, 1.8.1 & 1.8.2)

Radius R	Mid throw 28125/R	Nosing Included in KE/Structure Gauge for Tangent Track N	Gauge Widening on curves G	Extra Horizontal Clearance T1	Remarks
m	mm	mm	mm	mm	
3000	9.4	28	0	0	GAUGE WIDENING ON CURVES: is 9mm for Curves sharper than 500m radius. is 5mm for Curves of radius from 500m to 1000m and is 0mm for Curves with radius 1000m and above.
2800	10.0	28	0	0	
2600	10.8	28	0	0	
2400	11.7	28	0	0	
2200	12.8	28	0	0	
2000	14.1	28	0	0	
1900	14.8	28	0	0	
1800	15.6	28	0	0	
1700	16.5	28	0	0	
1600	17.6	28	0	0	
1500	18.8	28	0	0	
1400	20.1	28	0	0	
1300	21.6	28	0	0	
1200	23.4	28	0	0	
1100	25.6	28	0	0	
1000	28.1	28	0	0	T1 = V-N+G For 'V' equal to or greater than 'N' T1 = G for V < N
950	29.6	28	5	7	
900	31.3	28	5	8	
850	33.1	28	5	10	
800	35.2	28	5	12	
750	37.5	28	5	15	
700	40.2	28	5	17	
650	43.3	28	5	20	
600	46.9	28	5	24	
550	51.1	28	5	28	
500	56.3	28	5	33	
450	62.5	28	9	44	
400	70.3	28	9	51	
350	80.4	28	9	61	
300	93.8	28	9	75	
250	112.5	28	9	94	
200	140.6	28	9	122	
175	160.7	28	9	142	
150	187.5	28	9	169	
120	234.4	28	9	215	
100	281.3	28	9	262	

Mid throw (in mm)  $V = 125 C^2 / R = 28125 / R$

Where 'C' is the distance between bogies centres = 14800+200 = 15000 mm or 14800-200 = 14600 mm  
The worst case will be with C = 15000 mm  
R is the radius of curve in metres

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APPENDIX -2D					
EXTRA HORIZONTAL CLEARANCE ON CURVES (CURVATURE EFFECT)					
TUNNEL/ELEVATED/AT-GRADE (SURFACE) SECTIONS (BALLASTLESS TRACK)					
OUTSIDE OF CURVE					
(REFERENCE PARAS 1.7.1A, 1.6.1 & 1.6.2)					
Radius, R	End throw, 34020 / R	Gauge Widening on curves, G	Noting due to Gauge widening, EN = Gx0.219723183	Extra Horizontal Clearance, T2 = V0+G+EN	Remarks
m	mm	mm	mm	mm	
3000	11.3	0	0.0	11	
2800	12.2	0	0.0	12	
2500	13.1	0	0.0	13	
2400	14.2	0	0.0	14	
2200	15.5	0	0.0	15	
2000	17.0	0	0.0	17	
1900	17.9	0	0.0	18	
1800	18.9	0	0.0	19	
1700	20.0	0	0.0	20	
1600	21.3	0	0.0	21	
1500	22.7	0	0.0	23	
1400	24.3	0	0.0	24	
1300	26.2	0	0.0	26	
1200	28.4	0	0.0	28	
1100	30.9	0	0.0	31	
1000	34.0	0	0.0	34	
950	35.8	5	1.1	42	
900	37.8	5	1.1	44	
850	40.0	5	1.1	46	
800	42.5	5	1.1	49	
750	45.4	5	1.1	51	
700	48.6	5	1.1	55	
650	52.3	5	1.1	58	
600	56.7	5	1.1	63	
550	61.9	5	1.1	69	
500	68.0	5	1.1	74	
450	75.6	9	2.0	87	
400	85.1	9	2.0	96	
350	97.2	9	2.0	108	
300	113.4	9	2.0	124	
250	136.1	9	2.0	147	
200	170.1	9	2.0	181	
175	194.4	9	2.0	205	
150	226.8	9	2.0	236	
120	283.5	9	2.0	294	
100	340.2	9	2.0	351	

GAUGE WIDENING ON CURVES:  
 is 9mm for Curves sharper than 500m radius.  
 is 5mm for Curves of radius from 500m to 1000m and  
 is 0mm for Curves with radius 1000m and above.

End throw (in mm)  $V0 = (125 C^2) / R - (125x C^2) / R; = 34020 / R$

Where 'C' is the distance between bogies centres = 14800+200 = 15000mm or 14800-200 = 14600 mm  
 The worst case will with C = 14600 mm

'C1' is the length of coach in metres = 22.030 m and R is the radius of curve in metres.

COACH LENGTH = 21900 mm  
 FOR DMC IT CAN INCREASE TO = 21985 mm  
 DIFFERENCE IN LENGTH = 85 mm. (THIS INCREASE WILL BE ON ONE SIDE FOR DRIVING CAB)

HALF LENGTH FROM CENTRE OF TWO BOGIES = ((21900 / 2)+65) = 11015 mm  
 LENGTH FOR CALCULATION OF END THROW = 22030 mm  
 (2 x HALF LENGTH FROM CENTRE OF 2 BOGIES)

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 Project Director  
 Approved   
 23/02/22









Bhopal and Indore Metro Rail System  
 Schedule of Dimensions (SOD)

APPENDIX - 3B

CANT EFFECT ON STRUCTURE GAUGE  
 ELEVATED & AT-GRADE (SURFACE SECTION BALLASTLESS TRACK)

REFERENCE DIMENSION NUMBER: MARRC-CORPORATE-22-LAMPAL-CONSTRUCTION-07 AND DRAWN: L-18, 1/27/16 AND 1/33

Cant (mm)	Slope of	Grade (%)	1728		1725		1818		1808		1808		1818		1808													
			GA	HA	GA	HA	GA	HA	GA	HA	GA	HA	GA	HA	GA	HA												
125	0.200	0.200	0.007	0.1	1728.8	8155.2	802.8	265.8	1802.8	1807.1	1807.5	764.1	2000.2	1862.4	2079.8	2778.8	2078.8	1824.6	2038.2	2138.2	1753.8	3327.7	4120.1	2892.4	1722.1	3020.5	4100.8	4284.2
110	0.200	0.200	0.007	0.1	1723.3	8099.8	844.7	250.1	1820.2	1807.4	1807.6	780.0	2001.4	1821.4	2009.8	2768.8	2080.1	1828.8	2031.4	2143.4	1802.8	3327.7	4120.1	2892.4	1726.0	3015.5	4080.6	4287.4
118	0.075	0.075	0.697	0.1	1751.1	8189.4	836.5	272.9	1791.0	1842.0	1956.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
112	0.075	0.075	0.697	0.1	1796.8	8202.0	828.2	275.8	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
102	0.075	0.075	0.697	0.1	1762.0	8171.0	816.2	278.7	1790.0	1842.2	1956.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
105	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
100	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
95	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
90	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
85	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
80	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
75	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
70	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
65	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
60	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
55	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
50	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
45	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
40	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
35	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
30	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
25	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
20	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
15	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
10	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
5	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8
0	0.075	0.075	0.697	0.1	1748.1	8103.1	818.5	282.2	1790.5	1842.7	1958.4	691.3	2027.8	1843.4	2061.1	2765.7	2057.8	1848.0	2021.7	2143.8	1810.7	3327.7	4120.1	2892.4	1730.0	3020.1	4081.1	4290.8

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Project D. ...  
 Approved on ...  
 MPMRCL







Bhopal and Indore Metro Rail System  
 Schedule of Dimensions (SOD)

APPENDIX - 30

UNDERGROUND SECTION (RECTANGULAR BOX TUNNEL) - BALLASTLESS TRACK  
 REFERENCE DRAWING NUMBER: MPMRCL/SOD/INDORE-03-A/SECTION/SECTION/01 AND 01/04 (1:2.5), 1:7.5 & 1:4.2

Chainage from centre line of track to Structure Centre for Bridge	Height above rail level (measured above 50m to track plane) 'x' =		Chainage from centre line of track to Structure Centre for Bridge		Height above rail level (measured above 50m to track plane) 'y' =	
	ET	HT	ET	HT	ET	HT
1480	1474.9	1560.0	1480.0	1560.0	1480.0	1560.0
1475	1474.9	1560.0	1475.0	1560.0	1475.0	1560.0
1470	1474.9	1560.0	1470.0	1560.0	1470.0	1560.0
1465	1474.9	1560.0	1465.0	1560.0	1465.0	1560.0
1460	1474.9	1560.0	1460.0	1560.0	1460.0	1560.0
1455	1474.9	1560.0	1455.0	1560.0	1455.0	1560.0
1450	1474.9	1560.0	1450.0	1560.0	1450.0	1560.0
1445	1474.9	1560.0	1445.0	1560.0	1445.0	1560.0
1440	1474.9	1560.0	1440.0	1560.0	1440.0	1560.0
1435	1474.9	1560.0	1435.0	1560.0	1435.0	1560.0
1430	1474.9	1560.0	1430.0	1560.0	1430.0	1560.0
1425	1474.9	1560.0	1425.0	1560.0	1425.0	1560.0
1420	1474.9	1560.0	1420.0	1560.0	1420.0	1560.0
1415	1474.9	1560.0	1415.0	1560.0	1415.0	1560.0
1410	1474.9	1560.0	1410.0	1560.0	1410.0	1560.0
1405	1474.9	1560.0	1405.0	1560.0	1405.0	1560.0
1400	1474.9	1560.0	1400.0	1560.0	1400.0	1560.0
1395	1474.9	1560.0	1395.0	1560.0	1395.0	1560.0
1390	1474.9	1560.0	1390.0	1560.0	1390.0	1560.0
1385	1474.9	1560.0	1385.0	1560.0	1385.0	1560.0
1380	1474.9	1560.0	1380.0	1560.0	1380.0	1560.0
1375	1474.9	1560.0	1375.0	1560.0	1375.0	1560.0
1370	1474.9	1560.0	1370.0	1560.0	1370.0	1560.0
1365	1474.9	1560.0	1365.0	1560.0	1365.0	1560.0
1360	1474.9	1560.0	1360.0	1560.0	1360.0	1560.0
1355	1474.9	1560.0	1355.0	1560.0	1355.0	1560.0
1350	1474.9	1560.0	1350.0	1560.0	1350.0	1560.0
1345	1474.9	1560.0	1345.0	1560.0	1345.0	1560.0
1340	1474.9	1560.0	1340.0	1560.0	1340.0	1560.0
1335	1474.9	1560.0	1335.0	1560.0	1335.0	1560.0
1330	1474.9	1560.0	1330.0	1560.0	1330.0	1560.0
1325	1474.9	1560.0	1325.0	1560.0	1325.0	1560.0
1320	1474.9	1560.0	1320.0	1560.0	1320.0	1560.0
1315	1474.9	1560.0	1315.0	1560.0	1315.0	1560.0
1310	1474.9	1560.0	1310.0	1560.0	1310.0	1560.0
1305	1474.9	1560.0	1305.0	1560.0	1305.0	1560.0
1300	1474.9	1560.0	1300.0	1560.0	1300.0	1560.0
1295	1474.9	1560.0	1295.0	1560.0	1295.0	1560.0
1290	1474.9	1560.0	1290.0	1560.0	1290.0	1560.0
1285	1474.9	1560.0	1285.0	1560.0	1285.0	1560.0
1280	1474.9	1560.0	1280.0	1560.0	1280.0	1560.0
1275	1474.9	1560.0	1275.0	1560.0	1275.0	1560.0
1270	1474.9	1560.0	1270.0	1560.0	1270.0	1560.0
1265	1474.9	1560.0	1265.0	1560.0	1265.0	1560.0
1260	1474.9	1560.0	1260.0	1560.0	1260.0	1560.0
1255	1474.9	1560.0	1255.0	1560.0	1255.0	1560.0
1250	1474.9	1560.0	1250.0	1560.0	1250.0	1560.0
1245	1474.9	1560.0	1245.0	1560.0	1245.0	1560.0
1240	1474.9	1560.0	1240.0	1560.0	1240.0	1560.0
1235	1474.9	1560.0	1235.0	1560.0	1235.0	1560.0
1230	1474.9	1560.0	1230.0	1560.0	1230.0	1560.0
1225	1474.9	1560.0	1225.0	1560.0	1225.0	1560.0
1220	1474.9	1560.0	1220.0	1560.0	1220.0	1560.0
1215	1474.9	1560.0	1215.0	1560.0	1215.0	1560.0
1210	1474.9	1560.0	1210.0	1560.0	1210.0	1560.0
1205	1474.9	1560.0	1205.0	1560.0	1205.0	1560.0
1200	1474.9	1560.0	1200.0	1560.0	1200.0	1560.0
1195	1474.9	1560.0	1195.0	1560.0	1195.0	1560.0
1190	1474.9	1560.0	1190.0	1560.0	1190.0	1560.0
1185	1474.9	1560.0	1185.0	1560.0	1185.0	1560.0
1180	1474.9	1560.0	1180.0	1560.0	1180.0	1560.0
1175	1474.9	1560.0	1175.0	1560.0	1175.0	1560.0
1170	1474.9	1560.0	1170.0	1560.0	1170.0	1560.0
1165	1474.9	1560.0	1165.0	1560.0	1165.0	1560.0
1160	1474.9	1560.0	1160.0	1560.0	1160.0	1560.0
1155	1474.9	1560.0	1155.0	1560.0	1155.0	1560.0
1150	1474.9	1560.0	1150.0	1560.0	1150.0	1560.0
1145	1474.9	1560.0	1145.0	1560.0	1145.0	1560.0
1140	1474.9	1560.0	1140.0	1560.0	1140.0	1560.0
1135	1474.9	1560.0	1135.0	1560.0	1135.0	1560.0
1130	1474.9	1560.0	1130.0	1560.0	1130.0	1560.0
1125	1474.9	1560.0	1125.0	1560.0	1125.0	1560.0
1120	1474.9	1560.0	1120.0	1560.0	1120.0	1560.0
1115	1474.9	1560.0	1115.0	1560.0	1115.0	1560.0
1110	1474.9	1560.0	1110.0	1560.0	1110.0	1560.0
1105	1474.9	1560.0	1105.0	1560.0	1105.0	1560.0
1100	1474.9	1560.0	1100.0	1560.0	1100.0	1560.0
1095	1474.9	1560.0	1095.0	1560.0	1095.0	1560.0
1090	1474.9	1560.0	1090.0	1560.0	1090.0	1560.0
1085	1474.9	1560.0	1085.0	1560.0	1085.0	1560.0
1080	1474.9	1560.0	1080.0	1560.0	1080.0	1560.0
1075	1474.9	1560.0	1075.0	1560.0	1075.0	1560.0
1070	1474.9	1560.0	1070.0	1560.0	1070.0	1560.0
1065	1474.9	1560.0	1065.0	1560.0	1065.0	1560.0
1060	1474.9	1560.0	1060.0	1560.0	1060.0	1560.0
1055	1474.9	1560.0	1055.0	1560.0	1055.0	1560.0
1050	1474.9	1560.0	1050.0	1560.0	1050.0	1560.0
1045	1474.9	1560.0	1045.0	1560.0	1045.0	1560.0
1040	1474.9	1560.0	1040.0	1560.0	1040.0	1560.0
1035	1474.9	1560.0	1035.0	1560.0	1035.0	1560.0
1030	1474.9	1560.0	1030.0	1560.0	1030.0	1560.0
1025	1474.9	1560.0	1025.0	1560.0	1025.0	1560.0
1020	1474.9	1560.0	1020.0	1560.0	1020.0	1560.0
1015	1474.9	1560.0	1015.0	1560.0	1015.0	1560.0
1010	1474.9	1560.0	1010.0	1560.0	1010.0	1560.0
1005	1474.9	1560.0	1005.0	1560.0	1005.0	1560.0
1000	1474.9	1560.0	1000.0	1560.0	1000.0	1560.0

Examined & found in order  
 Date: \_\_\_\_\_  
 Signature: \_\_\_\_\_  
 Authority: \_\_\_\_\_







Bhopal and Indore Metro Rail System  
Schedule of Dimensions (SOD)

APPENDIX - 3D

CANT EFFECT ON KINEMATIC ENVELOPE - HORIZONTAL  
AT-GRADE (SURFACE) SECTION (BALLASTED TRACK)

REFERENCE DRAWING NUMBER: MPMRCL/DESIGN/INDO-01 & MPMRCL/DESIGN/INDO-01 AND PART 1.0.1

All figures in mm

Height above rail level measured above track to track plane 'V' m	348				907				2026				3215				4014				4390								
	F	H1	H2	H3	F	H1	H2	H3	F	H1	H2	H3	F	H1	H2	H3	F	H1	H2	H3	F	H1	H2	H3					
1351	0.083	0.074	0.067	0.061	18.154	18.817	541.4	277.2	1684.7	1624.2	1109.3	832.4	644.3	1608.3	2231.1	1951.9	1652.8	1401.0	3021.9	2322.4	1953.7	867.8	4294.3	3881.1	1644.2	887.4	6249.2	4146.8	
1350	0.083	0.074	0.067	0.061	18.477	18.592	533.7	286.1	1682.1	1632.1	1092.7	835.3	633.8	1615.9	2233.5	1952.9	1643.2	1415.0	3024.0	2328.4	1954.7	867.8	4294.3	3881.1	1644.2	887.4	6249.2	4146.8	
115	0.078	0.078	0.087	0.077	18.13.0	18.81.0	628.0	283.0	1678.9	1641.1	1085.1	838.6	633.8	1615.9	2233.5	1952.7	2218.0	1384.1	1923.8	1430.4	3047.4	3233.3	1527.7	875.1	4153.3	3848.2	1536.9	4238.4	4182.2
110	0.073	0.073	0.097	0.073	18.13.2	18.67.4	618.3	285.5	1678.9	1644.3	1077.4	841.7	627.1	1620.9	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
105	0.070	0.070	0.098	0.070	18.12.4	18.63.8	610.6	287.0	1674.3	1641.0	1069.8	844.8	628.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
100	0.068	0.068	0.098	0.067	18.11.6	18.60.4	602.9	291.0	1671.6	1641.3	1062.3	847.8	627.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
95	0.064	0.064	0.098	0.063	18.10.8	18.58.6	485.2	294.4	1663.0	1644.4	1054.8	845.0	626.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
90	0.060	0.060	0.098	0.060	18.09.1	18.56.8	479.7	300.2	1663.0	1661.3	1038.1	852.0	625.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
85	0.053	0.053	0.098	0.053	18.08.2	18.57.3	472.0	303.0	1662.9	1662.9	1031.5	853.0	624.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
80	0.049	0.049	0.098	0.049	18.07.3	18.57.2	464.3	305.8	1662.9	1664.8	1024.8	853.0	623.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
75	0.046	0.046	0.098	0.046	18.06.4	18.57.1	456.6	308.7	1662.9	1667.1	1018.0	853.0	622.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
70	0.043	0.043	0.098	0.043	18.05.5	18.57.0	448.9	311.6	1662.9	1671.4	1011.3	853.0	621.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
65	0.040	0.040	0.098	0.040	18.04.6	18.56.9	441.1	314.5	1662.9	1677.6	1004.6	852.0	620.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
60	0.037	0.037	0.098	0.037	18.03.7	18.56.8	433.4	317.5	1662.9	1683.7	998.0	851.0	619.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
55	0.033	0.033	0.098	0.033	18.02.7	18.56.7	425.7	320.5	1662.9	1690.0	992.0	850.0	618.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
50	0.030	0.030	0.098	0.030	18.01.7	18.56.6	418.0	323.5	1662.9	1696.3	986.0	849.0	617.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
45	0.027	0.027	0.098	0.027	18.00.7	18.56.5	410.3	326.5	1662.9	1702.6	980.0	848.0	616.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
40	0.023	0.023	0.098	0.023	17.59.7	18.56.4	402.6	329.5	1662.9	1708.9	974.0	847.0	615.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
35	0.021	0.021	0.098	0.021	17.58.7	18.56.3	394.9	332.4	1662.9	1715.2	968.0	846.0	614.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
30	0.020	0.020	0.098	0.020	17.57.8	18.56.2	387.2	335.4	1662.9	1721.5	962.0	845.0	613.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
25	0.017	0.017	0.098	0.017	17.56.8	18.56.1	379.5	338.4	1662.9	1727.8	956.0	844.0	612.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
20	0.013	0.013	0.098	0.013	17.55.8	18.56.0	371.8	341.4	1662.9	1734.1	950.0	843.0	611.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
15	0.010	0.010	0.098	0.010	17.54.8	18.55.9	364.1	344.4	1662.9	1740.4	944.0	842.0	610.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
10	0.007	0.007	0.098	0.007	17.53.8	18.55.8	356.4	347.4	1662.9	1746.7	938.0	841.0	609.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
5	0.003	0.003	0.098	0.003	17.52.8	18.55.7	348.7	350.4	1662.9	1753.0	932.0	840.0	608.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	
0	0.000	0.000	0.098	0.000	17.51.7	18.55.6	341.0	353.4	1662.9	1759.3	926.0	839.0	607.0	1620.0	2200.4	1962.7	1621.2	1432.0	3040.0	2334.2	1934.7	848.7	4141.7	3848.2	1536.9	4238.4	4182.2	4184.7	

$H = (h_0 + (h_1 - h_0) \frac{x}{L})$   
 $F1 = (f_0 + (f_1 - f_0) \frac{x}{L})$   
 $H1 = (h_1 + (h_2 - h_1) \frac{x - x_1}{x_2 - x_1})$   
 $H2 = (h_2 + (h_3 - h_2) \frac{x - x_1 - x_2}{x_3 - x_1 - x_2})$   
 $H3 = (h_3 + (h_4 - h_3) \frac{x - x_1 - x_2 - x_3}{x_4 - x_1 - x_2 - x_3})$   
 Note: A distance from inclined centre line of vehicle to structure change for horizontal track at height 'V' from rail level in the direction parallel to the line joining the top of rails.



Prepared by: *[Signature]*  
 Checked by: *[Signature]*  
 Approved by: *[Signature]*  
 Date: \_\_\_\_\_





Bhopal and Indore Metro Rail System  
 Schedule of Dimensions (SOD)

APPENDIX - 3E

BI-LEVELLED AND AT-GRADE (SURFACE) SECTION - BALLASTLESS TRACK

REFERENCE DIMENSIONS FOLLOWING: MPMRCL/INDORE/2019/30/14/SOD/BHOPAL-INDORE/30/14/SECTION-3E/APPENDIX-3E/DIMENSIONS

All figures in mm

Height above rail level measured above track to track centre line	1451		1688		2878		3298		4014		4200	
	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2
126	0.017	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
130	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
115	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
110	0.017	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
105	0.017	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
100	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
95	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
90	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
85	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
80	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
75	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
70	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
65	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
60	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
55	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
50	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
45	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
40	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
35	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
30	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
25	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
20	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
15	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
10	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
5	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
0	0.016	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017

*Handwritten signature*

Auth. Sign : Director/Civil Engineering







MPMRCL

Bhopal and Indore Metro Rail System  
Schedule of Dimensions (SOD)

APPENDIX -3F

UNDERGROUND SECTION (RECTANGULAR BOX TUNNEL) BALLASTLESS TRACK  
REF: SCHEDULE DIMENSIONS NUMBER: MPMRCL/SOD/BHOPAL-INDORE/30/14/MPMRCL/SOD/BHOPAL-INDORE/30/14

Chain km	Jangle m	Slo %	Cov %	Tm %	346		895		2005		2297		4188		4280													
					E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2								
120	0.083	0.083	0.097	0.003	1474.9	1417.1	635.7	289.9	1544.8	1495.3	1065.1	823.7	1862.7	1504.1	2072.2	2002.4	1886.0	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
120	0.080	0.080	0.097	0.000	1474.1	1418.7	632.4	281.4	1544.2	1495.7	1072.7	820.7	1863.0	1504.1	2072.2	2002.4	1886.0	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
115	0.070	0.070	0.097	0.017	1473.0	1420.2	615.2	283.8	1540.7	1493.1	1070.2	820.8	1864.4	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
110	0.070	0.070	0.097	0.017	1473.0	1420.2	615.2	283.8	1540.7	1493.1	1070.2	820.8	1864.4	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
105	0.070	0.070	0.098	0.010	1471.2	1423.2	608.3	289.2	1537.1	1492.6	1072.8	825.2	1865.2	1504.1	2071.3	2001.3	1886.1	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
100	0.065	0.065	0.098	0.007	1470.9	1424.7	603.3	290.9	1531.9	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
95	0.062	0.062	0.098	0.003	1470.2	1428.2	600.2	303.3	1528.3	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
90	0.060	0.060	0.098	0.000	1469.2	1427.8	597.8	305.7	1527.8	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
85	0.056	0.056	0.098	0.005	1467.4	1430.9	592.4	310.5	1526.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
80	0.053	0.053	0.099	0.002	1467.4	1430.9	592.4	310.5	1526.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
75	0.048	0.048	0.099	0.000	1465.5	1431.9	587.5	312.9	1525.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
70	0.046	0.046	0.099	0.007	1465.5	1433.3	582.0	315.2	1524.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
65	0.043	0.043	0.099	0.004	1464.7	1434.6	577.1	317.6	1523.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
60	0.040	0.040	0.099	0.000	1463.7	1435.0	572.0	320.1	1522.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
55	0.037	0.037	0.099	0.007	1462.7	1435.7	567.1	322.2	1521.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
50	0.033	0.033	0.099	0.003	1461.7	1435.7	562.0	324.2	1520.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
45	0.030	0.030	1.000	0.000	1460.7	1435.0	557.0	327.0	1519.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
40	0.027	0.027	1.000	0.000	1459.7	1434.1	552.0	329.4	1518.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
35	0.023	0.023	1.000	0.000	1458.7	1433.3	547.0	331.7	1517.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
30	0.020	0.020	1.000	0.000	1457.6	1432.5	542.0	334.0	1516.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
25	0.017	0.017	1.000	0.000	1456.6	1431.6	537.0	336.3	1515.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
20	0.013	0.013	1.000	0.000	1455.6	1430.7	532.0	338.6	1514.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
15	0.010	0.010	1.000	0.000	1454.6	1429.8	527.0	340.9	1513.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
10	0.007	0.007	1.000	0.000	1453.6	1428.9	522.0	343.2	1512.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
5	0.000	0.000	1.000	0.000	1452.6	1428.0	517.0	345.5	1511.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0
0	0.000	0.000	1.000	0.000	1451.6	1427.1	512.0	347.8	1510.0	1491.6	1071.1	824.7	1864.8	1504.1	2070.8	2001.8	1885.6	1360.7	2472.3	2070.1	1071.9	831.2	4387.5	4124.0	1165.5	468.9	4316.0	4190.0

ET = (Ld + Ph x sin α) / g x cos α  
 F1 = (Ca / Z) x (sin α + γ) / (γ x tan α + c / γ)  
 F2 = (Ca / Z) x (sin α + γ) / (γ x tan α + c / γ)  
 α = Dip of the ground surface  
 γ = Unit weight of the soil  
 c = Cohesion  
 Z = Distance from the centre line of the track to the toe of the slope  
 Ld = Distance from the centre line of the track to the toe of the slope  
 Ph = Horizontal distance from the centre line of the track to the toe of the slope  
 γ = Unit weight of the soil  
 tan α = Tangent of the angle of the slope  
 cos α = Cosine of the angle of the slope  
 sin α = Sine of the angle of the slope







Bhopal and Indore Metro Rail System  
Schedule of Dimensions (SOD)

APPENDIX - 4						
LATERAL AND VERTICAL SHIFT OF CENTRE OF CIRCULAR TUNNEL FOR DIFFERENT CANT VALUES						
REFERENCE DRAWING NUMBER: MPMRCL/GEN/SOD/IND-04 AND PARAs 1.7.1 B & 1.7.2 B						
Tan(q) = (r-D)/(G/2) 2.707365627			Radius of circular tunnel 'r' = 2800			
q in radians 1.216977044			Height from invert to rail level 'D <sub>1</sub> ' = 760			
Cant	sin α	α	Angle Pi/2-θ-α/2	Lateral shift of tunnel centre =X	Vertical shift of tunnel centre =Y	Remarks
mm		radians	radians	mm	mm	
125	0.082946251	0.0830418593	0.3123	172	55	(A). THE CANT IS PROVIDED BY ROTATING THE TUNNEL ABOUT THE MID POINT OF TOP OF INNER RAIL, THIS WILL RESULT IN LATERAL AND VERTICAL SHIFT OF THE CENTRE OF THE CIRCULAR TUNNEL
120	0.076828401	0.0797127915	0.3140	165	54	
115	0.076310551	0.0783848087	0.3155	158	52	
110	0.072992701	0.0730578733	0.3173	151	50	(B). LATERAL SHIFT OF THE CENTRE OF THE TUNNEL (TOWARDS INSIDE OF CURVE) IS
105	0.069674851	0.0697313480	0.3190	144	48	
100	0.066357001	0.0664057952	0.3206	137	46	
95	0.063039151	0.0630809777	0.3223	130	43	X = [ [ 2 x (r-D <sub>1</sub> /sinθ) x sin (α/2) ] x cos(90-θ-α/2)
90	0.059721301	0.0597568584	0.3239	123	41	
85	0.056403451	0.0564334000	0.3256	116	39	
80	0.053085601	0.0531105655	0.3273	109	37	(C). VERTICAL SHIFT OF THE CENTRE OF THE TUNNEL (UPWARDS) IS
75	0.049767750	0.0497883178	0.3289	102	35	
70	0.046449900	0.0464666200	0.3306	96	33	
65	0.043132050	0.0431454353	0.3322	89	31	Y = [ [ 2 x (r-D <sub>1</sub> /sinθ) x sin(α/2) ] x sin(90-θ-α/2)
60	0.039814200	0.0398247266	0.3339	82	28	
55	0.036496350	0.0365044573	0.3356	75	26	
50	0.033178500	0.0331845906	0.3372	68	24	where, Y is internal radius of the circular tunnel = 2800mm D <sub>1</sub> ' is the depth from rail level to invert of circular tunnel.
45	0.029860650	0.0298650897	0.3389	61	22	
40	0.026542800	0.0265459179	0.3405	54	19	
35	0.023224950	0.0232270387	0.3422	48	17	θ' is the angle of rotation = sin <sup>-1</sup> (Cant /G) and θ is angle subtended by line joining top of two rails and the line joining mid point of top of inner rail and the centre of circular Tunnel.
30	0.019907100	0.0199084153	0.3439	41	15	
25	0.016589250	0.0165900112	0.3455	34	12	
20	0.013271400	0.0132717697	0.3472	27	10	= (tan <sup>-1</sup> ((r-D <sub>1</sub> )/(G/2)) in degrees = 59.752267 G = Centre to centre of rails = 1507mm
15	0.009953550	0.0099537145	0.3488	20	7	
10	0.006635700	0.0066357488	0.3505	14	5	
5	0.003317850	0.0033178561	0.3522	7	2	
0	0.000000000	0.0000000000	0.3538	0	0	



Examined & Found in order  
Date

Auth. Sign. : Director/Construction





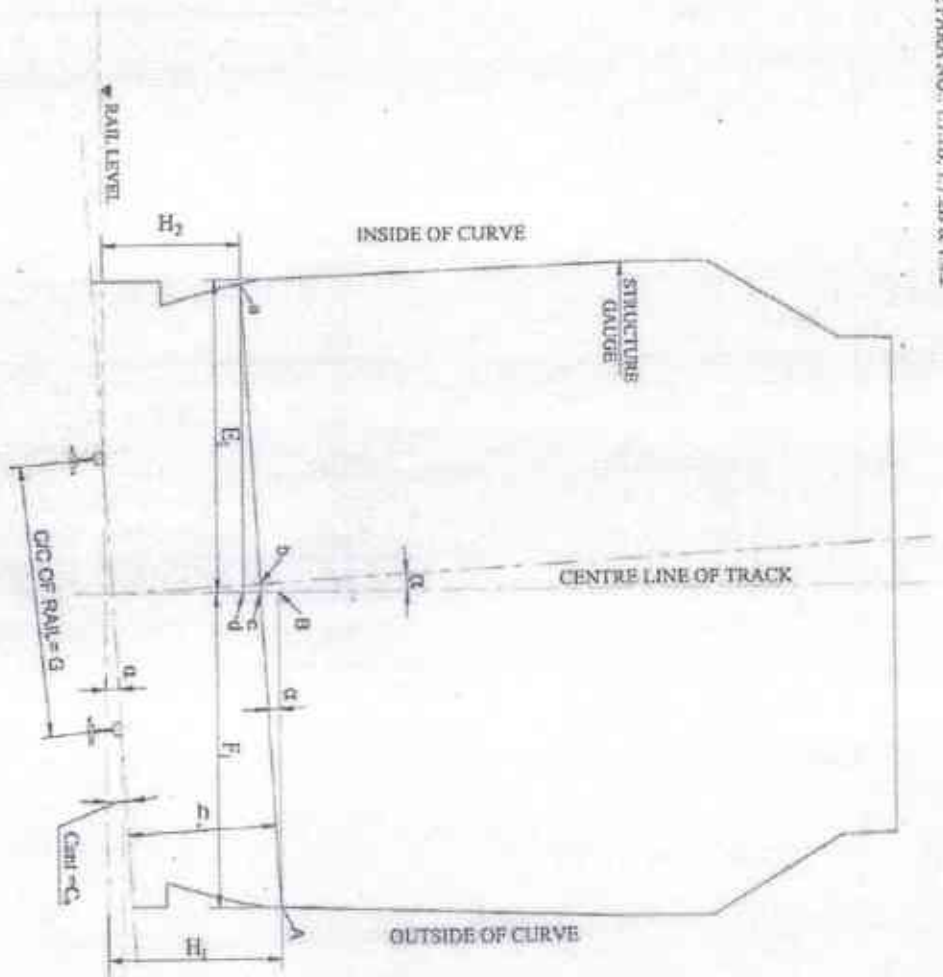
APPENDIX - 5 ADDITIONAL CLEARANCE FOR PLATFORMS ON CURVES UNDERGROUND, ELEVATED AND SURFACE SECTIONS (REFERENCE PARA 2.7)				
Radius R	Cant	Extra clearance for passenger platform		Remarks
		Inside of Curve	Outside of Curve	
m	mm	mm	mm	Extra Clearance for Curves.
1000	0	28	34	(A). Inside of Curve = $\text{Midthrow} = 28125/R$ (B). Outside of Curve = $\text{Endthrow} = 34020/R$ .  Please see Appendix 2A, 2B, 2C & 2D.  Additional sway (nosing effect) has been neglected in the calculations as a measure of additional safety to passengers.
1100	0	26	31	
1200	0	23	28	
1300	0	22	26	
1500	0	19	23	
1750	0	16	19	
2000	0	14	17	
2500	0	11	14	
3000	0	9	11	
5000	0	6	7	



Examined & Found in order  
 Date 23/02/23  
 Auth. Sign: Director (Civil) MPMRCL



REFERENCE PARA NO.: L7.1B, L7.2B & L8.2



- NOTE:
1. STRUCTURE GAUGE FOR AT-GRADE/LEVEL/INVERTED SECTION HAS BEEN SHOWN AS A TYPICAL PROFILE.
  2. THE FORMULA FOR E, F, G, H, AND I, IS SHOWN THIS PROFILE WILL ALSO APPLY TO UNDER GROUND BOX TUNNELS.
  3. KINEMATIC ENVELOPE IS VALID FOR THE MAXIMUM SPEED OF 90 KM/HR. WIND SPEED OF 100 KM/HR.
  4. MAXIMUM ENDSH/ARE/CANT (CA) = 110 MM, MAXIMUM DESIRABLE CANT DEFICIENCY (CD) = 85 MM.

also Ab= Distance from centreline of track to structure gauge for tangent track at height 'h'

sin  $\alpha$  = cant/g

G= 1507mm

Cant= Cant applied

B= [ab+bx tan  $\alpha$ ] x cos  $\alpha$

F= [ab-bx tan  $\alpha$ ] x cos  $\alpha$

H= (Ga/2)+(b/cos  $\alpha$ )+(Ab-bx tan  $\alpha$ ) x sin  $\alpha$

H<sub>2</sub>= (Ga/2)+(b/cos  $\alpha$ )-(Ab-bx tan  $\alpha$ ) x sin  $\alpha$

For values of E, F, G, H, and I, refer to Appendix 3A, 3B & 3C.



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 Date: 23/01/23

Auth. Sign: *[Signature]*



LEGEND

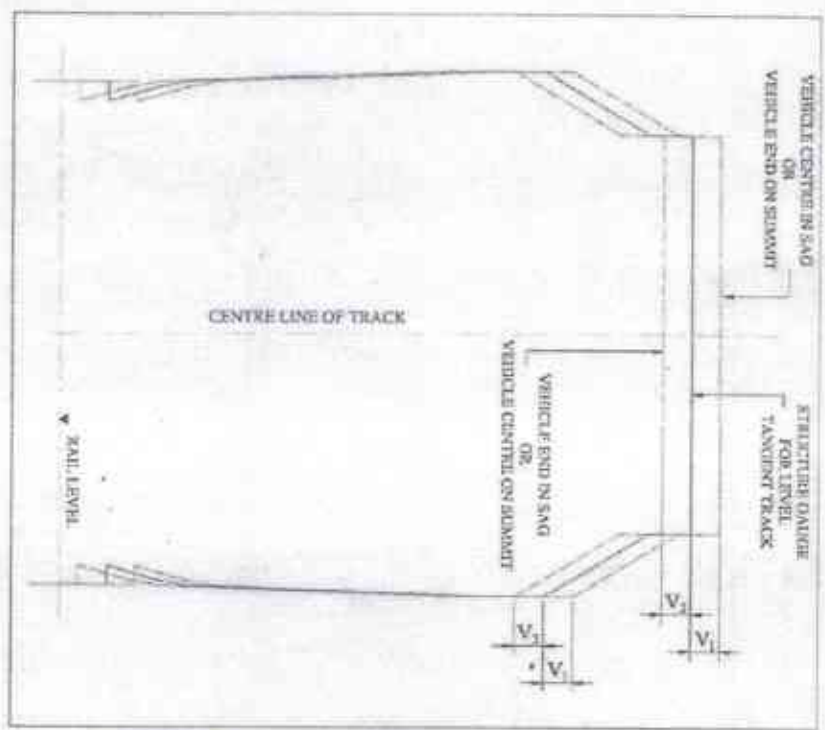
NO.	DESCRIPTION	SYMBOL
1	RAIL LEVEL	—
2	STRUCTURE GAUGE	—

DB GEODATA Louis Berger  
 GEODATA  
 Louis Berger

MPMETRO

MPMRCL  
 EFFECT OF CANT ON STRUCTURE GAUGE  
 TYPICAL

REFERENCE PARA NO: 1710 AL 7.2C



*Handwritten:* **Radius**

Examined & found in order  
 Date \_\_\_\_\_  
 Auth. Sign: \_\_\_\_\_

- V1 = 125 x C/R
- V2 = (125 x C/R) - (125 x C/R)
- C = BRIDGE CENTRE DISTANCE
- CI = COACH LENGTH



NOTES  
 1. THE FIGURE IS TYPICAL AND WILL APPLY TO ISOMER GRADIENT ELEVATED AND AT-GRADE SECTIONS.  
 2. VALID FOR MAXIMUM SPEED OF 90 KM/HR.

RADIUS OF VERTICAL CURVE (M)	VERTICAL THROW	
	V <sub>1</sub> (mm)	V <sub>2</sub> (mm)
1500	15	22
1600	15	23
1700	17	25
1800	16	18
1900	15	18
2000	16	17
2100	16	16
2200	12	15
2300	12	15
2400	12	14
2500	11	14
2600	11	13
2700	11	12
2800	10	12
2900	10	12
3000	10	11

1	REVISION	NO.	DATE
2			
3			
4			
5			
6			
7			
8			
9			
10			

**DB** GEODATA  
 28 Engineering & Consulting GmbH - CHINAKI, KENNEDY BRIDGE, 104A - 104B, Berlin, GERMANY

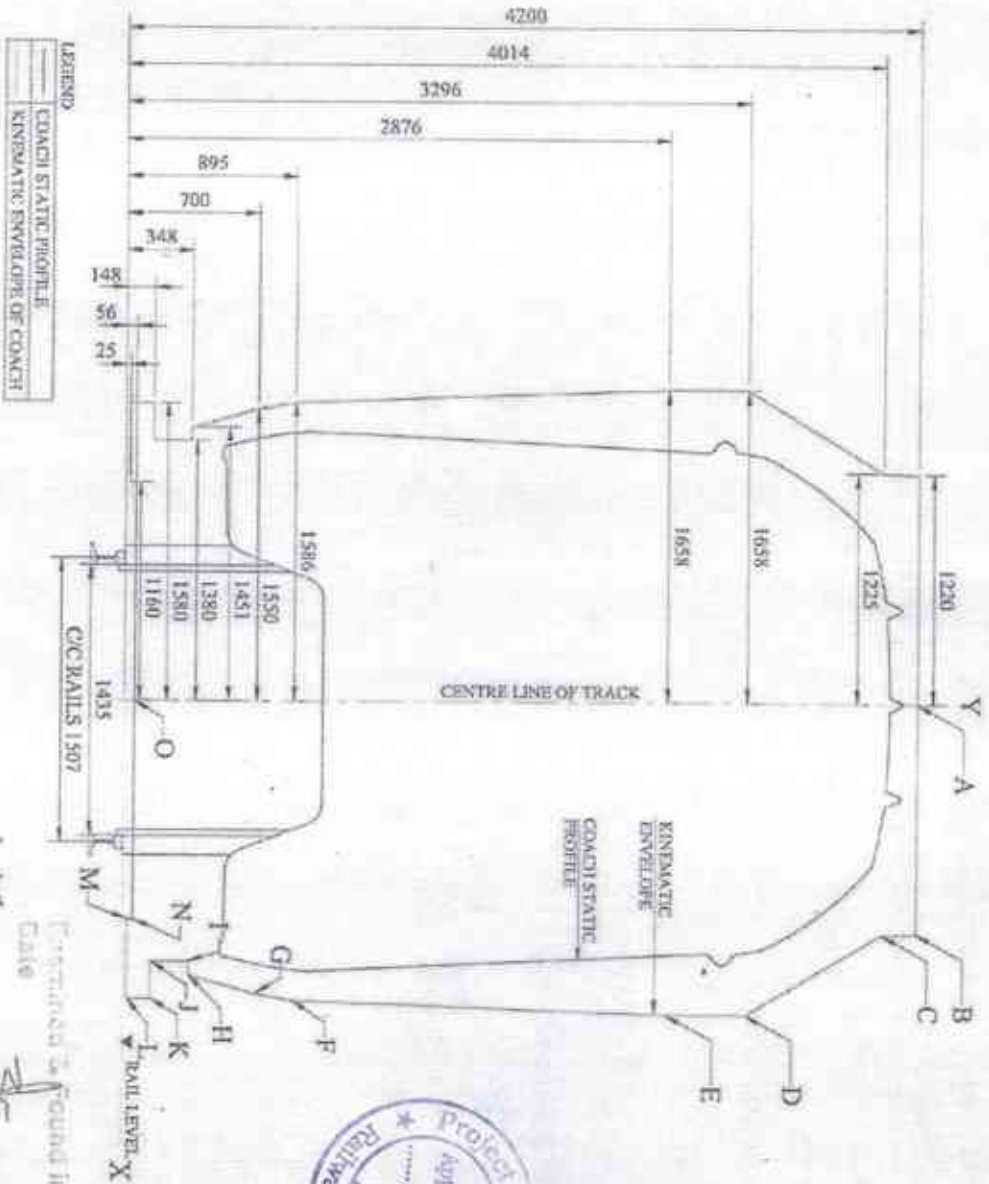
**MPMETRO**

MAHARAJA WILKINSON BUILDING, 606, CROSSING 17B  
 EFFECT OF VERTICAL CURVE ON STRUCTURE GAUGE





REFERENCE PARK NO. 15



- NOTES:
1. ALL DIMENSIONS ARE IN mm.
  2. HORIZONTAL AND VERTICAL ALLOWANCE DUE TO CURVES, INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA.
  3. KINEMATIC ENVELOPES VALID FOR VEHICLES WITH SEMI-RIGID WINDSCREENS AND CLOSED DOORS WHEN IN MOTION.
  4. A TYRE OR ATTACHMENT OF A WHEEL MAY PRODUCE BELOW THE MINIMUM HEIGHT OF KINEMATIC ENVELOPE FOR A DISTANCE OF 51 mm, INSIDE AND 216 mm OUTSIDE OF THE GAUGE FACE OF THE RAIL.
  5. THE KINEMATIC ENVELOPE IS FOR A DESIGN SPEED OF 90 KM/PH WITH A WIND SPEED 160 KM/PH.
  6. COACH SIZE WIDTH=2000 mm AND HEIGHT=4120 mm.

CO-ORDINATES		
SL.NO.	X	Y
A	0	4200
B	1220	4200
C	1225	4214
D	1658	2166
E	1658	2000
F	1586	895
G	1550	700
H	1451	348
I	1380	348
J	1380	148
K	1380	148
L	1580	25
M	1400	25
N	1400	56
O	0	56

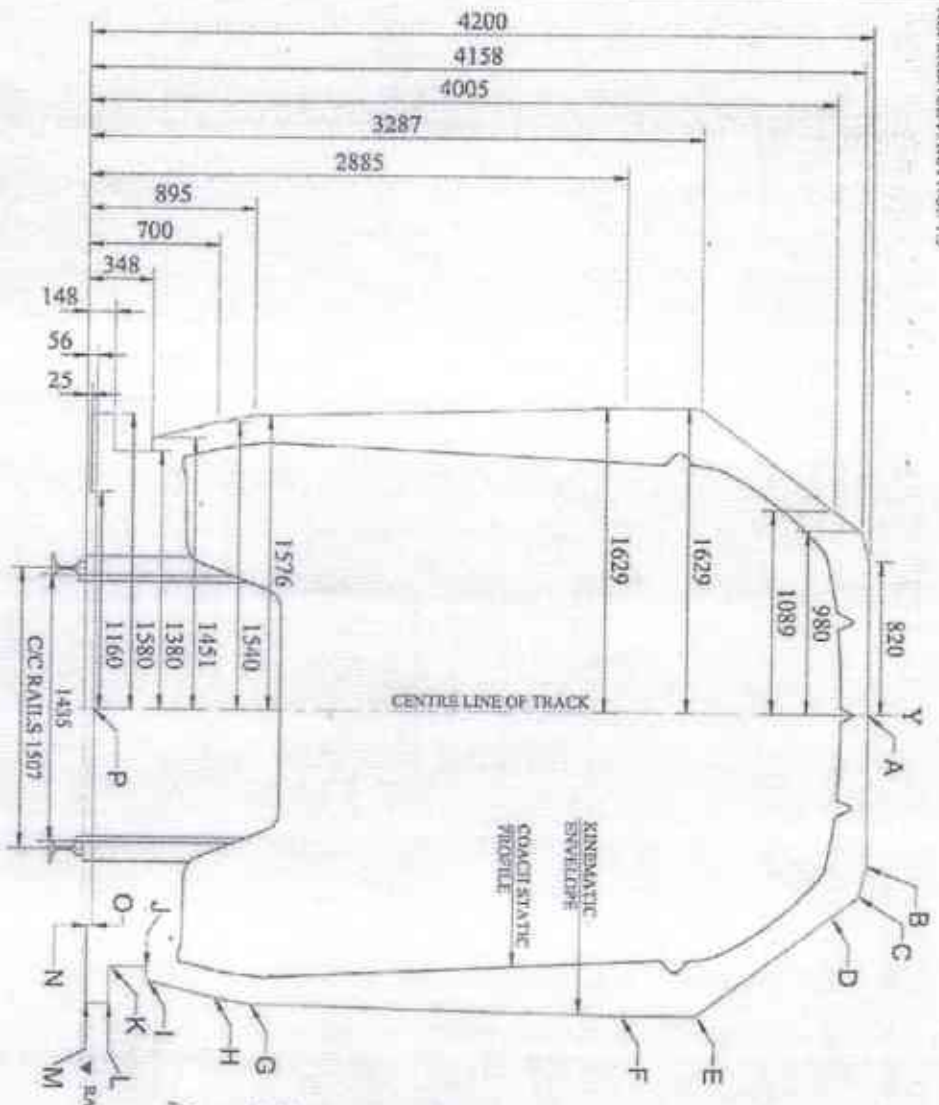
Sl. No.	Particulars	Quantity	Unit
1	...	...	...
2	...	...	...
3	...	...	...
4	...	...	...
5	...	...	...
6	...	...	...
7	...	...	...
8	...	...	...
9	...	...	...
10	...	...	...

DB GEODATA  
 100% Empowered by a Proven Model - GEODATA & Engineering Team - Local Support 24x7  
 Loyal Bengali

MPMETRO  
 MADHYA PRADESH METRO RAIL CORP. LTD.  
 PROJECT NO. ...  
 SHEET NO. ...



REFERENCE PARA NO. 13



LEGEND  
 COACH STATIC PROFILE  
 KINEMATIC ENVELOPE OF COACH

NO.	DESCRIPTION	SCALE	DATE
1	Profile	1:1	
2	Envelope	1:1	
3	Envelope	1:1	
4	Envelope	1:1	
5	Envelope	1:1	
6	Envelope	1:1	
7	Envelope	1:1	
8	Envelope	1:1	
9	Envelope	1:1	
10	Envelope	1:1	

CENTRE LINE OF TRACK

KINEMATIC ENVELOPE  
 COACH STATIC PROFILE

Examined & Found in order  
 Date \_\_\_\_\_  
 Auth. Sign: Director Civil Engineering  
 X

- NOTES:-
1. ALL DIMENSIONS ARE IN mm.
  2. HORIZONTAL AND VERTICAL CLEARANCE DUE TO CURVES INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA.
  3. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION.
  4. A TYRE SR ATTACHMENT OR A WHEEL MAY PROJECT BELOW THE MINIMUM HEIGHT OF KINEMATIC ENVELOPE FOR A DISTANCE OF 51 mm INSIDE AND 216 mm OUTSIDE OF THE GAUGE FACE OF THE RAIL.
  5. KINEMATIC ENVELOPE IS VALID FOR THE MAXIMUM SPEED OF 90 kmph AND SIDE WIND SPEED OF 42 kmph AND RAINY SHED WIND REPRESENTS 100% PROVISION.
  6. CONSIDERED AS IMPERMISSIBLE EFFECT. COACH SIZE WIDTH=2900 mm. AND HEIGHT=4120 mm.

SL. NO.	X	Y
A	0	4200
B	820	4200
C	880	4158
D	2020	4200
E	1629	2187
F	1629	2185
G	1576	2000
H	1540	1900
I	1451	1448
J	1380	1180
K	1380	118
L	1590	108
M	1580	25
N	1160	25
O	1160	55
P	0	58



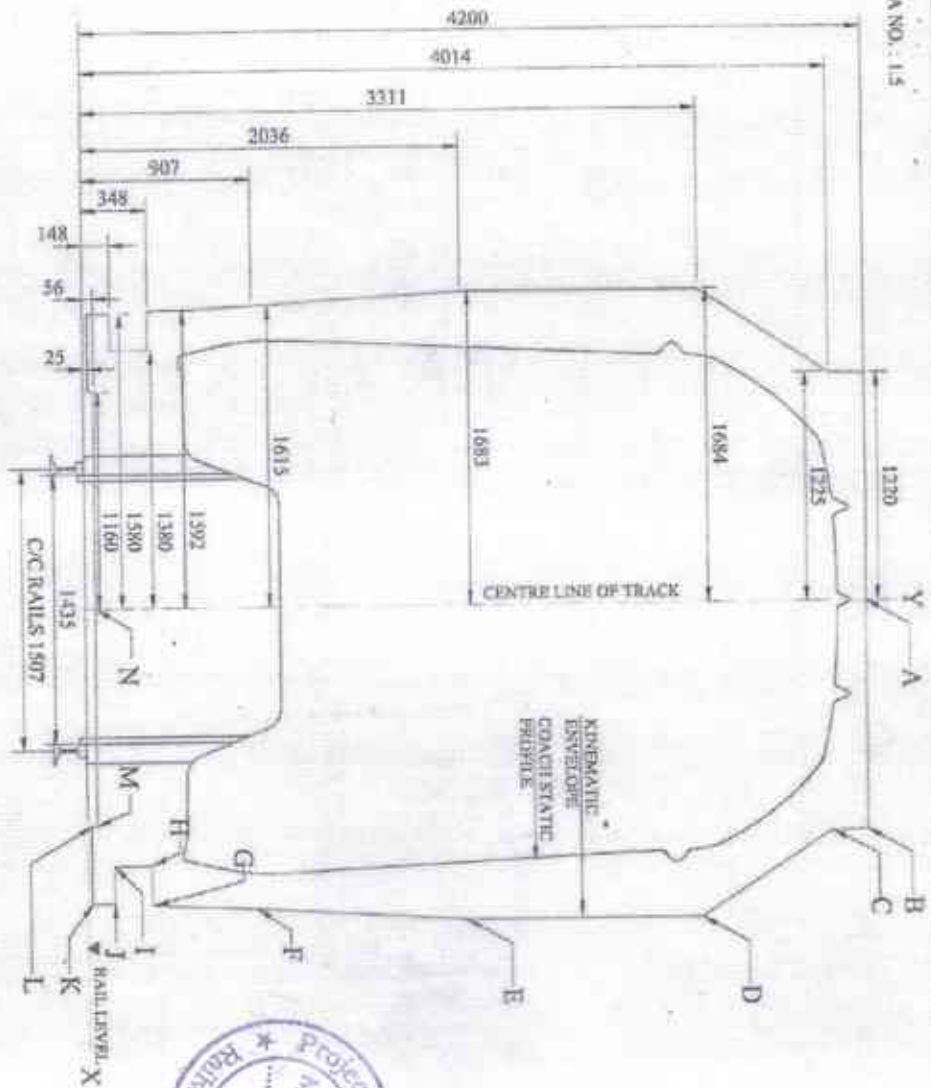
DB CEDATA  
 DB Engineering & Consulting India Pvt. Ltd. Lucknow, India

MPMRC  
 MPMETRO

MPMRC PROJECT NO. MPMRC/170  
 SHEET NO. 01 OF 01  
 DRAWING TITLE: COACH STATIC PROFILE AND KINEMATIC ENVELOPE OF COACH  
 PROJECT NO: 2019/Proj./MPMRC/SOD/BHOPAL-INDORE/30/14  
 DRAWING NO: 1366705/2023/O/o DD(Project)



REFERENCE PARA NO. : 15



LARGED)  
COACH STATIC PROFILE  
KINEMATIC ENVELOPE OF COACH

Sl. No.	Particulars	Quantity	Unit	Remarks
1	...	...	...	...
2	...	...	...	...
3	...	...	...	...
4	...	...	...	...
5	...	...	...	...
6	...	...	...	...
7	...	...	...	...
8	...	...	...	...
9	...	...	...	...
10	...	...	...	...

Examined & Found in order  
Date \_\_\_\_\_  
Place \_\_\_\_\_

DB GEODATA Louis Berger  
DB Engineering & Consulting GmbH - (Germany), Engineering & Consulting India Pvt. Ltd.

MPMETRO

MPMRCL  
M.P. Railway Corporation Ltd.

Project D.  
Approved by  
Railway Board

SL.NO.	X	Y
A	4200	4200
B	3220	4200
C	1220	4014
D	1684	3311
E	1683	2036
F	1615	907
G	1592	348
H	1380	148
I	1380	56
J	1580	25
K	1580	25
L	1160	25
M	1160	25
N	1435	25

- NOTES:
1. ALL DIMENSIONS ARE IN mm.
  2. HORIZONTAL AND VERTICAL CLEARANCES ARE TO CURVES, INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA.
  3. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND CLOSED DOORS WHILE IN MOTION.
  4. COACH SIZE WIDTH-2990 mm AND HEIGHT-4120 mm.
  5. THE KINEMATIC ENVELOPE IS FOR A DESIGN SPEED OF 90 KMPH WITH MAXIMUM PERMISSIBLE TOLLENANCE FOR TRACK AND SIGNALING STOCK FOR WIND SPEED OF 100 KMPH.

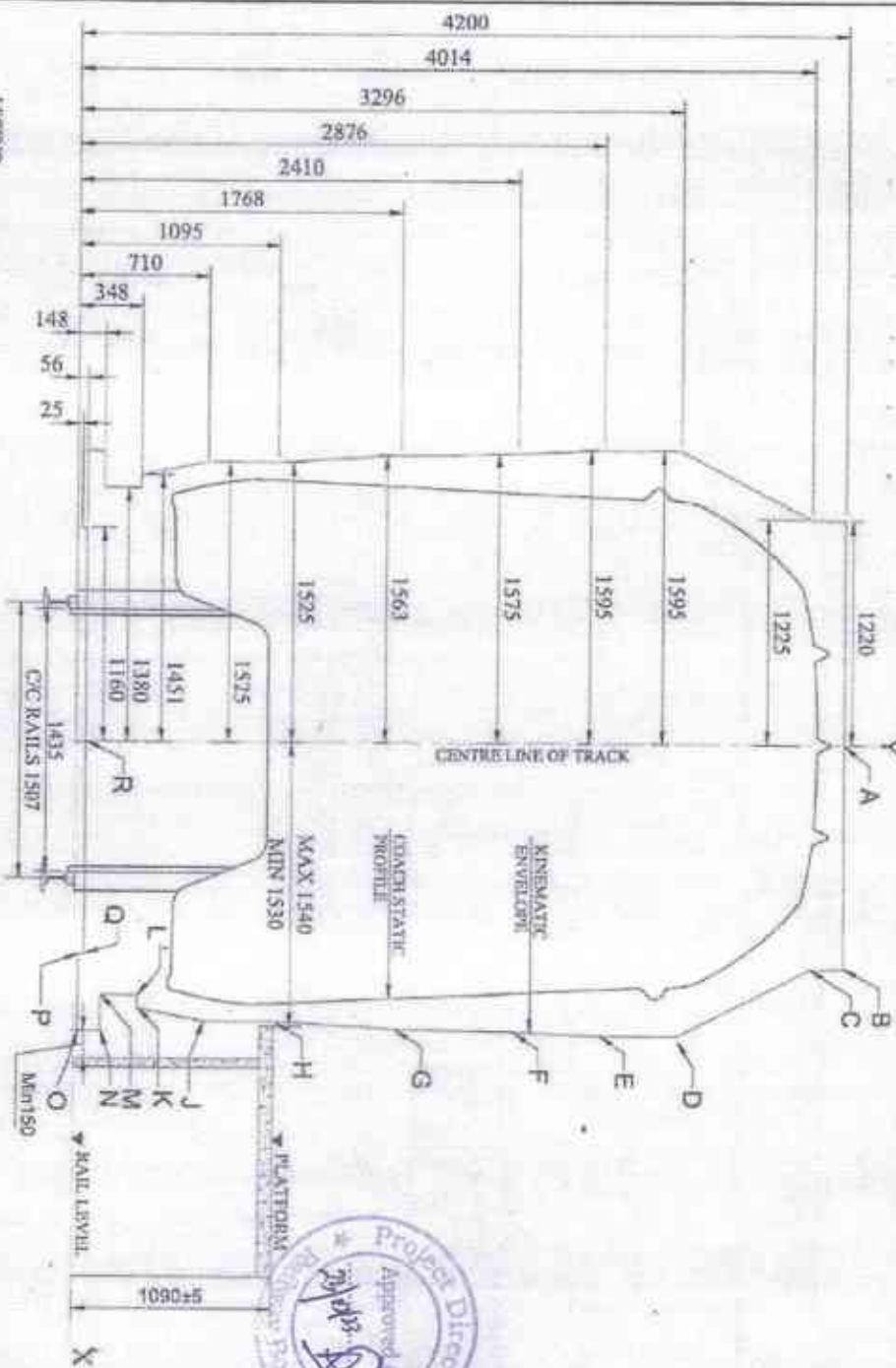
MOTVA PRADESH WATTO INK CORR. LTD.

MPMRCL

Page No. 38 of 78



REFERENCE PARA NO. 15



LEGEND  
 COACH STATIC PROFILE  
 KINEMATIC ENVELOPE OF COACH

Sl. No.	Part	Material	Quantity	Remarks
1	Steel	MS		
2	Aluminum	AL		
3	Wood	W		
4	Paint	P		
5	Welding	W		
6	Other	O		
7	Assembly	A		
8	Transport	T		
9	Storage	S		
10	Disposal	D		

DB GEODATA Louis Berger  
 DB Engineering & Consulting GmbH, UDAKOTA V. Srinivasan, K.A. 1, New, Bangalore, KA

MPMETRO

Project Directorate  
 Approved for  
 20/03/23

- NOTES
1. ALL DIMENSIONS ARE IN mm.
  2. HORIZONTAL AND VERTICAL CLEARANCE DUE TO CURVES INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA.
  3. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION.
  4. KINEMATIC ENVELOPE IS VALID FOR 70 KM/H OPERATING SPEED & WIND SPEED OF 70 KM/H FOR ELEVATED & AT GRADE PLATFORM.
  5. COACH SIZE WIDTH- 2968 mm AND HEIGHT- 4120 mm.

Sl. No.	X	Y
A	0	4200
B	1220	4200
C	1225	4014
D	1595	4014
E	1575	3276
F	1525	2410
G	1563	1768
H	1525	1095
I	1435	710
J	1481	348
K	1380	248
L	1380	148
M	1380	148
N	1160	25
O	1160	25
P	1160	25
Q	1435	96
R	1435	96

MPMRCL  
 M.P. Prasad  
 M.P. Prasad

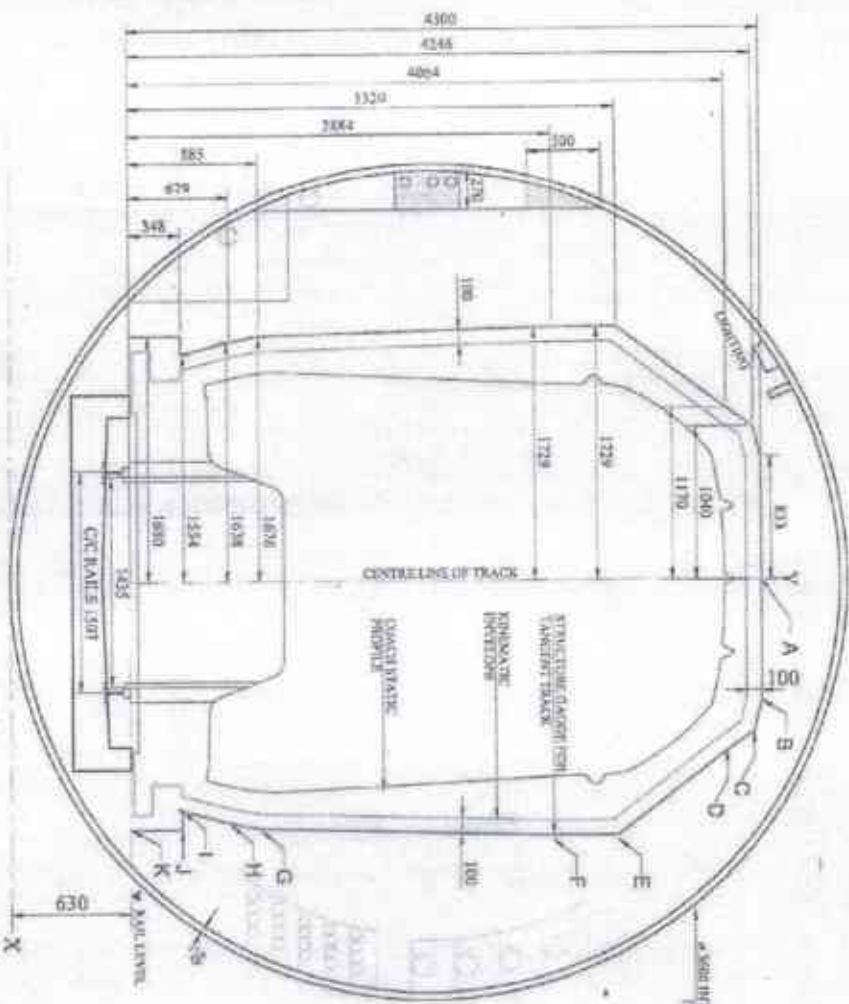
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 Date  
 Auth. Sign. & Project/Contract UTR No.







REFERENCE PARA NO. 1A(1) & 1A1



CIRCULAR TUNNEL 5500mm DIA

LISTED IN:

1	CONCRETE STRUCTURE
2	STEEL STRUCTURE
3	WOODEN STRUCTURE
4	GLASS STRUCTURE
5	OTHER STRUCTURE

REVISIONS:

NO.	DESCRIPTION	DATE	BY	CHECKED
1	ISSUED FOR TENDER			
2	ISSUED FOR TENDER			
3	ISSUED FOR TENDER			
4	ISSUED FOR TENDER			
5	ISSUED FOR TENDER			

Examined & Found in order  
 L-110  
*Rajesh*



- NOTE:
1. ALL DIMENSIONS ARE IN mm.
  2. DIMENSIONS OF STRUCTURE AND STRUCTURE GAUGE ARE VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION.
  3. STRUCTURE GAUGE FOR CURVE DOES NOT ENCLOSE LATERAL SHIFT (LEANS) DUE TO CANT.
  4. HORIZONTAL AND VERTICAL CLEARANCE BETWEEN STRUCTURE INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA.
  5. CANT WILL BE PROVIDED BY RAISING EITHER RAIL ONLY AND SHIFTING OF TOWARDS INSIDE OF THE CURVE AND LEWARDS. THIS WILL BE SAME AS ROTATING THE CIRCULAR TUNNEL ABOUT THE MID POINT OF TOP OF INNER RAIL.
  6. MINIMUM CLEARANCE BETWEEN MINIMUM ENVELOPE AND STRUCTURE GAUGE - 100 mm.
  7. VERTICAL TIRING DUE TO VERTICAL CURVE HAS NOT BEEN SHOWN IN THE FRONT AND SHALL BE EXTRA.
  8. FOR DETAILS OF MINIMUM ENVELOPE REFER TO MPMRCL/GEN/ENCL/DND-02. GUAGE SIZE WITH 1-2000 mm AND HEIGHT - 4120 mm.

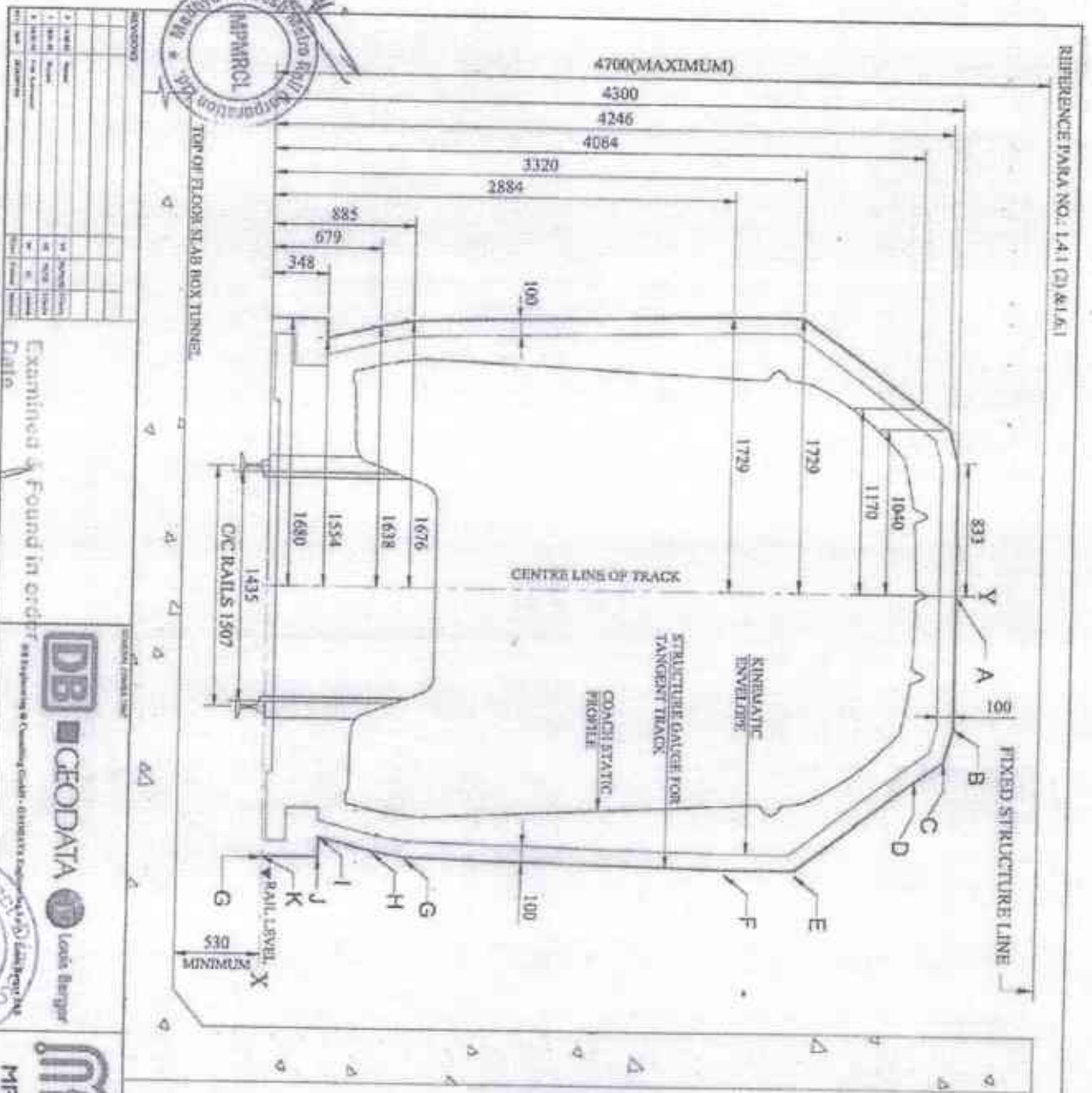
SL. NO.	A	B	C	D
1	4300	4246	4064	3320
2	850	800	784	720
3	2100	2050	1964	1880
4	1700	1650	1564	1480
5	1000	950	864	780
6	1000	950	864	780
7	1000	950	864	780
8	1000	950	864	780
9	1000	950	864	780
10	1000	950	864	780

DB CEODATA  
 Laxmi Banger  
 MPMRCL

MPMETRO

MPMRCL  
 MPMRCL/GEN/ENCL/DND-02





REFERENCE PARA NO. 141 (C) A/L/61

Sl. No.	Particulars	Quantity	Unit
1	...	...	...
2	...	...	...
3	...	...	...
4	...	...	...
5	...	...	...
6	...	...	...
7	...	...	...
8	...	...	...
9	...	...	...
10	...	...	...

Author: *Pradip*  
 Date: \_\_\_\_\_  
 Examined & Found in order: \_\_\_\_\_  
 Auth. Sign: Director/CI/15/13/2023

- NOTES
1. ALL DIMENSIONS ARE IN mm.
  2. KINEMATIC ENVELOPE AND STRUCTURE GAUGE ARE VALID FOR VEHICLES WITH SEALED WINDSHIELDS AND DOORS CLOSED WHILE IN MOTION.
  3. STRUCTURE GAUGE FOR CURVE DOES NOT INCLUDE LATERAL BERT TISSAN DUE TO CAST, HORIZONTAL AND VERTICAL CLEARANCE DUE TO CURVES INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA.
  4. CANT WILL BE PROVIDED BY RAISING OUTER RAIL ONLY AND SHIFTING OF THE CENTRE OF THE CIRCULAR TUNNEL TOWARDS INSIDE OF THE CURVE AND UPWARDS. THIS WILL BE SAME AS ROTATING THE CIRCULAR TUNNEL ABOUT THE MID POINT OF TOP OF INNER RAIL.
  5. MINIMUM CLEARANCE BETWEEN KINEMATIC ENVELOPE AND STRUCTURE GAUGE-100 mm.
  6. VERTICAL TIRING DUE TO VERTICAL CURVE HAS NOT BEEN SHOWN IN THE PROFILE AND SHALL BE EXTRA.
  7. FOR DETAILS OF KINEMATIC ENVELOPE, REFER TO MPMRC/INDORE/IND-02.
  8. COACH SIZE WIDTH-2900 mm AND HEIGHT-4120 mm.

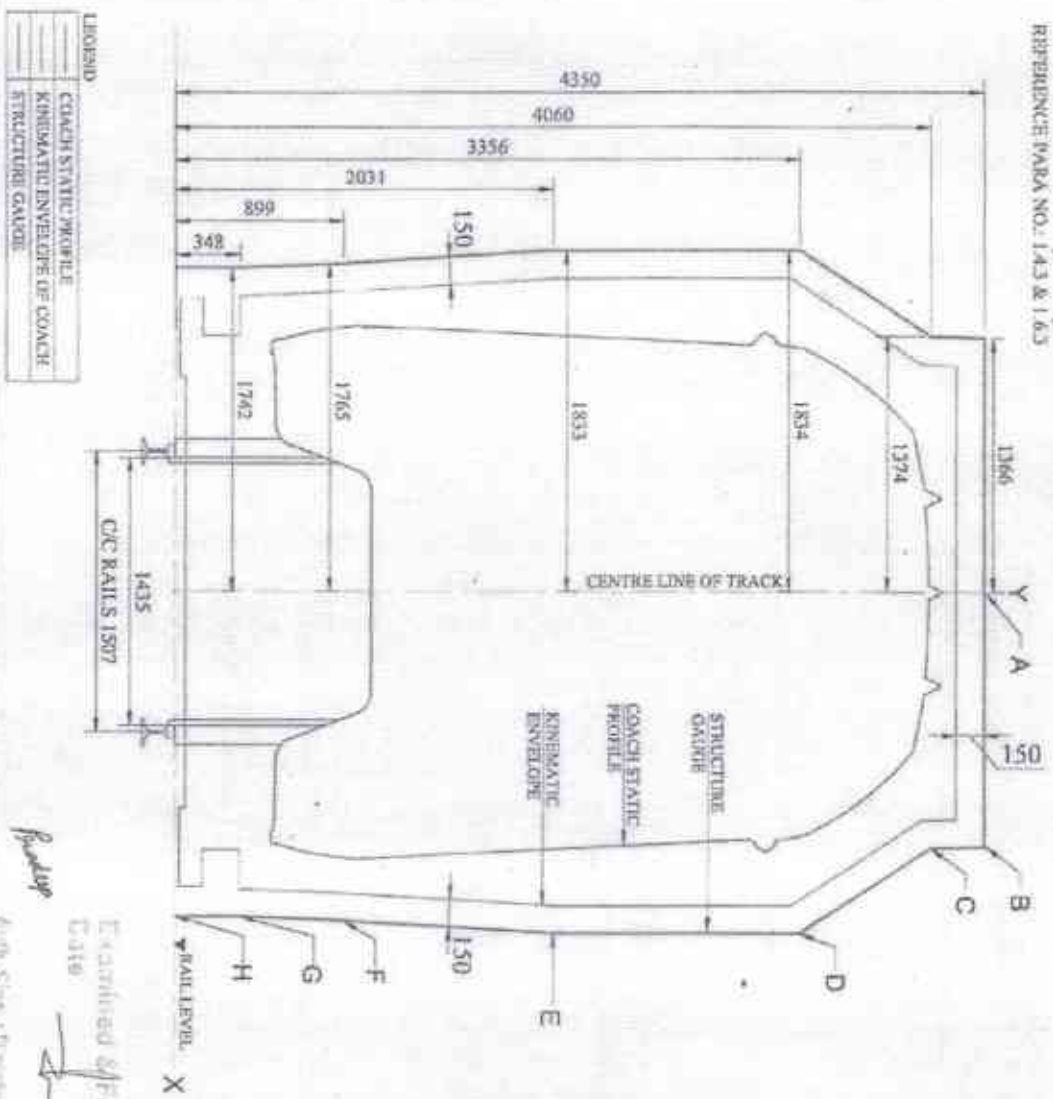
CO-ORDINATES

SLNO.	X	Y
A	0	4590
B	411	4550
C	1000	4245
D	1120	4084
E	1120	3320
F	1720	3114
G	1875	300
H	1875	475
I	3562	548
J	3400	548
K	1800	0

LEGEND

	COACH STATIC PROFILE
	KINEMATIC ENVELOPE OF COACH
	STRUCTURE GAUGE

REFERENCE PARA NO. 1.4.3 & 1.6.3



Enclined & Found in order  
 Date \_\_\_\_\_  
*Handwritten signature*

Auto Sign. - Prudesh Metro Rail Corporation Ltd.



CO-ORDINATES			
SL.NO.	X	Y	Z
A	0	0	0
B	1500	0	0
C	1765	0	0
D	1834	0	0
E	1833	0	0
F	1765	0	0
G	1500	0	0
H	0	0	0

- NOTE:-
1. ALL DIMENSIONS ARE IN mm.
  2. HORIZONTAL AND VERTICAL CLEARANCES DUE TO CURVES, INCLUDING VERTICAL CURVES AND CAN'T SHALL BE EXTRA STRUCTURE GASKET IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION.
  3. COACH SIZE WIDTH-2900 mm AND HEIGHT-1150 mm.
  4. MINIMUM CLEARANCE BETWEEN KINEMATIC ENVELOPE & STRUCTURE GASKET IS 150mm.

NO.	REV.	DESCRIPTION	DATE

NO.	REV.	DESCRIPTION	DATE

DB CEDATA Louis Berger  
 Infrastructure & Consulting India Pvt. Ltd. 2020/13/Engineering/Prudesh Metro Rail

MPMETRO

MACHIN FINGERPRINTING AND COPY LTD.  
 STRUCTURE GASKET FOR ALL QUADRANT SECTION  
 BALLASTED TRACK, OVERHEAD, COACHWAY  
 TRACK SUPPORTS FOR THE STATION  
 WINDOW STRUCTURE, TRACK LEVEL INDICATOR  
 TRACK SUPPORTS FOR THE STATION

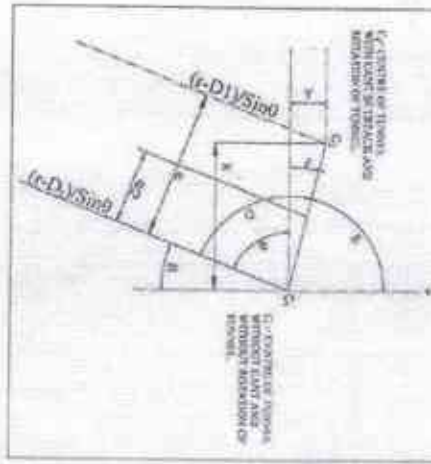


REFERENCE PARA NO.: 1.7.1B (b) & 1.7.2 B (b) & APPENDIX-4

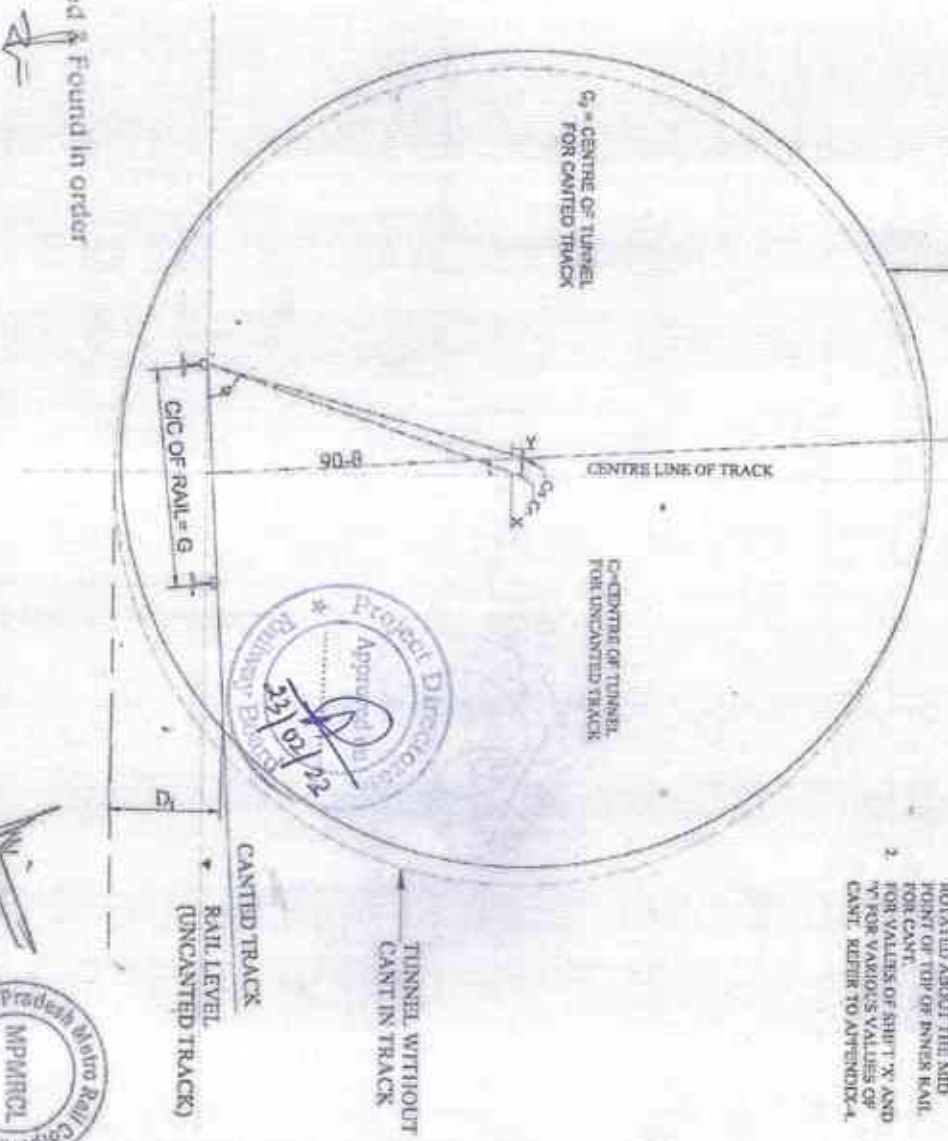
$\tan \theta = (e-D) / (g/2)$   
 $\theta = \tan^{-1} [(e-D) / (g/2)]$   
 $\sin \alpha = \frac{e-D}{r}$   
 $\alpha = \sin^{-1} (e-D/r)$   
 Chord  $e_1 e_2 = 2r \sin \theta \sin \theta / \sin \alpha / 2$   
 $X = e_1 e_2 \times \cos (90 - \theta - \alpha/2)$   
 $Y = 2 \times [(e-D) / \sin \theta] \times (\sin \alpha / 2) \times \cos (90 - \theta - \alpha/2)$   
 Where 'Y' is internal radius of tunnel.  
 D = depth from Rail level to invert of tunnel  
 E = distance between centers of rails = 1507mm

DETAIL AT CENTRE OF TUNNEL

Angle  $\theta = (90-\alpha)$   
 Angle  $D = (90-\alpha/2)$   
 Angle  $E = (\theta+\alpha/2)$   
 Angle  $F = (90-\theta-\alpha/2)$



TUNNEL WITH CANT IN TRACK



- NOTES:
1. THE CIRCULAR TUNNEL IS ROTATED ABOUT THE MID POINT OF TOP OF INNER RAIL FOR CANT.
  2. FOR VALUES OF SIGHT 'X' AND 'Y' FOR VARIOUS VALUES OF CANT, REFER TO APPENDIX-4.

Examined & Found in order  
 Date \_\_\_\_\_  
 Auth. Sign : Director Civil (TR) 67/130



Sl. No.	Name	Designation	Signature	Date
1	Author			
2	Checked			
3	Reviewed			
4	Approved			

DB GEODATA Lothi Banger  
 88 Engineering & Consulting Circle, (GATEWAY), Vidyanagar, K.A. - 500 002, K.A.

MPMRC

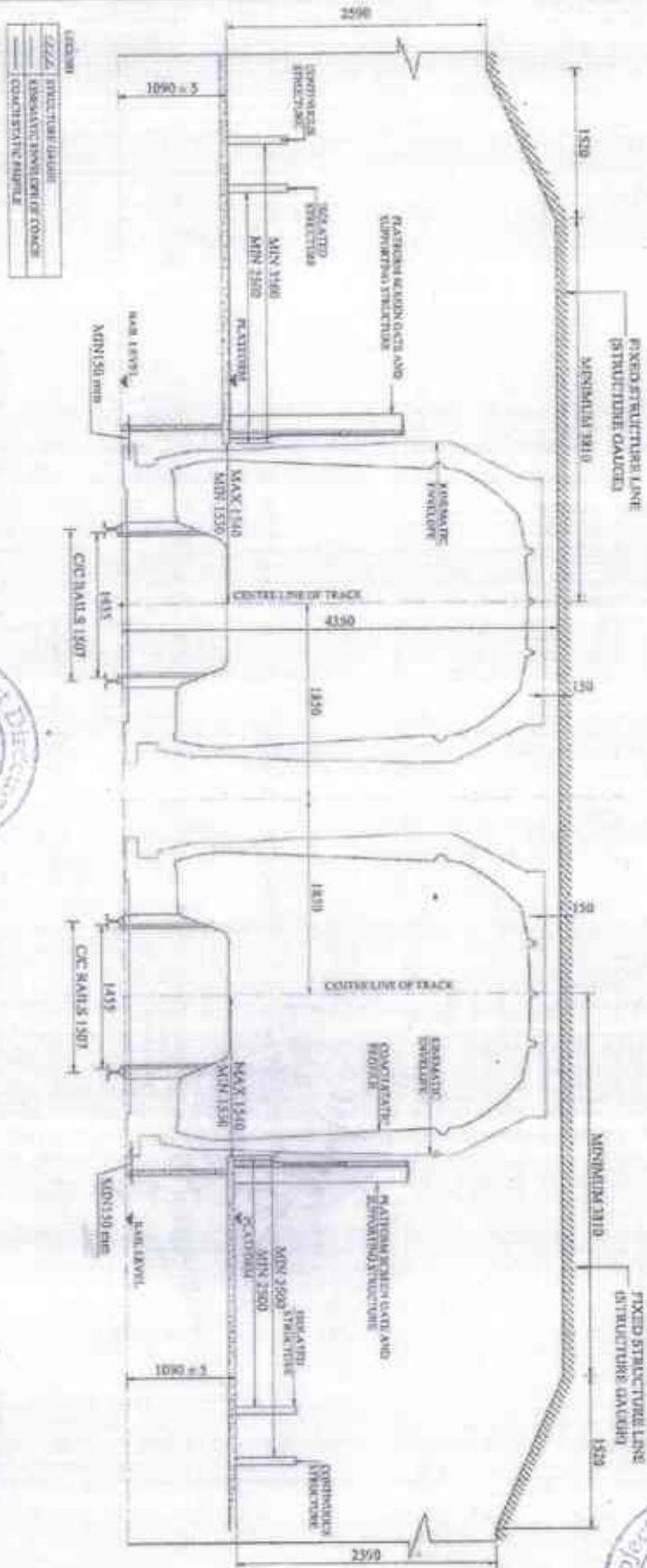
MPMRC CLERK/IN-CHARGE OF THE OFFICE OF THE CHIEF ENGINEER (TUNNEL) TO BE PRESENT AT THE SITE FOR CANT	MPMRC CHIEF ENGINEER (TUNNEL) TO BE PRESENT AT THE SITE FOR CANT
-------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------







REFERENCE PARA NO. 224/2023



LEGEND

-----	STRUCTURE OUTLINE
-----	MINIMUM ELEVATION OF COACH
-----	CONTINUOUS PARALLEL

- NOTES
1. ALL DIMENSIONS ARE IN mm.
  2. CLEARANCE FOR CURVE SHALL BE EXTRA, HOWEVER THE TRACK CENTRES AT STATION WILL NOT INCREASE WITH CURVES OF RADII OF 1000 M & ABOVE.
  3. STRUCTURE GAUGE IS VALID FOR VEHICLES WITH SEALED WINDOWS & DOORS CLOSED WHILE IN MOTION.
  4. KINEMATIC ENVELOPES VALID FOR 70 KMPH OPERATING SPEED & WIND SPEED OF 70 KMPH FOR ELEVATED & AT GRADE PLATFORM.
  - 5.



*Pradeep*

Examined & Found in order  
 Date \_\_\_\_\_  
 Auth. Sign : Director/MPMRC/SOD



REVISIONS

NO.	DATE	DESCRIPTION	BY	CHECKED BY
1				
2				
3				
4				
5				

GENERAL CONTRACTOR

118 Engineering & Consulting Circle - D-Block, Engineering Park, Luckhimpur, Lucknow

MPMRC

MP METRO

MPMRC PROJECT - METRO RAIL CORP. LTD.

STATION: BHOPAL

STATION WITH AAS WITH (MIN. 2500) PLATFORM GAUGE

HALLWAY WITH TRACK ON LEVEL/CONCRETE GRADE

TRACK WIDTH: 16000 mm

TRACK GAUGE: 1600 mm

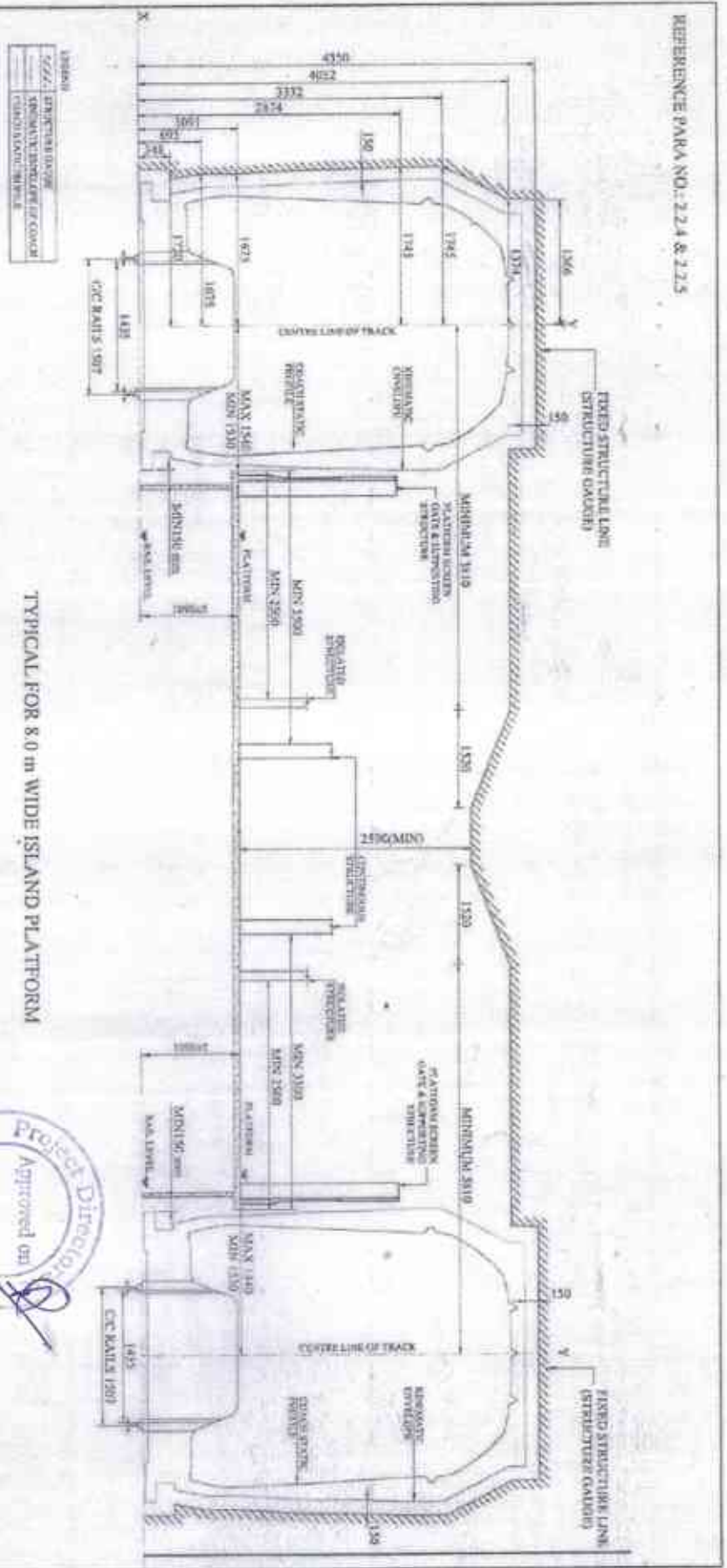
TRACK WIDTH: 16000 mm

TRACK GAUGE: 1600 mm





REFERENCE PARA NO.: 224 & 225



TYPICAL FOR 8.0 m WIDE ISLAND PLATFORM

- NOTES:
1. ALL DIMENSIONS ARE IN mm.
  2. CLEARANCE FOR CURVE SHALL BE EXTRA.
  3. STRUCTURE ELEVATION IS VALID FOR STRUCTURE WITH BEAM/D WINDOW & DOORS CLOSED WITH E IN POSITION.

Examined & Found in order  
 Date \_\_\_\_\_  
 Author Sign : *[Signature]*  
 Director/Civil/UPIS/CR-80

Project Director  
 Approved on  
 23/01/23  
 Project Director  
 MPMRCL  
 Madhya Pradesh Metro Rail Corporation Ltd.

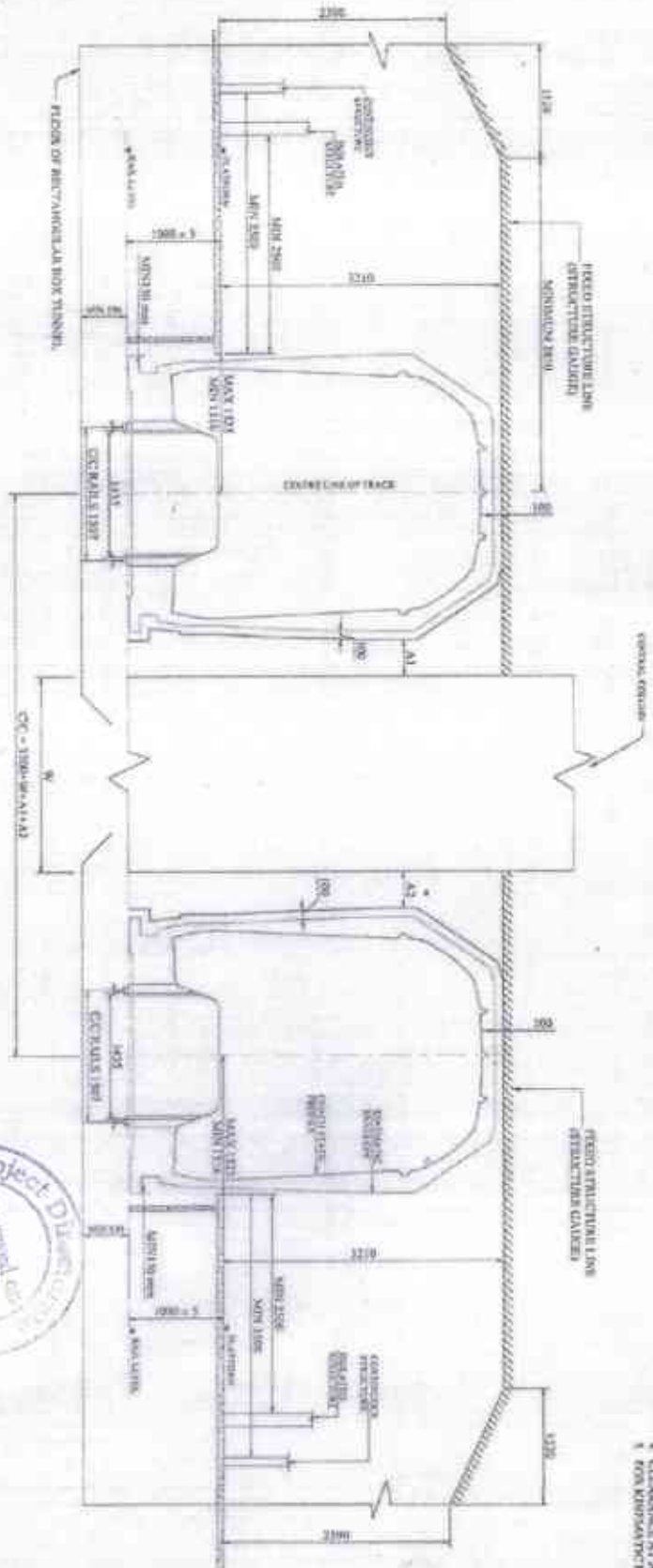
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DB CEDATA  
 The Engineering & Consulting Group - Government's Engineering S.A. - South Bengaluru

MPMETRO

MPMRCL  
 Madhya Pradesh Metro Rail Corporation Ltd.  
 Page No. 01 of 70

REFERENCE PARA NO. 2.2.4 & 2.2.5



- NOTES:
1. ALL DIMENSIONS ARE IN mm.
  2. FOR STATION ON CURVE EXTRA CLEARANCE FOR CURVATURE SHALL BE PROVIDED.
  3. THE STRUCTURE GAUGE IS VALID FOR VEHICLES WITH SPALLID WINDOWS & DOORS CLOSED WHEEL IN MOTION.
  4. CLEARANCE AT A1 & A2 SHALL NOT BE LESS THAN 100 mm.
  5. FOR KINDNESS SWEEP THE REFER TO PAPER - MP/MPRCL/GEN/359/01/01

TABLE

1. ALL DIMENSIONS ARE IN mm.
2. FOR STATION ON CURVE EXTRA CLEARANCE FOR CURVATURE SHALL BE PROVIDED.
3. THE STRUCTURE GAUGE IS VALID FOR VEHICLES WITH SPALLID WINDOWS & DOORS CLOSED WHEEL IN MOTION.
4. CLEARANCE AT A1 & A2 SHALL NOT BE LESS THAN 100 mm.
5. FOR KINDNESS SWEEP THE REFER TO PAPER - MP/MPRCL/GEN/359/01/01

- NOTES:
1. ALL DIMENSIONS ARE IN mm.
  2. FOR STATION ON CURVE EXTRA CLEARANCE FOR CURVATURE SHALL BE PROVIDED.
  3. THE STRUCTURE GAUGE IS VALID FOR VEHICLES WITH SPALLID WINDOWS & DOORS CLOSED WHEEL IN MOTION.
  4. CLEARANCE AT A1 & A2 SHALL NOT BE LESS THAN 100 mm.
  5. FOR KINDNESS SWEEP THE REFER TO PAPER - MP/MPRCL/GEN/359/01/01

Examined & Found in order  
Date \_\_\_\_\_  
Atch Sign: Director of Engineering



REVISIONS

NO.	DATE	DESCRIPTION	BY	CHECKED
1				
2				
3				
4				
5				

GENERAL CONTRACTOR

DB CEODATA Louis Berger  
DB Engineering & Consulting GmbH - CEODATA Engineering S.A. - Louis Berger Ltd

MPMETRO

MAHYA PRADESH METRO RAIL CORP. LTD.

STRUCTURAL GAUGE FOR UNDER GAUGING SPACES WITH SOD IN APPROX. ON LINE & EXISTING GAUGE LAYOUT TRACK WITH SOD IN APPROX. SOD ON LINE.

SCALE: 1:100

DATE: 25/02/23

PROJECT NO: 2019/Proj./MPMRCL/SOD/BHOPAL-INDORE/30/14

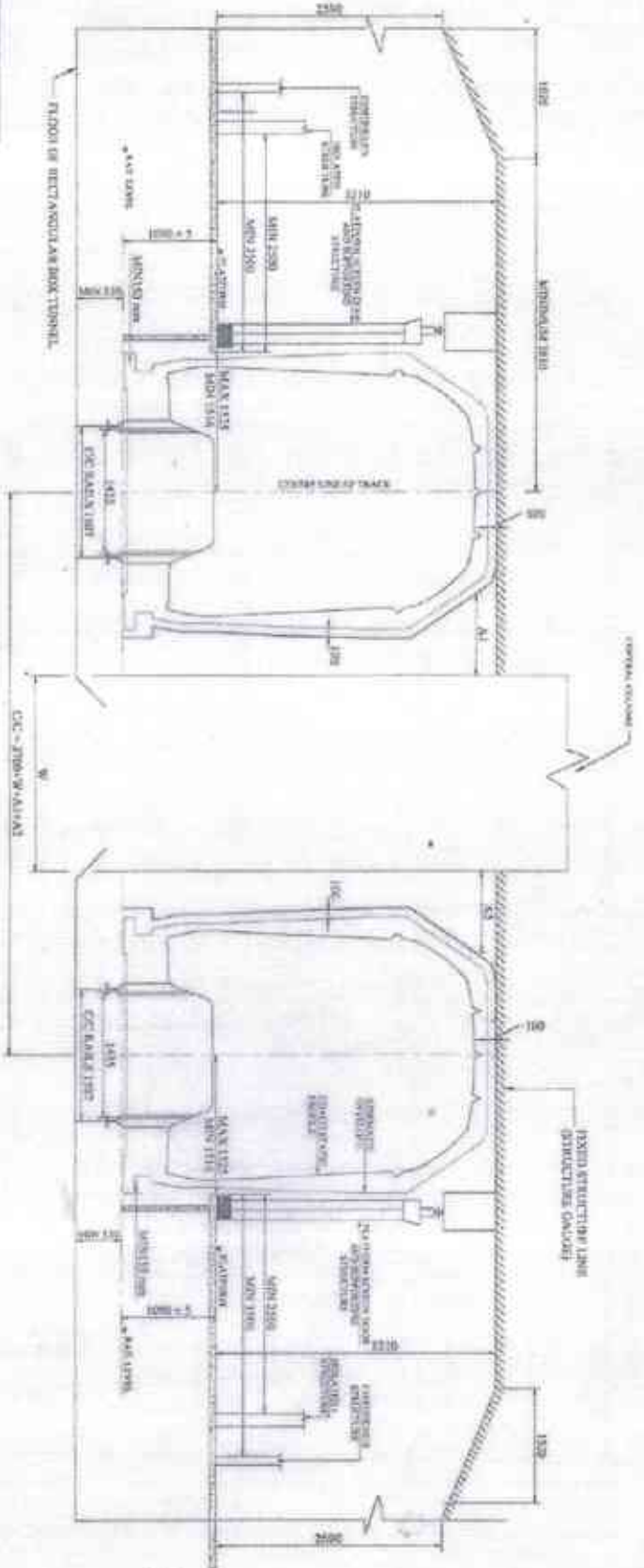
FILE NO: 1366705/2023/O/o DD(Project)

Page No. 42 of 70





REFERENCE PARA NO. 224 & 213



TABLE

1	DATE	DESCRIPTION

- NOTES:
1. ALL DIMENSIONS ARE IN mm.
  2. FOR STATION ON CURVE EXTRA CLEARANCE FOR CURVATURE SHALL BE PROVIDED.
  3. THE STRUCTURE GAUGE IS VALID FOR VEHICLES WITH SEALED WINDOWS & DOORS CLOSED WHILE IN MOTION.
  4. CLEARANCE AT A1 & A2 SHALL NOT BE LESS THAN 100 mm.
  5. FOR KINEMATIC LEVEL ONE REFER TO FIGURE: MPMD/CON/STATION/02



Examined & Found in order  
 Date \_\_\_\_\_  
 With Sign: Director, MPMetro



Sl. No.	Name	Designation	Date
1			
2			
3			

DB CEDATA Louis Berger  
 MPMetro Rail & Consulting GmbH - 1000001314 Corporation for A1 (Cash) Project 028

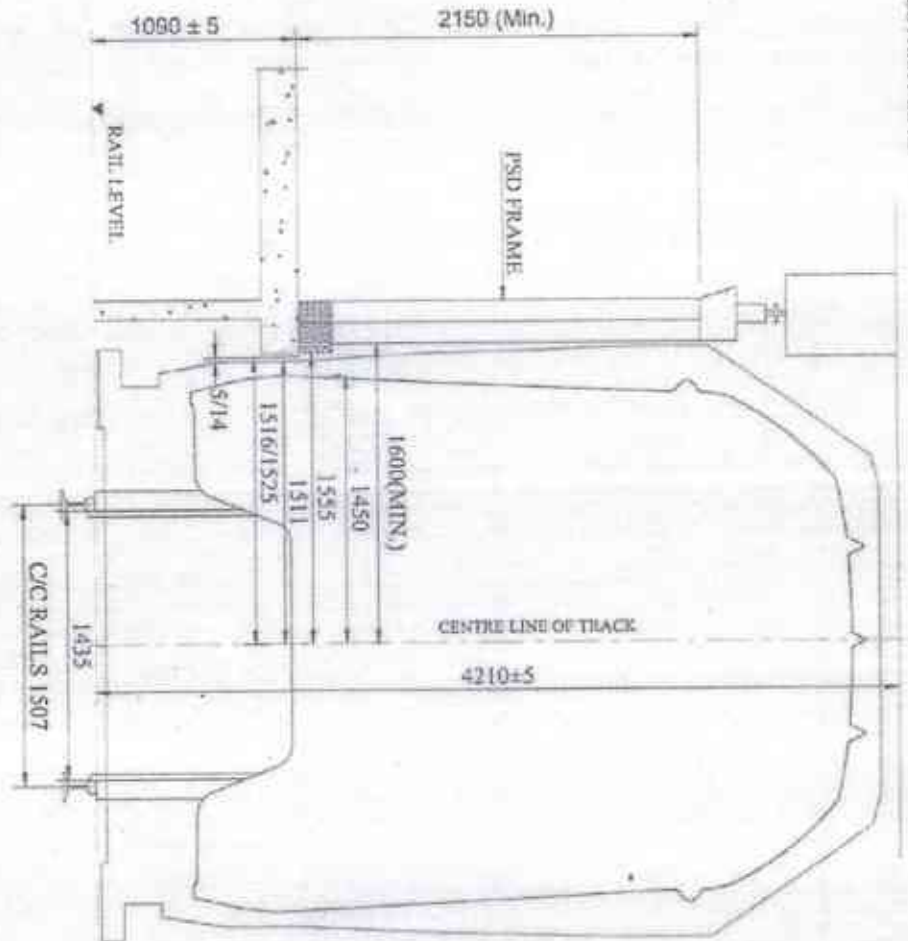


MAADVA PROJECTS - METRO (P) CORP. LTD.  
 EXECUTIVE ENGINEER FROM DESIGN ENGINEERING STATION  
 WITH BUILT PLANTING FOR LEVEL, CROSS AND GAUGE  
 (TANGENT, MAX. MIN. DIA. AND GRADE) CHECKED BY  
 SUPERVISOR (NAME) - 22/05/2023





REFERENCE PARA NO. 13



LEGEND  
 COACH STATIC PROFILE  
 KINEMATIC ENVELOPE OF COACH

NO.	DESCRIPTION	UNIT	VALUE
1	COACH STATIC PROFILE	MM	1000
2	KINEMATIC ENVELOPE OF COACH	MM	1000
3	PSD FRAME	MM	1000
4	RAIL LEVEL	MM	1000
5	C/C RAILS 1507	MM	1507
6	PSD FRAME	MM	1000
7	RAIL LEVEL	MM	1000
8	C/C RAILS 1507	MM	1507
9	PSD FRAME	MM	1000
10	RAIL LEVEL	MM	1000
11	C/C RAILS 1507	MM	1507
12	PSD FRAME	MM	1000
13	RAIL LEVEL	MM	1000
14	C/C RAILS 1507	MM	1507
15	PSD FRAME	MM	1000
16	RAIL LEVEL	MM	1000
17	C/C RAILS 1507	MM	1507
18	PSD FRAME	MM	1000
19	RAIL LEVEL	MM	1000
20	C/C RAILS 1507	MM	1507

DB CEODATA Louis Berger  
 88 Engineering & Consulting Limited, 100/101/102/103/104/105/106/107/108/109/110/111/112/113/114/115/116/117/118/119/120/121/122/123/124/125/126/127/128/129/130/131/132/133/134/135/136/137/138/139/140/141/142/143/144/145/146/147/148/149/150/151/152/153/154/155/156/157/158/159/160/161/162/163/164/165/166/167/168/169/170/171/172/173/174/175/176/177/178/179/180/181/182/183/184/185/186/187/188/189/190/191/192/193/194/195/196/197/198/199/200/201/202/203/204/205/206/207/208/209/210/211/212/213/214/215/216/217/218/219/220/221/222/223/224/225/226/227/228/229/230/231/232/233/234/235/236/237/238/239/240/241/242/243/244/245/246/247/248/249/250/251/252/253/254/255/256/257/258/259/260/261/262/263/264/265/266/267/268/269/270/271/272/273/274/275/276/277/278/279/280/281/282/283/284/285/286/287/288/289/290/291/292/293/294/295/296/297/298/299/300/301/302/303/304/305/306/307/308/309/310/311/312/313/314/315/316/317/318/319/320/321/322/323/324/325/326/327/328/329/330/331/332/333/334/335/336/337/338/339/340/341/342/343/344/345/346/347/348/349/350/351/352/353/354/355/356/357/358/359/360/361/362/363/364/365/366/367/368/369/370/371/372/373/374/375/376/377/378/379/380/381/382/383/384/385/386/387/388/389/390/391/392/393/394/395/396/397/398/399/400/401/402/403/404/405/406/407/408/409/410/411/412/413/414/415/416/417/418/419/420/421/422/423/424/425/426/427/428/429/430/431/432/433/434/435/436/437/438/439/440/441/442/443/444/445/446/447/448/449/450/451/452/453/454/455/456/457/458/459/460/461/462/463/464/465/466/467/468/469/470/471/472/473/474/475/476/477/478/479/480/481/482/483/484/485/486/487/488/489/490/491/492/493/494/495/496/497/498/499/500/501/502/503/504/505/506/507/508/509/510/511/512/513/514/515/516/517/518/519/520/521/522/523/524/525/526/527/528/529/530/531/532/533/534/535/536/537/538/539/540/541/542/543/544/545/546/547/548/549/550/551/552/553/554/555/556/557/558/559/560/561/562/563/564/565/566/567/568/569/570/571/572/573/574/575/576/577/578/579/580/581/582/583/584/585/586/587/588/589/590/591/592/593/594/595/596/597/598/599/600/601/602/603/604/605/606/607/608/609/610/611/612/613/614/615/616/617/618/619/620/621/622/623/624/625/626/627/628/629/630/631/632/633/634/635/636/637/638/639/640/641/642/643/644/645/646/647/648/649/650/651/652/653/654/655/656/657/658/659/660/661/662/663/664/665/666/667/668/669/670/671/672/673/674/675/676/677/678/679/680/681/682/683/684/685/686/687/688/689/690/691/692/693/694/695/696/697/698/699/700/701/702/703/704/705/706/707/708/709/710/711/712/713/714/715/716/717/718/719/720/721/722/723/724/725/726/727/728/729/730/731/732/733/734/735/736/737/738/739/740/741/742/743/744/745/746/747/748/749/750/751/752/753/754/755/756/757/758/759/760/761/762/763/764/765/766/767/768/769/770/771/772/773/774/775/776/777/778/779/780/781/782/783/784/785/786/787/788/789/790/791/792/793/794/795/796/797/798/799/800/801/802/803/804/805/806/807/808/809/810/811/812/813/814/815/816/817/818/819/820/821/822/823/824/825/826/827/828/829/830/831/832/833/834/835/836/837/838/839/840/841/842/843/844/845/846/847/848/849/850/851/852/853/854/855/856/857/858/859/860/861/862/863/864/865/866/867/868/869/870/871/872/873/874/875/876/877/878/879/880/881/882/883/884/885/886/887/888/889/890/891/892/893/894/895/896/897/898/899/900/901/902/903/904/905/906/907/908/909/910/911/912/913/914/915/916/917/918/919/920/921/922/923/924/925/926/927/928/929/930/931/932/933/934/935/936/937/938/939/940/941/942/943/944/945/946/947/948/949/950/951/952/953/954/955/956/957/958/959/960/961/962/963/964/965/966/967/968/969/970/971/972/973/974/975/976/977/978/979/980/981/982/983/984/985/986/987/988/989/990/991/992/993/994/995/996/997/998/999/1000



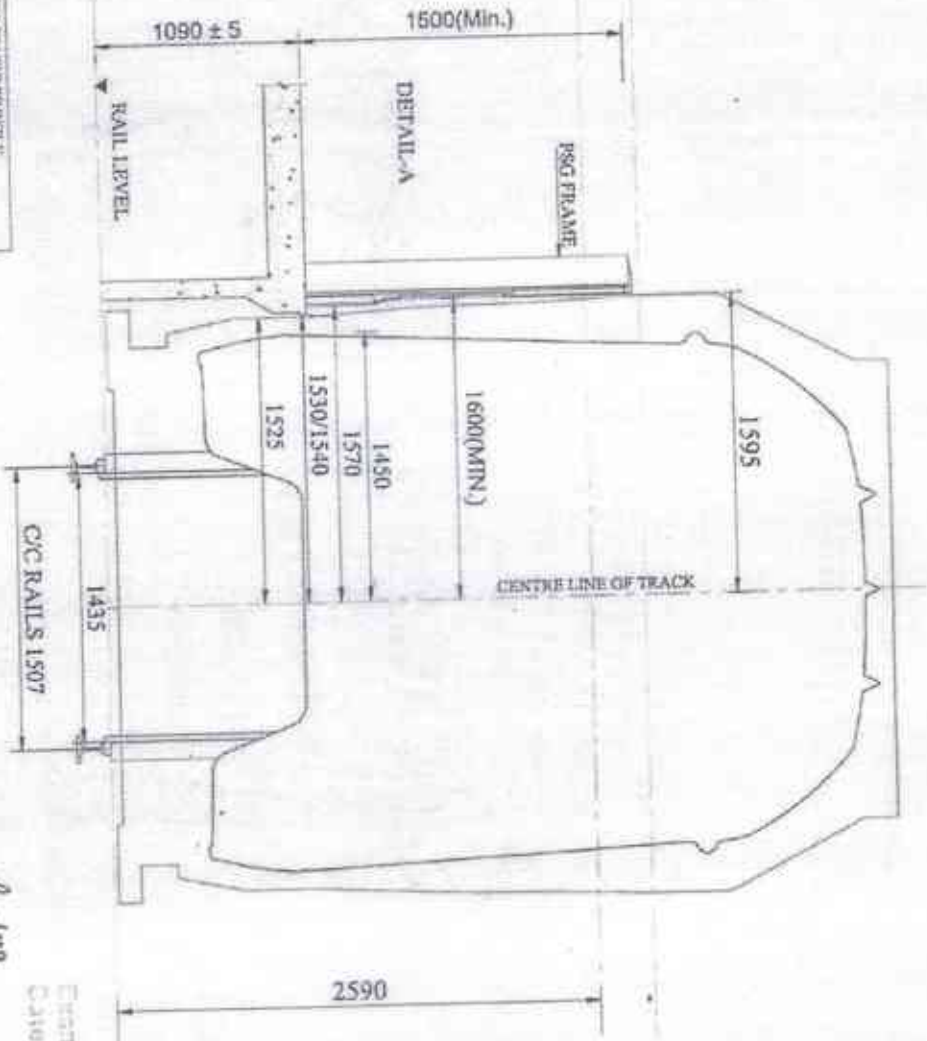
Examined & Found in order  
 Date  
 Sign: Director

- NOTE:
1. ALL DIMENSIONS ARE IN mm.
  2. HORIZONTAL AND VERTICAL CLEARANCES DUE TO CURVES, INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA.
  3. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION.
  4. COACH SIZE IS 3800 X 4150.
  5. FOR CURVED PLATFORM, THESE DIMENSIONS TO BE INCREASED AS TAIL B IN APPENDIX C.
  6. DESIGN SPEED OVER PLATFORM LINES SHALL NOT EXCEED 75KM/HR.
  7. THE KINEMATIC ENVELOPE IS VALID FOR A SIDE WIND SPEED OF 40KM/HR.

MPM Metro  
 MPMRCL  
 MPMRCL  
 MPMRCL



REFERENCE PARA NO.: 13

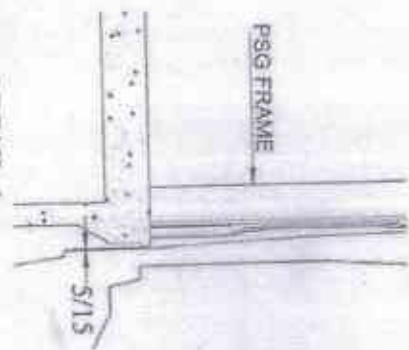


LEGEND

COACH STATIC PROFILE
KINEMATIC ENVELOPE OF COACH

NO.	DESCRIPTION	UNIT	QUANTITY	REMARKS
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- NOTE
1. ALL DIMENSIONS ARE IN mm.
  2. HORIZONTAL AND VERTICAL CLEARANCES DUE TO CURVES, INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA.
  3. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION.
  4. COACH SIZE IS 2900x4120.
  5. DESIGN SPEED OVER PLATFORM LINES SHALL NOT EXCEED 70KM/HR.
  6. THE KINEMATIC ENVELOPE IS VALID FOR A WIND SPEED OF 70KM/HR.



*Handwritten:* Engr. S. S. D. ...  
 Applied in ...

DB ENGINEERING & CONSULTING  
 CEODATA  
 Louis Berger

MPMRC  
 MPMETRO

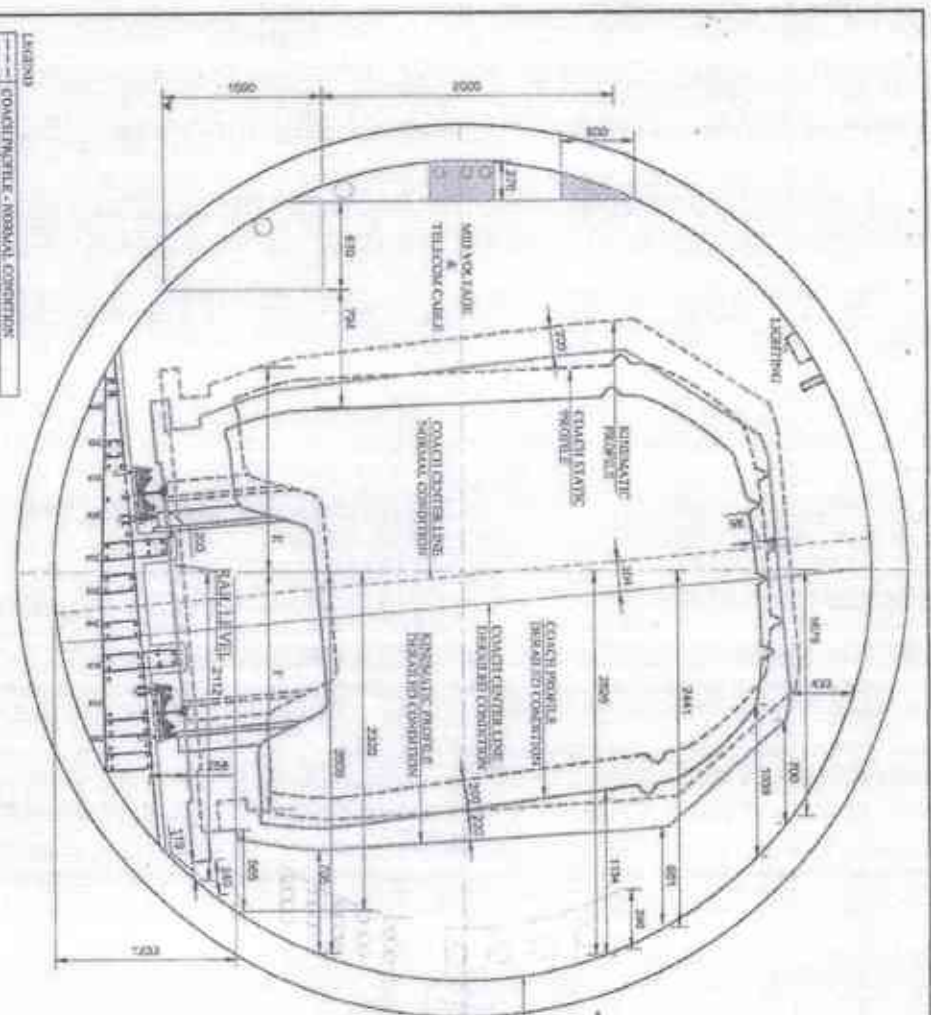


MADE IN PRAKASHI METHODRAI, COCHIN, INDIA  
 RAJATRAI ENGINEERING & ARCHITECTURE  
 10/10, 10/11, 10/12, 10/13, 10/14, 10/15, 10/16, 10/17, 10/18, 10/19, 10/20, 10/21, 10/22, 10/23, 10/24, 10/25, 10/26, 10/27, 10/28, 10/29, 10/30, 10/31, 10/32, 10/33, 10/34, 10/35, 10/36, 10/37, 10/38, 10/39, 10/40, 10/41, 10/42, 10/43, 10/44, 10/45, 10/46, 10/47, 10/48, 10/49, 10/50, 10/51, 10/52, 10/53, 10/54, 10/55, 10/56, 10/57, 10/58, 10/59, 10/60, 10/61, 10/62, 10/63, 10/64, 10/65, 10/66, 10/67, 10/68, 10/69, 10/70, 10/71, 10/72, 10/73, 10/74, 10/75, 10/76, 10/77, 10/78, 10/79, 10/80, 10/81, 10/82, 10/83, 10/84, 10/85, 10/86, 10/87, 10/88, 10/89, 10/90, 10/91, 10/92, 10/93, 10/94, 10/95, 10/96, 10/97, 10/98, 10/99, 10/100

LEGEND

(Symbol)	CONCRETE - RIGID CONCRETE
(Symbol)	CONCRETE - REINFORCED CONCRETE
(Symbol)	ASPHALTIC PAVEMENT - RIGID CONCRETE
(Symbol)	ASPHALTIC PAVEMENT - REINFORCED CONCRETE

**DERAILED OUTSIDE THE CURVE**



- NOTE:
1. ALL DIMENSIONS ARE IN mm
  2. HORIZONTAL AND VERTICAL CLEARANCES DUE TO CURVES INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA
  3. STRUCTURE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND CLOSED DOORS WHILE IN ADDITION
  4. COACH SEAT WIDTH - 2900 mm AND HEIGHT - 1120 mm
  5. MIN CLEARANCE BETWEEN CROSSBATTEN LEVELS & STRUCTURE GAVNE IS 100 mm.
  6. MAXIMUM LATERAL SHIFT OF ROLLING STOCK DUE TO DERAILMENT WITH IN STAND AT FAIL LEVEL IS 210 mm.
  7. THE DRAWING IS FOR REFERENCE PURPOSE ONLY.

Height above Rail level	Clearance	Clearance
mm	mm	mm
12000	1471.1	641.1
11500	1460.3	629.3
11000	1361.2	530.2
10500	1261.7	430.7
10000	1162.0	331.0
9500	1062.7	231.7
9000	963.5	132.5
8500	864.3	33.3

Approved on \_\_\_\_\_  
 Project Director  
 Bhopal

Examined & found in order  
 Date: \_\_\_\_\_



<p>108 Engineering &amp; Consulting Centre, 200/117 Engineering Park, 1st Floor, Sector 14A</p>					
<p>MAHARAJA PRASAD KUMAR MATHS SOCIETY, LTD.</p>					
<p>CONTRACT NO. _____</p>					
<p>REVISIONS</p>					
NO.	DATE	BY	REASON	APPROVED BY	DATE

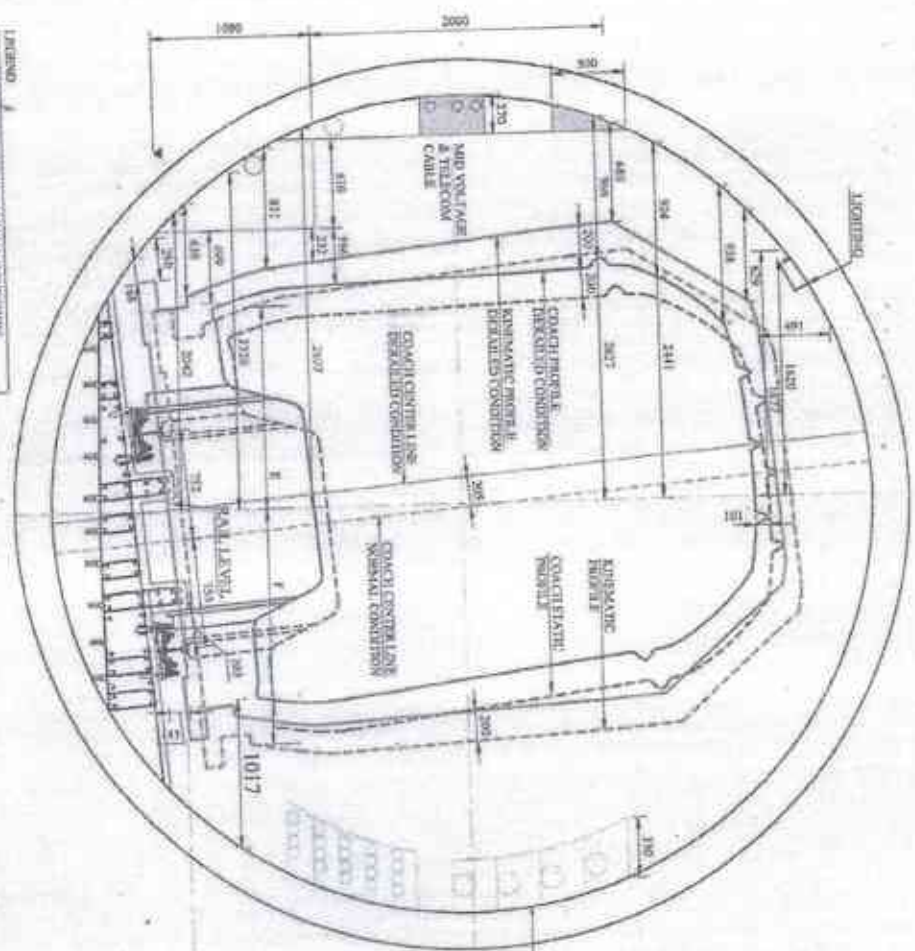


Sl. No.	Particulars	Quantity	Unit	Rate	Amount
1	...	...	...	...	...
2	...	...	...	...	...
3	...	...	...	...	...
4	...	...	...	...	...
5	...	...	...	...	...
6	...	...	...	...	...
7	...	...	...	...	...
8	...	...	...	...	...
9	...	...	...	...	...
10	...	...	...	...	...
11	...	...	...	...	...
12	...	...	...	...	...
13	...	...	...	...	...
14	...	...	...	...	...
15	...	...	...	...	...
16	...	...	...	...	...
17	...	...	...	...	...
18	...	...	...	...	...
19	...	...	...	...	...
20	...	...	...	...	...
21	...	...	...	...	...
22	...	...	...	...	...
23	...	...	...	...	...
24	...	...	...	...	...
25	...	...	...	...	...
26	...	...	...	...	...
27	...	...	...	...	...
28	...	...	...	...	...
29	...	...	...	...	...
30	...	...	...	...	...
31	...	...	...	...	...
32	...	...	...	...	...
33	...	...	...	...	...
34	...	...	...	...	...
35	...	...	...	...	...
36	...	...	...	...	...
37	...	...	...	...	...
38	...	...	...	...	...
39	...	...	...	...	...
40	...	...	...	...	...
41	...	...	...	...	...
42	...	...	...	...	...
43	...	...	...	...	...
44	...	...	...	...	...
45	...	...	...	...	...
46	...	...	...	...	...
47	...	...	...	...	...
48	...	...	...	...	...
49	...	...	...	...	...
50	...	...	...	...	...
51	...	...	...	...	...
52	...	...	...	...	...
53	...	...	...	...	...
54	...	...	...	...	...
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60	...	...	...	...	...
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95	...	...	...	...	...
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97	...	...	...	...	...
98	...	...	...	...	...
99	...	...	...	...	...
100	...	...	...	...	...

DERAILED INSIDE THE CURVE

LEGEND

- COACH PROFILE - NORMAL CONNECTION
- COACH PROFILE - BREAKER CONNECTION
- KINEMATIC PROFILE - NORMAL CONNECTION
- KINEMATIC PROFILE - BREAKER CONNECTION



DB GEODATA Louis Berger  
 5th Expanding & Contracting (Civil) - 02203113 Engineering Pvt. Ltd. Lucknow, India

MPMETRO

MPMRCL  
 MUMBAI INDIA RAILWAYS CORP. LTD.  
 DIRECTOR GENERAL, TECHNICAL AND SECTION  
 INCHARGE OF TRACKS AND RAILWAYS TRACK  
 WITH MAIN CANT & SENS. SECTION OF CURVE

Approved on 31/01/23  
 Project Director  
 Railway Board

Examined & Found in order  
 Date 31/01/23  
 MPMRCL  
 MUMBAI INDIA RAILWAYS CORP. LTD.

Height above Rail level	2 in approx	4 in approx	6 in approx	8 in approx	10 in approx	12 in approx	14 in approx	16 in approx	18 in approx	20 in approx
200	214.8	217.3	219.8	222.3	224.8	227.3	229.8	232.3	234.8	237.3
300	314.8	317.3	319.8	322.3	324.8	327.3	329.8	332.3	334.8	337.3
400	414.8	417.3	419.8	422.3	424.8	427.3	429.8	432.3	434.8	437.3
500	514.8	517.3	519.8	522.3	524.8	527.3	529.8	532.3	534.8	537.3
600	614.8	617.3	619.8	622.3	624.8	627.3	629.8	632.3	634.8	637.3
700	714.8	717.3	719.8	722.3	724.8	727.3	729.8	732.3	734.8	737.3
800	814.8	817.3	819.8	822.3	824.8	827.3	829.8	832.3	834.8	837.3
900	914.8	917.3	919.8	922.3	924.8	927.3	929.8	932.3	934.8	937.3
1000	1014.8	1017.3	1019.8	1022.3	1024.8	1027.3	1029.8	1032.3	1034.8	1037.3

- NOTE
1. ALL DIMENSIONS ARE IN mm
  2. HORIZONTAL AND VERTICAL CLEARANCES DUE TO CURVES, INCLUDING VERTICAL, CURVES AND CANT SHALL BE IN ACCORDANCE WITH THE RULES OF THE RAILWAYS.
  3. STRUCTURE IS VALUED FOR VEHICLES WITH SEATED PASSENGERS AND CLOSED DOORS WHILE IN MOTION.
  4. COACH SIZE WIDTH-2900 mm AND HEIGHT-4100 mm.
  5. MIN. CLEARANCE BETWEEN KINEMATIC DERAILURE & STRUCTURE GADGET IS 100mm.
  6. MAXIMUM LATERAL SHIFT OF ROLLING STOCK DUE TO DERAILMENT WITH IN UPSTAND AT RAIL LEVEL IS 200mm.
  7. THIS DRAWING IS FOR REFERENCE PURPOSE ONLY.