GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

2016/Proj./SoD/Noida/30/12

New Delhi, dated 04.12.2017

Managing Director,
Noida Metro Rail Corporation Limited,
Ganga Shopping Complex, Sector-29
Noida 301201 (Uttar Pradesh)

Sub: Schedule of Dimensions for Standard Gauge (1435mm) of Noida-Greater Noida for Elevated/At Grade Corridor.

Ref: Noida Metro's letter No. NMRC/ED/2017/1461 dated 16.10.2017

The Schedule of Dimensions (SoD) of Noida- Greater Noida Corridor Metro Rail project for Standard Gauge (1435mm), Version-3, (October, 2017) for Elevated and At-Grade Sections has been examined in consultation with RDSO and approval of Railway Board is hereby conveyed.

Accordingly, approved copy of SoD is enclosed.

DA: As above

04.12.2017

(Ruth Changsan)
Director/Works (Plg.)
Railway Board
☎ 011-23097061

Copy to: **Executive Director/UTHS**, RDSO, Manak Nagar, Lucknow w.r.t their letter No. UTHS/110/Noida Metro/Civil dated 20.11.2017

SCHEDULE OF DIMENSIONS

FOR

STANDARD GAUGE

(1435 mm)

(October-2017)

Version -03



NOIDA METRO RAIL CORPORATION LIMITED

Ganga Shopping Complex, Sector-29
Noida -301201 (Uttar Pradesh)

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Project Directorate Approved on 04/12/17 Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

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Project Directorate Approved on 04/12/17 Railway Board

ASHOK KUMAR
Chief Engineer/Consult
Delhi Metro Rail
Ganga Shopping Complex, Sector-15
NOIDA (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

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Project Directorate
Approved on
04/12/17
Railway Board

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy (U.G.)
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-4,
NOIDA (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

PREAMBLE

The Schedule of Dimensions for Standard Gauge corridor has been prepared based on following factors:

1. The kinematic envelope and other infringements have been calculated for the 2900mm wide and 4048 mm (pantograph in locked down condition) and 4023 mm (without pantograph) high rolling stock, based on the kinematic envelope calculations. The track and vehicle maintenance shall conform to the clearances indicated therein during the period these stocks are in operation.
2. The clearances are based on the assumption that windows are sealed and doors are closed during movement/operation.
3. Track shall be maintained to the tolerances taken for calculation of Kinematic Envelope.
4. The Structure Gauge indicated in SOD shall not be violated under any circumstances except for platform coping, platform gate, hand railing in back of house of platform edge and related structures.
5. The Kinematic envelope(s) indicated in SOD shall not be violated under any circumstances.
6. The vehicle Kinematic Envelope at a speed of 70 Kmph for the platform area shall be applied within confines of stations. At all other locations, maximum operating speed shall be 80 Kmph and the kinematic envelope corresponding to maximum vehicle speed of 80 kmph shall be used for determining the Structure Gauge and electrical clearances.
7. The evacuation of passengers in between stations shall be done from front & rear emergency doors of the trains, hence no separate walkway is provided. However, space available between the track plinths shall be used as the walkway. The evacuation system shall be legislated by NMRC and evacuation shall be effected under the supervision of NMRC. It shall be ensured that no train operation on the adjacent track will be allowed during evacuation.
8. In case of all at-grade sections and wherever necessary on elevated sections, the sections will be robustly fenced to prevent the access to the track by people.
9. The maximum operating speed through station platforms shall be limited to 70 kmph and the Kinematic Envelope for stations shall not be infringed under any circumstances.
10. No vertical curve shall be provided in platform portion.
11. The SOD is applicable for Ballastless track on main line and ballasted/ballastless track in Depots.
12. No work/work men/Equipment are allowed between vehicle and structure gauge during operation of trains.

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NCR
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-5
NOIDA (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

Project Directorate
Approved on
04/12/17
Railway Board

NOIDA METRO

SCHEDULE OF DIMENSIONS

STANDARD GAUGE (1435 mm GAUGE)

INTRODUCTION

The dimensions given in this Schedule of Dimensions are to be observed in all works on 1435 mm gauge (STANDARD GAUGE), unless prior sanction has been obtained from the Railway Board through the Commissioner of Metro Railway safety to execute works which infringe this Schedule of Dimensions

This Schedule of Dimensions is applicable to Elevated and At-Grade sections of Noida Metro which shall be with 25 KV AC Traction system and Over Head current collection. The Rolling Stock shall be 2900 mm wide with sealed windows and doors closed while in motion.

The Schedule of Dimensions (SOD) has been divided into five chapters as under

Chapter-1	----------	General
Chapter-2	----------	Stations
Chapter-3	----------	Rolling Stock
Chapter-4	----------	Electric Traction
Chapter-5	----------	Platform Gate

Project Directorate
Approved on
04/12/17
Railway Board

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy(CN)
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29
NOIDA (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

CHAPTER-I

GENERAL

1.1 SPACING OF TRACKS

1.1.1 Minimum distance, centre to centre of tracks without any structure between tracks for tangent (straight) track for:

(a) Elevated and At-Grade Sections ..... 3650 mm

Note: See Appendix-1 for minimum track centers on curves.

1.2 CURVES

1.2.1 **Minimum radius of curves (horizontal)**

i) On main running lines

a) Elevated and At-Grade Sections 120 m

ii) Depot and other non-passenger Lines 100 m

iii) At passenger platforms 1000 m

1.2.2 **Check rail/Restraining Rail**

(a) Check rail/Restraining Rail shall be provided on curves on main line where radius is 190m 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 **Minimum radius of vertical curve** 1500m

1.2.4 **Cant and Cant Deficiency**

a) Maximum Cant on curves = 110 mm
b) Maximum Cant Deficiency = 85 mm

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1.3 GRADIENTS

1.3.1 The maximum grade (compensated) shall be 4%.

Notes:

(i) There will be no change of gradient in transition portion of curve.

(ii) The gradient will be compensated for curvature at the rate of 0.04% per degree of curve

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NCR
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29
NOIDA (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

1.3.2 Maximum permissible gradient on turnout

i) On Ballasted Track	0.25%
ii) On Ballastless Track	3.00%

Note:

(i) There shall be no change of gradient (i.e. vertical curve) on and within 15.0 m (desirable)/3.0 m (minimum) of any turnout on Ballastless track. In case of Ballasted track, there shall be no change of gradient on and within 30 meters of any turnout.

(ii) There shall be no horizontal curve within 15.0m (desirable)/ 3.0 m (minimum) of any turnout on Ballastless Track and 30 meters of any Turnout on Ballasted Track.

(iii) Turnout shall normally be installed on straight track. In exceptional situations, turnout may take off from curve provided that the radius of lead curve (main line as well as diverging line) is not less than 190m. The negotiability of rolling stocks on such turnout must be certified by rolling stock supplier and confirmed through oscillation trial and a suitable speed restriction should be imposed on 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 15m for Ballastless track. Turnout shall not be laid on transition curve.

(iv) The limit of turnout for above purposes shall be taken from Stock Rail Joint (SRJ) to end (i.e. heel) of crossing for Ballastless track. For Ballasted track, it shall be from SRJ to last common sleeper behind end of crossing.

(v) The maximum permissible gradient on turnout and the location of turnout with respect to vertical/horizontal curves in vicinity shall be confirmed from rolling stock supplier for the negotiability of rolling stock.

(vi) The above stipulations shall also be applicable for turnout to be laid outside station limit, if any.

1.4 BUILDINGS AND STRUCTURES

1.4.1 Minimum horizontal distance from centre of track to any structure (except platform coping, platform screen door and hand railing in back of house of platform edge) for heights above rail level on level/constant grade tangent track shall be as under:

(a) Elevated and At-Grade Sections

	Height from rail level	Horizontal distance from C.L. of track
(i)	Upto 65 mm	1465 mm
(ii)	65 mm to 200 mm	1465 mm increasing to 1640 mm
(iii)	200 mm to 305 mm	1640 mm

ASHOK KUMAR GUPTA
Chief Engineer/Consultant (Civil)
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-34
NOIDA (U.P.)

Project Directorate
Approved on 04/12/15
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

(iv)	305 mm to 930 mm	1640 mm increasing to 1735 mm
(iv)	930 mm to 1095 mm	1735 mm increasing to 1740 mm
(v)	1095 mm to 3310 mm	1740 mm increasing to 1825 mm
(vi)	3310 mm to 3775 mm	1825 mm decreasing to 1546 mm
(vii)	3775 mm to 6250 mm	1546 mm

Also refer to Figure No. NMSG-2

Notes:

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, cables etc. erected alongside the track.
iii) Minimum lateral clearance for OHE masts for tangent track shall be 2150 mm from Centre line of nearest track.
iv) For passenger platform refer to para 2.2.1 to 2.2.3 of chapter 2.

1.5 KINEMATIC ENVELOPE

a. The Kinematic Envelope for level or constant grade tangent track, refer to:Figure No. NMSG-1 for At-Grade and Elevated Sections.
b. Figure No. NMSG-1A for At-Grade and Elevated Sections at platform.

1.6 STRUCTURE GAUGE

1.6.1 Elevated and At-Grade Sections

The Structure Gauge (Fixed Structure Line) has been arrived at by allowing minimum clearance of 150 mm to Kinematic Envelope for structures above 305 mm above Rail level and minimum electrical clearance of 320 mm from 25 KV live parts conforming to the stipulations in chapter-4 of this SOD.

Refer to Figure No. NMSG-2 for Structure Gauge for outside stations on level or constant grade tangent track.

Note:
Extra clearance shall be provided for curves as laid down at para 1.7

1.7 EXTRA CLEARANCES ON CURVES

Following are the extra clearances considered for curves.

Abbreviations used in para 1.7:

C is the distance between centres of bogies in metres,
C_1 is the coach (vehicle) length in metres,
R is the radius of curve in metres,
Ca is the Cant applied in mm,
h is the height from rail level in mm and
g is the distance between centres of rails in mm

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ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NCR
Delhi Metro Rail Corp. Ltd
Ganga Shopping Complex, Sector-29
NOIDA (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

1.7.1 INSIDE OF CURVE

(A) **Curvature effect**

i) Mid throw at the center of the vehicle = V (in mm) = $125xC^2/R$
ii) Clearance due to gauge widening on curves

For values of items (i) and (ii) above, refer to Appendix-2

Note:

Lateral shift of 26 mm due to nosing is included in Kinematic Envelope for tangent track (and as a result, included in Structure Gauge also) shall be subtracted from the total extra clearance worked out as at para 1.7.1(A)-i &ii above for inside of a curve in case the value of mid throw (V) is equal to or greater than 26 mm. In case the value of mid throw (V) is less than 26 mm, the curvature effect shall be due to widening of the gauge only. (The Mid throw minus 26 mm shall be taken as zero).

Refer to Appendix-2

(B) **Clearance for Super elevation**

(a) Elevated and At-Grade Sections

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

L = Ca x h/g (all in mm)

For values of Structure Gauge (E_1) for inside of a curve with cant effect only, (as shown in Figure No. NMSG-3, refer to:

(i) Appendix -3 for At-Grade and Elevated Sections

(C) **Clearance for vertical curve (vertical throw)**

Vertical Throw V_1 and V_2 (in mm) for vertical curve shall be calculated as under:

V_1 (with vehicle centre in sag or vehicle end on summit) = $125xC^2/R$
V_2 (with vehicle centre on summit or vehicle end in sag)
= $(125xC_1^2/R)-(125xC^2/R)$
Values of vertical throw due to vertical curves of different radii are given in Figure- NMSG-4

1.7.2 OUTSIDE OF CURVE

(A) **Curvature effect**

i) End throw at the end of vehicle = Vo (in mm)
= $[125xC_1^2/R]-[125xC^2/R]$
ii) Clearance due to gauge widening on curves
iii) Additional nosing due to gauge widening on curves

The values of items (i) to (iii) are shown in Appendix-2

ASHOK KUMAR GUPTA
Chief Engineer/Const.-II
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-34
NOIDA (U.P.)

Project Directorate
Approved on
04/12/17
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

(B) **Clearance for Superelevation**

(a) Elevated, and At-Grade

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

L = (-) Ca x h/g (all in mm)

-ve sign indicates relief due to cant or reduction in clearance required.

Note:

Full relief for lean due to cant (Ca) 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 50 mm and shall be limited to a value = (Ca - 50) x h/g.

Values of Structure Gauge (F_1) on outside of curve with cant effect only (as shown in Figure No. NMSG-3), refer to:

i) Appendix 3 for Elevated and At-Grade Sections

(C) Clearance for vertical curve (vertical throw)

The provisions at para 1.7.1 (C) above shall be applicable in this case also.

1.8 MINIMUM TRACK SPACING ON CURVES

Elevated and At-Grade 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.

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:

i) **(E + F)**,
ii) **T_1** (Extra lateral clearance due to curvature on inside of curve
iii) **T_2** (Extra lateral clearance due to curvature on outside of curve
iv) Minimum clearance between adjacent Kinematic Envelopes stipulated is as under:
   a) 300 mm for Elevated and At-Grade Sections.

Where,

'**E**' is the 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 (Figure No. NMSG-3A) and

'**F**' is the 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 (Figure No. NMSG-3A).

ASHOK KUMAR GUPTA
Chief Engineer/Civil Works-IV
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29
NOIDA (U.P.)

Project Directorate
Approved on
04/12/17
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

Notes:

i) The value of '**F**', calculated from the formula at Figure No. NMSG-3A 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**, T_1 and T_2, refer to the Appendices as shown below:

SECTIONS	For E & F	For T_1 &T_2
i) Elevated and At-Grade	3A	2

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:

i) (E_1 +T_1) Minimum clearance to the structure from centre line of track on inside of curve (for outer track)
ii) (F_1 +T_2) Minimum clearance to the structure from centre line of track on outside of curve (for inner track)
iii) Width of structure between adjacent tracks (measured across the tracks).

Where,

E_1 is the horizontal distance from vertical axis of centre line of track to canted Structure Gauge on inside of curve for a given cant,
F_1 is the horizontal distance from vertical axis of centre line of track to canted Structure Gauge on outside of curve for a given cant,
T_1 is extra lateral clearance due to curvature on inside of curve and
T_2 is extra lateral clearance due to curvature on outside of curve

Notes:

(i) The values of 'E_1' and 'F_1' for a given cant Ca, shall each be the maximum of values at different heights of structure from rail level. In case the cant provided is greater than 50 mm on inner track, the value of F_1 shall be for the cant of (Ca-50) mm. In case the cant provided is 50 mm or less on inner track, the value of F_1 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 E_1, F_1, T_1 and T_2, refer to the Appendices as shown below:

SECTIONS	For E_1 & F_1	For T_1 & T_2
a) Elevated and At-Grade	3	2

ASHOK KUMAR GUPTA
Chief Engineer
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-1
NOIDA (U.P.)

Project Directorate
Approved on
04/12/17
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

1.9 DERAILMENT GUARD

(a) Derailment Guard shall be provided on inside/outside of running rail on viaduct as well as At grade section at locations specified by the Metro Railway.

(b) The Lateral Clearance between the running rail and the derailment Guard shall be 210 ± 30 mm. It shall not be lower than 25mm 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 MoR, the lateral clearance between running rail and the derailment guard shall be 250 ± 20 mm. This fastening system, if used in tunnels having multiple tracks, Metro Administration should ensure that K.E. for adjacent track is not infringed so long as the wheels of any derailed vehicle are within the main rail and derailment guard.

Project Directorate
Approved on
04/12/13
Railway Board

ASHOK KUMAR GUPTA
Chief Engineer/Consultant (NSN)
Delhi Metro Rail Corp. Ltd.
Metro Bhawan, Shopping Complex, Sector-32
NOIDA (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

CHAPTER - 2

STATIONS

2.1 SPACING OF TRACKS AT STATIONS

Minimum spacing of tracks at station on straight and on curve of radius of 1000M and flatter, without any structure between tracks at-Grade and Elevated Stations 3900 mm

2.2 PLATFORMS

2.2.1 Maximum horizontal distance from centre of track to face of passenger platform coping

(i) For elevated/at grade section 1525 mm

2.2.2 Minimum horizontal distance from centre of track to face of passenger platform coping

(i) For elevated/At-Grade section 1520 mm

Notes:

a) Platform faces shall be flared away smoothly from the centre line of the track at either end for a minimum distance of 1500 mm beyond passenger area so as to give from centre of track a minimum dimension:

- 1590 $\pm$ 5 for At-Grade and Elevated Stations

b) For additional clearance for platforms on curves, refer to para 2.7

c) The track access gates at the end of platform upto a height of one meter from top of platform shall not infringe the Kinematic Envelope.

d) Refer Figure No. NMSG - 5.

2.2.3 Height above rail level for passenger platform:

		Maximum	Minimum
(a)	At-Grade	1085 mm	1075 mm
(b)	Elevated	1095 mm	1085 mm

2.2.4 (i) Minimum horizontal distance of any isolated structure on a passenger platform from the edge of coping except Platform Gate (PG) 2500 mm

ii) Minimum horizontal distance of any continuous structure on a passenger platform from the edge of coping except Platform Gate (PG) 3000 mm

ASHOK KUMAR GUPTA
Chief Engineer/Delhi Metro/...
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29
NOIDA (U.P.)

Project Directorate
Approved on
04/12/17
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

Notes:

a) The Platform Gates (PG) may be installed at platform as per design of Original Equipment Manufacturer (OEM) of PG but should of having a minimum clearance of 10mm from Kinematic Envelope.

b) The structure on the platform is treated as isolated if the length along the platform length is 2000 mm or less. Any structure having a length exceeding 2000 mm is treated as continuous structure. The clocks/mirrors/CCTV screens 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 2000 mm from top of platform.

c) For platform structure setting-out dimensions at stations, refer to figure No. NMSG – 5 for Elevated & At-Grade Section. No fixed structures should infringe the Structure Gauge except for designated railway operational structures. Designated railway operational structures include platform edges, hand railing in back-of-house platform edge, OHE and its support structure and traction feeding cables and wires. Such designated railway operational structures should not infringe the Kinematic Envelope under any circumstances.

2.2.5 For the structure gauge of At Grade and Elevated section, refer to following Figures.

a) For At Grade and elevated stations NMSG-5

2.3 TRACK GRADIENT IN PLATFORM

(a) Maximum	1 in 400
(b) Desirable	Level

Note:- There shall be no change of gradient in platform track

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 subject to the restrictions embodied in Note below shall be as under:

(a) For At-Grade and Elevated Stations

• From C.L. of track to 1330 mm	25 mm
• From 1330 mm to 1465 mm	25 mm increasing to 65 mm
• From 1465 mm to 1640 mm	65 mm increasing to 200 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 229 mm outside and 140 mm inside the gauge face of the rails.

ASHOK KUMAR GUPTA

Project Directorate Approved on 04/12/17 Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

2.5 POINTS & CROSSING

2.5.1	Maximum clearance of check rail opposite nose of crossing	42 mm
2.5.2	Minimum clearance of check rail opposite nose of crossing	40 mm
2.5.3	Clerance between switch rail and stock rail at heel of switch	60± 2 mm
2.5.4	Maximum clearance of wing rail at nose of crossing	46 mm
2.5.5	Minimum clearance of wing rail at nose of crossings.	44 mm
2.5.6	Minimum clerance between toe of open switch and stock rail.	160 mm
2.5.7	Minimum radius of curvature for slip points, turnouts and crossover roads.	140 m
2.5.8	Minimum angle of crossing (ordinary)	1 in 9
2.5.9	Diamond crossing not to be flatter than	1 in 4.5

Note:

a) The above restrictions shall not apply to moveable diamond crossings

b) There must be no change of super elevation (of outer over inner rail) between points 18 meters outside toe of switch rail and nose of crossings respectively, except in the case of special crossing leading to snag dead-ends or under circumstances as provided for in item 2.6 below

2.5.10	Minimum length of tongue rail	9000 mm

2.6 SUPERELEVATION AND SPEED AT STATIONS 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 superelevation, calculated for the speed of the fastest train may be reduced by a maximum amount of cant deficiency without reducing speed on the main line.

2.6.2 **Turnouts:**

i) **Curves of contrary flexure**

The equilibrium superelevation (**s**) in mm should be = (1510/127) (V^2 / R)
Where, R = radius of turnout in meters and V is speed on turnout in Kmph.
The permissible negative superelevation on the turnout (which is also the actual superelevation of the main line) may then be = (Cd – **s**) mm

Where Cd = Permissible Cant deficiency

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NCR
Delhi Metro Rail Corpn. Ltd.
Sunga Shopping Complex, Sector-29
NOIDA (U.P.)

Project Directorate
Approved on
04/12/17
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

i) **Curves of Similar flexure**

The question of reduction or otherwise of superelevation on the main line must necessarily be determined by the administration concerned. In the case of a reverse curve close behind the crossing of a turnout, the superelevation may be run out at the maximum of 1 mm in 440 mm.

2.7 ADDITIONAL CLEARANCE FOR PLATFORMS ON CURVES

1. The minimum radius of horizontal curve for station platform line is 1000 meters. There will be no superelevation and gauge widening of station on passenger platform lines.
2. Platform located in area shall be fitted with a gap filler wherever necessary to maintain the maximum stepping distance of 75 mm. The gap filler shall be of elastic nature and flexible to allow train contact without any adverse effect on passenger safety and suitability of train.

Note:

The additional clearance for platform on curves is to be provided as shown at Appendix-4.

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ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/CON
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29
NOIDA (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

CHAPTER-3
ROLLING STOCK

3.1 PASSENGER ELECTRIC MULTIPLE UNITS

S.No.		
1.	(a) Length of the coach body (Maximum including end fairings) (b) The maximum width of the vehicle (c) Height of the coach body (maximum with pantograph in locked down condition)	23000mm 2900 mm 4048 mm
2.	(a) Distance between bogie centre's (b) Maximum distance apart between any two adjacent axles	14750± 350 mm 12900mm
3.	Kinematic Envelope for level tangent track (i) For At-Grade and Elevated Sections (ii) For At-Grade and Elevated Sections at platform	 Figure No. NMSG-1 Figure No. NMSG-1A
4.	Minimum clearance from rail level with fully loaded condition for bogie mounted equipment in worst condition* (*The worst condition means wheels with maximum tread wear and primary springs with maximum deflection) in static condition.	75 mm
5.	Minimum clearance from rail level under fully Loaded condition for body mounted equipment in worst condition* (*The 'worst condition' means deflated secondary air spring wheels with maximum tread wear and primary springs with maximum deflection) in static condition.	102 mm
6	Minimum clearance from rail level, under dynamic condition of fully loaded vehicle for bogie and body mounted equipment with maximum tread wear and primary springs with maximum deflection, with the exception of wheel & attachments. There to (vide note below #) Note: # A tyre or an attachment to a wheel or sand pipes or Wheel/Track Lubrication Nozzle in line with the wheel may project below the minimum height of 50mm from a distance of 51 mm inside to 216 mm outside of the gauge face of wheel.	50 mm
7.	Incline of Tread/Wheel Profile	RDSO wheel Profile to SK 91146 ALT-2 or UIC S1002 Wheel Profile.

ASHOK KUMAR GUPTA
Chief Engineer/Construction
Delhi Metro Rail Corporation Ltd.
Ganga Bhagirathi Complex, Sector-29
NOIDA (U.P.)

Project Directorate
Approved on 04/12/12
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

8.	Wheel a) Maximum wheel gauge back to back distance b) Minimum wheel gauge back to back distance	 1360 mm 1358 mm
9.	a) Maximum diameter on the tread measured at 63.5 mm from wheel gauge face for RDSO wheel Profile as per SK 91146 ALT 2 b) Minimum diameter on the tread measured at 63.5 mm from wheel gauge face for RDSO wheel Profile as per SK 91146 ALT - 2 c) Maximum diameter on the tread measured at 70 mm from wheel gauge face for UIC S 1002 profile d) Minimum diameter on the tread measured at 70 mm from wheel gauge face for UIC S 1002 profile	860 mm 780 mm 860 mm 780 mm
10.	a) Minimum projection for flange of new wheel measured from tread at 63.5 mm from the wheel gauge face for RDSO Profile as per SK 91146 ALT-2 b) Minimum projection for flange of new wheel measured from tread at 70 mm from the wheel gauge face for UIC S1002 profile c) Maximum projection for flange worn wheel measured from tread at 63.5 mm from wheel gauge face for RDSO wheel Profile as per SK 91146 ALT-2 d) Maximum projection for flange of worn wheel measured from tread of 70mm from wheel gauge face for UIC S1002 profile	28.5+1 mm -0 mm 28+1 mm -0 mm 34 mm 36 mm
11.	a) Maximum thickness of flange of wheel measured at 13 mm from tip of Flange for RDSO profile as per SK 91146 ALT-2 b) Maximum *q_R of new wheel for UIC S1002 profile c) Minimum thickness of flange of wheel measured at 13 mm from tip of Flange for RDSO profile as per SK 91146 ALT-2 d) Minimum *q_R for flange of worn wheel for UIC S1002 profile * q_R shall be measured as defined in UIC 510-2 for S 1002 wheel profile.	29.4 mm 10.8 mm 25 mm 6.5 mm

Project Directorate
Approved on
04/12/17
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

12.	a) Width of wheel for RDSO profile as per SK 91146 ALT-2 b) Width of wheel for UIC S1002 profile	130 mm nominal 135 mm nominal
13.	Floor Height a) Maximum height above rail level for floor of any unloaded vehicle b) Minimum height above rail level for floor of fully loaded normal vehicle	 1130 mm 1100 mm
14.	a) Maximum height of centre coupler above rail level for unloaded vehicle b) Minimum height of centre coupler above rail level for fully loaded vehicle	815mm 740 mm
15.	Maximum length of coach over couplers	23708 mm
16.	Length of rigid wheel base for single bogie	2200 to 2600 mm

3.2 LOCOMOTIVES AND ENGINEERING SERVICE VEHICLES

Other items of rolling stock, viz shunting locomotives, OHE maintenance and inspection cars, emergency re-railing van, track machines, etc., used on Noida Metro System (where these cars would be plying) will conform with the Kinematic Envelope of the Passenger Electric Multiple Units as shown in Figure No. NMSG - 1 for Elevated and At-Grade sections.

ASHOK KUMAR GUPTA
Chief Engineer/Consultant (Civil)
Delhi Metro Rail Corporation
Ganga Bhawan, Plot No. 2, Phase-III
Noida (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

Project Directorate
Approved on
04/12/17
Railway Board

CHAPTER 4

OVERHEAD ELECTRIC TRACTION 25 KV/AC 50 CYCLES PER SECOND

Note: Wherever electric traction is in use, special precautions must be taken to maintain following clearances:

4.1 ELECTRICAL CLEARANCES FOR AT-GRADE AND ELEVATED SECTIONS

4.1.1 Minimum vertical distance between any live bare conductor (overhead equipment or pantograph) and any earthed structure or other bodies (rolling stock, over bridges, signal gantries etc.)

	Condition	For Flexible OHE
(i)	Long duration (Static)	320mm
(ii)	Short Duration (Dynamic)	270mm

Note:

A minimum vertical distance of 340 mm shall normally be provided between rolling stock and contact wire to allow for a 20 mm temporary raising of the tracks during maintenance. Wherever the clearance required for track maintenance exceeds 20 mm, the vertical distance between rolling stock and contact wire shall correspondingly be increased.

4.1.2 Minimum lateral distance between any bare live conductor (over head equipment or pantograph) or any earthed structure or other bodies (rolling stock, over bridges, signal gantries etc.)

	Condition	For Flexible OHE
(i)	Long duration (Static)	320 mm
(ii)	Short Duration (Dynamic)	220 mm

4.1.3 Height of contact wire:

Minimum height from rail level to the underside of live Conductor wire

i)	Underbridge (FOB,ROB,Railway Bridge,viaduct).....	4800 mm
ii)	In the open	5000 mm
iii)	At level crossings	5500 mm
iv)	In running and carriage sheds wherever staff are expected to work on the roof of rolling stock.	5200 mm

ASHOK KUMAR GUPTA

Project Directorate Approved on 04/12/11 Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

Note:

a) On curves, all vertical distances specified in items 4.1.3 above, shall be measured above level of the inner rail, increased by half the super-elevation.

b) Maximum variation of the live conductor wire on either side of the centre line of the track under static conditions:

i) On straight ..... ±200mm

ii) On Curves ..... ±300mm

Note: These limits would not apply to special locations like insulated overlaps and out of run wires.

4.1.4 Maximum width of pantograph collector :

The Kinematic Envelope with the size of Pantograph adopted shall be within the Kinematic Envelope shown at Figure No. NMSG-1

ASHOK KUMAR GUPTA
Chief Engineer/Construction/HQ
Delhi Metro Rail Corporation Ltd.
Delhi

Project Directorate
Approved on
04/12/17
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

Chapter- 5

PLATFORM GATE

5.1 PLATFORM GATE SETTING OUT DIMENSIONS:

Minimum Platform Gate Width (clear opening)	2000 mm
Minimum Platform Gate Height from PF level	1500 mm
Minimum Platform threshold offset from track centerline – straight track (Elevated/At Grade)	1520 mm
Minimum Platform gate panel offset from track centerline – straight track (Elevated/At Grade)	1545 mm

Note:

(a) Assumed plus/minus 300 mm stopping accuracy.

(b) Platform gates at stations on curves shall be considered separately taking into account the additional clearance as per Appendix-4.

(c) Platform Gates are considered as designated railway operational structures. Therefore, platform gates may infringe the structure gauge, but does not infringe the station kinematic envelope and having minimum clearance of 10 mm from kinematic Envelope to Platform Gate.

(d) Refer figure NMSG-6.

ASHOK KUMAR GUPTA

Project Directorate Approved on 04/12/17 Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

Appendix-1

PERMISSIBLE SPEED, CANT AND
MINIMUM TRACK SPACING ON CURVES.

ELEVATED AND AT-GRADE SECTIONS

(REFERENCE: PARA 1.1)

RADIUS OF CURVE	CANT	MAXIMUM PERMISSIBLE SPEED	MINIMUM DISTANCE BETWEEN ADJACENT TRACKS See note (a)
			ELEVATED AND AT-GRADE
metres	mm	kmph	mm
3000 or more	15	85	3650
2800	15	85	3650
2400	20	85	3650
2000	20	85	3650
1600	25	85	3650
1500	30	85	3700
1200	35	85	3700
1000	45	85	3700
800	55	85	3700
600	70	85	3750
500	85	85	3750
450	95	85	3800
400	105	80	3800
350	110	75	3800
300	110	70	3850
200	110	55	3950
150	110	50	4050
150*	0	30	4050
120	110	45	4150
120*	0	30	4150
100*	0	25	4250

Notes:

(a) The track spacing shown in the table above is without any column/structure between two tracks and is with equal cant for both outer and inner tracks.

b) Track spacing shown in Table above is not applicable to stations which should be calculated depending on specific requirement but the spacing should not be less than the spacing stipulated in para 2.1

c) Figure for any intermediate radius of curvature may be obtained by adopting the value for sharper curve.

d) Cant provided is limited to desirable value of 110 mm

e) Maximum cant defficiency is 85 mm.

f) *Curves in depot/workshop are NON transitioned and without any cant.

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NON
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29
NOIDA (U.P.)

Project Directorate
Approved on
04/12/17
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

APPENDIX-2

EXTRA HORIZONTAL CLEARANCE ON CURVES

(CURVATURE EFFECT)

INSIDE OF CURVE

REFERENCE: PARA 1.7.1

RADIUS (metres)	MID-THROW (28500/R) (mm)	NOSING INCLUDED IN K.E/ STRUCTURE GAUGE FOR TANGENT TRACK (mm)	EXTRA GAUGE CLEARANCE ON CURVES (mm)	EXTRA HORIZONTAL CLEARANCE ON CURVE (mm)	REMARKS
R	(V)	(N)	(G)	(T_1)	
100	285.0	26.0	9.0	268	
120	237.5	26.0	9.0	221	1.0 EXTRA GAUGE CLEARANCE ON CURVES (G) = 9mm for curves sharper than 500m and 5mm for curves with radius of 500m to less than 1000m.
150	190.0	26.0	9.0	173	
175	162.9	26.0	9.0	146	
200	142.5	26.0	9.0	126	
250	114.0	26.0	9.0	97	
300	95.0	26.0	9.0	78	
350	81.4	26.0	9.0	64	
400	71.3	26.0	9.0	54	2.0 T1=V-N+G for V ≥ N and T1= G for V < N
450	63.3	26.0	9.0	46	
500	57.0	26.0	5.0	36	
600	47.5	26.0	5.0	27	
700	40.7	26.0	5.0	20	
800	35.6	26.0	5.0	15	
900	31.7	26.0	5.0	11	
1000	28.5	26.0	0.0	3	
1200	23.8	26.0	0.0	0	
1500	19.0	26.0	0.0	0	
1600	17.8	26.0	0.0	0	
2000	14.3	26.0	0.0	0	
2400	11.9	26.0	0.0	0	
2800	10.2	26.0	0.0	0	
3000 or more	9.5	26.0	0.0	0	

Mid throw (in mm) V = (125 x C^2) /R= 28500/R

Where 'C' is the distance between bogie centers = 14.750+0.350=15.100m **OR** 14.750 - 0.350=14.400 m.

The worst case will be with C=15.100 m

R is the radius of curve in metres.

Mid throw (in mm) V = (125 x C^2) /R= 28500/R

OUTSIDE OF CURVE

REFERENCE PARA 1.7.2

RADIUS (metres)	END-THROW (34635/R) (mm)	EXTRA GAUGE CLEARANCE ON CURVES (mm)	EXTRA NOSING DUE TO EXTRA GAUGE CLEARANCE (mm)	EXTRA HORIZONTAL CLEARANCE ON CURVE (mm)	REMARKS
R	Vo	G	EN	T_2	
100	346.4	9.0	2.3	358	1.0 EXTRA GAUGE CLEARANCE ON CURVES (G) = 9mm for curves sharper than 500m and 5mm for curves with radius of 500m to less than 1000m.
120	288.6	9.0	2.3	300	
150	230.9	9.0	2.3	242	
175	197.9	9.0	2.3	209	
200	173.2	9.0	2.3	184	
250	138.5	9.0	2.3	150	
300	115.5	9.0	2.3	127	2.0 T_2=Vo+G+EN
350	99.0	9.0	2.3	110	
400	86.6	9.0	2.3	98	3.0 EN=Gx0.251986301
450	77.0	9.0	2.3	88	
500	69.3	5.0	1.3	76	
600	57.7	5.0	1.3	64	
700	49.5	5.0	1.3	56	
800	43.3	5.0	1.3	50	
900	38.5	5.0	1.3	45	
1000	34.6	0.0	0.0	35	
1200	28.9	0.0	0.0	29	
1500	23.1	0.0	0.0	23	
1600	21.6	0.0	0.0	22	
2000	17.3	0.0	0.0	17	
2400	14.4	0.0	0.0	14	
2800	12.4	0.0	0.0	12	
3000 or more	11.5	0.0	0.0	12	

End Throw (in mm) Vo= (125 x C_1^2) /R - (125xC^2)/R = 34635/R

Where 'C' is the distance between bogie centers = 14.750+0.350=15.100m OR 14.750-0.350=14.400m .

Worst case will be with C=14.400

'C_1' is length of coach in meters = 22.01 m and 'R' is radius of curve in meters.

ASHOK KUMAR GUPTA
Chief Engineer/Consultant (Civil)
Delhi Metro Rail Corp. Ltd.
Gaur Shopping Complex, Sector-22
NOIDA (U.P.)

Project Directorate
Approved on
04/12/17
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

APPENDIX-3

NOIDA GREATER NOIDA METRO

CANT EFFECT ON STRUCTURE GAUGE-HORIZONTAL

AT-GRADE AND ELEVATED

REFERENCE: PARA 1.8.1 & 1.8.2

ALL FIGURES ARE IN mm

Height above rail level measured perpendicular to plane of track →					h= 305				h= 930				h= 3310				h= 3775				h= 6250			
Distance from center line of track to Structure Gauge for tangent track. →					ab= 1640				ab= 1735				ab= 1825				ab= 1546				ab= 1546			
Cant	Angle α Degrees	Sin α	cos α	tan α	E_1	F_1	H_1	H_2	E_1	F_1	H_1	H_2	E_1	F_1	H_1	H_2	E_1	F_1	H_1	H_2	E_1	F_1	H_1	H_2
110	4.178	0.073	0.997	0.07	1658	1613	479	240	1798	1663	1109	856	2061	1579	3489	3223	1817	1267	3933	3707	1997	1087	6401	6176
105	3.987	0.070	0.998	0.07	1657	1615	471	243	1795	1666	1101	860	2051	1590	3481	3228	1805	1280	3926	3711	1977	1108	6395	6180
100	3.797	0.066	0.998	0.07	1657	1616	463	246	1793	1670	1093	863	2040	1602	3474	3232	1793	1293	3919	3714	1957	1129	6389	6184
95	3.607	0.063	0.998	0.06	1656	1618	455	249	1790	1673	1085	867	2030	1613	3466	3236	1780	1305	3912	3718	1936	1150	6382	6188
90	3.417	0.060	0.998	0.06	1655	1619	447	252	1787	1676	1077	870	2019	1624	3458	3240	1768	1318	3905	3721	1916	1171	6376	6192
85	3.227	0.056	0.998	0.06	1655	1620	439	255	1785	1680	1069	873	2008	1636	3450	3245	1756	1331	3899	3724	1895	1192	6370	6196
80	3.037	0.053	0.999	0.05	1654	1622	431	258	1782	1683	1061	877	1998	1647	3442	3249	1744	1344	3892	3728	1875	1213	6363	6199
75	2.847	0.050	0.999	0.05	1653	1623	424	261	1779	1687	1053	880	1987	1658	3434	3253	1732	1357	3885	3731	1855	1234	6357	6203
70	2.657	0.046	0.999	0.05	1652	1624	416	264	1776	1690	1044	884	1976	1670	3426	3257	1719	1369	3878	3734	1834	1255	6350	6207
65	2.467	0.043	0.999	0.04	1652	1625	408	267	1773	1693	1036	887	1966	1681	3418	3261	1707	1382	3871	3737	1814	1276	6343	6210
60	2.277	0.040	0.999	0.04	1651	1627	400	270	1771	1697	1028	890	1955	1692	3410	3265	1695	1395	3863	3741	1793	1296	6336	6214
55	2.087	0.036	0.999	0.04	1650	1628	392	273	1768	1700	1020	894	1944	1703	3402	3269	1682	1407	3856	3744	1773	1317	6330	6217
50	1.898	0.033	0.999	0.03	1649	1629	384	276	1765	1703	1012	897	1934	1714	3394	3273	1670	1420	3849	3747	1752	1338	6323	6220
45	1.708	0.030	1.000	0.03	1648	1630	376	278	1762	1707	1004	900	1923	1726	3385	3277	1658	1433	3842	3750	1732	1359	6316	6224
40	1.518	0.026	1.000	0.03	1648	1631	368	281	1759	1710	996	904	1912	1737	3377	3280	1645	1445	3835	3753	1711	1380	6309	6227
35	1.328	0.023	1.000	0.02	1647	1632	360	284	1756	1713	987	907	1901	1748	3369	3284	1633	1458	3827	3756	1690	1401	6302	6230
30	1.138	0.020	1.000	0.02	1646	1634	353	287	1753	1716	979	910	1890	1759	3361	3288	1621	1471	3820	3759	1670	1422	6294	6233
25	0.949	0.017	1.000	0.02	1645	1635	345	290	1750	1719	971	914	1880	1770	3352	3292	1608	1483	3813	3761	1649	1442	6287	6236
20	0.759	0.013	1.000	0.01	1644	1636	337	293	1747	1723	963	917	1869	1781	3344	3296	1596	1496	3805	3764	1629	1463	6280	6239
15	0.569	0.010	1.000	0.01	1643	1637	329	296	1744	1726	955	920	1858	1792	3335	3299	1583	1508	3798	3767	1608	1484	6273	6242
10	0.379	0.007	1.000	0.01	1642	1638	321	299	1741	1729	946	923	1847	1803	3327	3303	1571	1521	3790	3770	1587	1505	6265	6245
5	0.190	0.003	1.000	0	1641	1639	313	302	1738	1732	938	927	1836	1814	3319	3306	1558	1533	3783	3772	1567	1525	6258	6247
0	0.000	0.000	1.000	0	1640	1640	305	305	1735	1735	930	930	1825	1825	3310	3310	1546	1546	3775	3775	1546	1546	6250	6250

REFER TO FIGURE: NMSG-3

E_1=[ab+(h x tan α)] x cos α

F_1=[Ab- (h x tan α)] x cos α

H_1=(Ca/2)+(h / cos α)+(Ab-h x tan α)xsin α

H_2=(Ca/2)+(h/ cos α)-(ab+h x tan α)xsin α

ab=Ab=Distance from center line of vehicle to Structure gauge for Tangent track at height 'h' from rail level

ac=Distance from center line of canted tack to Structure Gauge for Tangent track at height 'h' from rail level.

bc=hxtanα=Lateral increment due to cant (measured along the line parallel to line joining top of rails).

Project Directorate * Railway Board * Approved on 04/12/17

(ATAL KUMAR RAI) I.A.S
Executive Director
N.M.R.C.

ASHOK KUMAR GUPTA

APPENDIX-3A

NOIDA GREATER NOIDA METRO

CANT EFFECT ON KINEMATIC ENVELOPE-HORIZONTAL

AT-GRADE AND ELEVATED SECTIONS

REF: PARA 1.8.1

Height above rail level measured perpendicular to plane of track ⟶					h= 938				h= 997				h= 1130				h= 2878				h= 3296				h= 4014				h= 4866				h= 5018			
Distance from center line of track to K.E for tangent track. ⟶					ab= 1582				ab= 1584				ab= 1590				ab= 1658				ab= 1658				ab= 1225				ab= 1220				ab= 880			
Cant	Angle α Degres	Sin α	cos α	tan α	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2
110	4.178	0.073	0.997	0.073	1646	1509	1106	875	1652	1507	1165	934	1668	1503	1298	1066	1863	1444	3046	2805	1894	1413	3463	3221	1514	929	4148	3969	1671	862	4997	4819	1243	512	5124	4996
105	3.987	0.070	0.998	0.07	1643	1513	1098	878	1649	1511	1157	937	1665	1508	1290	1069	1854	1454	3039	2808	1883	1425	3456	3225	1501	943	4142	3972	1655	879	4992	4822	1227	529	5120	4997
100	3.797	0.066	0.998	0.066	1641	1516	1091	881	1647	1514	1150	940	1661	1512	1283	1072	1845	1464	3031	2812	1873	1436	3449	3229	1488	956	4136	3974	1640	895	4986	4825	1210	546	5115	4999
95	3.607	0.063	0.998	0.063	1638	1520	1083	884	1644	1518	1142	943	1658	1516	1275	1075	1836	1474	3024	2815	1862	1447	3441	3233	1475	970	4131	3976	1524	911	4981	4827	1194	563	5111	5000
90	3.417	0.060	0.998	0.06	1635	1523	1076	887	1641	1522	1135	946	1655	1520	1268	1078	1827	1484	3017	2819	1852	1459	3434	3236	1462	984	4125	3979	1508	928	4975	4830	1178	579	5107	5002
85	3.227	0.056	0.998	0.056	1632	1527	1068	890	1638	1525	1127	949	1651	1524	1260	1081	1817	1493	3009	2823	1841	1470	3427	3240	1449	997	4119	3981	1492	944	4969	4832	1161	596	5102	5003
80	3.037	0.053	0.999	0.053	1629	1530	1060	893	1635	1529	1120	952	1648	1528	1253	1084	1808	1503	3002	2826	1830	1481	3419	3244	1436	1011	4113	3983	1476	960	4964	4835	1145	613	5098	5004
75	2.847	0.050	0.999	0.05	1627	1533	1053	896	1632	1533	1112	955	1644	1532	1245	1087	1799	1513	2994	2830	1820	1492	3412	3247	1423	1024	4107	3986	1460	977	4958	4837	1128	630	5093	5006
70	2.657	0.046	0.999	0.046	1624	1537	1045	899	1629	1536	1104	957	1641	1536	1237	1090	1790	1523	2987	2833	1809	1503	3404	3251	1410	1038	4101	3988	1444	993	4952	4839	1112	646	5088	5007
65	2.467	0.043	0.999	0.043	1621	1540	1038	902	1625	1540	1097	960	1637	1540	1230	1093	1780	1533	2979	2836	1798	1515	3397	3254	1397	1051	4096	3990	1428	1009	4947	4841	1095	663	5084	5008
60	2.277	0.040	0.999	0.04	1618	1543	1030	904	1622	1543	1089	963	1634	1544	1222	1096	1771	1542	2972	2840	1788	1526	3389	3258	1384	1065	4090	3992	1412	1026	4941	4844	1079	680	5079	5009
55	2.087	0.036	0.999	0.036	1615	1547	1023	907	1619	1547	1082	966	1630	1548	1215	1099	1762	1552	2964	2843	1777	1537	3382	3261	1370	1078	4083	3994	1396	1042	4935	4846	1062	697	5074	5010
50	1.898	0.033	0.999	0.033	1612	1550	1015	910	1616	1550	1074	969	1627	1552	1207	1102	1752	1562	2956	2847	1766	1548	3374	3264	1357	1091	4077	3996	1380	1058	4929	4848	1046	713	5069	5011
45	1.708	0.030	1.000	0.03	1609	1553	1007	913	1613	1554	1066	972	1623	1556	1199	1105	1743	1571	2949	2850	1755	1559	3366	3268	1344	1105	4071	3998	1364	1074	4923	4850	1029	730	5064	5012
40	1.518	0.026	1.000	0.026	1606	1557	1000	916	1610	1557	1059	975	1619	1560	1192	1107	1734	1581	2941	2853	1745	1570	3359	3271	1331	1118	4065	4000	1348	1091	4917	4852	1013	747	5060	5013
35	1.328	0.023	1.000	0.023	1603	1560	992	919	1607	1560	1051	978	1616	1563	1184	1110	1724	1591	2933	2856	1734	1581	3351	3274	1318	1132	4059	4002	1332	1107	4910	4854	996	763	5055	5014
30	1.138	0.020	1.000	0.02	1600	1563	984	921	1603	1564	1043	980	1612	1567	1176	1113	1715	1600	2925	2859	1723	1592	3343	3277	1305	1145	4053	4004	1316	1123	4904	4856	980	780	5049	5015
25	0.949	0.017	1.000	0.017	1597	1566	977	924	1600	1567	1036	983	1608	1571	1169	1116	1705	1610	2918	2863	1712	1603	3335	3281	1291	1158	4046	4006	1300	1139	4898	4858	963	797	5044	5015
20	0.759	0.013	1.000	0.013	1594	1569	969	927	1597	1571	1028	986	1605	1575	1161	1119	1696	1620	2910	2866	1702	1614	3328	3284	1278	1172	4040	4007	1284	1155	4892	4859	946	813	5039	5016
15	0.569	0.010	1.000	0.01	1591	1573	961	930	1594	1574	1020	989	1601	1579	1153	1122	1687	1629	2902	2869	1691	1625	3320	3287	1265	1185	4033	4009	1268	1172	4885	4861	930	830	5034	5017
10	0.379	0.007	1.000	0.007	1588	1576	953	933	1591	1577	1012	991	1597	1582	1146	1124	1677	1639	2894	2872	1680	1636	3312	3290	1252	1198	4027	4011	1252	1188	4879	4863	913	847	5029	5017
5	0.190	0.003	1.000	0.003	1585	1579	946	935	1587	1581	1005	994	1594	1586	1138	1127	1668	1648	2886	2875	1669	1647	3304	3293	1238	1212	4021	4012	1236	1204	4873	4864	897	863	5023	5018
0	0.000	0.000	1.000	0	1582	1582	938	938	1584	1584	997	997	1590	1590	1130	1130	1658	1658	2878	2878	1658	1658	3296	3296	1225	1225	4014	4014	1220	1220	4866	4866	880	880	5018	5018

REFER TO FIGURE NMSG-3A

E=[ab+(h x tan α)] x cos α

F=[Ab- (h x tan α)] x cos α

H_1=(Ca/2)+(h / cos α)+(Ab-h x tan α)xsin α

H_2=(Ca/2)+(h/ cos α)-(ab+h x tan α)xsin α

ab=Ab=Distance from center line of vehicle to K.E for Tangent track at height 'h' from rail level

ac=Distance from center line of canted tack to K.E for Tangent track at height 'h' from rail level.

bc=hxtanα=Lateral increment due to cant(measured along the line parallel to line joining top of rails.

Project Directorate Approved on 04/12/14 Railway Board

ASHOK KUMAR
Chief Engineer/Civil
Delhi Metro
Delhi 33

(ATAL KUMAR RAI) I.A.S
Executive Director
N.M.R.C.

(ATAL KUMAR RAI) I.A.S
Executive Director
N.M.R.C.

APPENDIX -4

ADDITIONAL CLEARANCE FOR PLATFORMS ON CURVES
ELEVATED AND AT GRADE SATIONS

REF: PARA 2.7

RADIUS	EXTRA CLEARANCE													
	INSIDE OF CURVE								OUTSIDE OF CURVE					
	AT CENTRE LINE OF BOGIES				AT EDGE OF OPEN DOOR NEAREST TO C.L. OF BOGIES				AT END OF COACH	AT EDGE OF OPEN DOOR, FARTHEST FROM C.L. OF BOGIES				
	MID THROW =28500/R	NOSING	ADDITIONAL CLEARANCE	ADDITIONAL CLEARANCE (ROUNDED OFF TO NEAREST 5 mm) (i)	THROW =28498/R	NOSING = 13x 0.873/11	ADDITIONAL CLEARANCE	ADDITIONAL CLEARANCE (ROUNDED OFF TO NEAREST 5 mm) (ii)	END THROW = 34635/R	THROW =20064/R	NOSING =13x 9.59/11	DIFFERENCE BETWEEN N AND N_2	ADDITIONAL CLEARANCE	ADDITIONAL CLEARANCE (ROUNDED OFF TO NEAREST 5 mm) (ii)
R	V	N	V-N	V-N	V_3	N_1	$V_3 - (N-N_1)$	$V_3 - (N-N_1)$	V_0	V_4	N_2	$N-N_2$	$V_4-(N-N_2)$	$V_4-(N-N_2)$
metres	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	2	3	4a	4	5	6	7a	7	8	9	10	11	12a	12
3000	9.5	13.0	-3.5	0	9.5	1.0	-2.5	0	12	6.7	11.3	1.7	5.0	5
2800	10.2	13.0	-2.8	0	10.2	1.0	-1.8	0	12	7.2	11.3	1.7	5.5	10
2400	11.9	13.0	-1.1	0	11.9	1.0	-0.1	0	14	8.4	11.3	1.7	6.7	10
2000	14.3	13.0	1.3	5	14.2	1.0	2.3	5	17	10.0	11.3	1.7	8.4	10
1800	15.8	13.0	2.8	5	15.8	1.0	3.9	5	19	11.1	11.3	1.7	9.5	10
1600	17.8	13.0	4.8	5	17.8	1.0	5.8	10	22	12.5	11.3	1.7	10.9	15
1500	19.0	13.0	6.0	10	19.0	1.0	7.0	10	23	13.4	11.3	1.7	11.7	15
1200	23.8	13.0	10.8	15	23.7	1.0	11.8	15	29	16.7	11.3	1.7	15.1	20
1000	28.5	13.0	15.5	20	28.5	1.0	16.5	20	35	20.1	11.3	1.7	18.4	20

NOTES:

1. For outside of curve, the difference between clearance required at coach end that at the farthest door edge is less than 25 mm. As half width of coach at ends is at least 25 mm less than that at door locations, additional clearance to be provided is additional clearance required at the farthest door edge (column 12).
2. Values of additional clearances (columns 4, 7and 12) are rounded off to the nearest 5 mm.
3. Negative values of additional clearance are taken as Zero in the columns 4 and 7 with rounded off figures.
4. Extra clearance for curve:

(a) Inside of curve:

$V = (125C^2/R)=28500/R$ with C=15.10 m for the worst case.

$V_3=[(125)x(15.1^2- 4x0.873^2)/R]=28498/R$

$N_1=Nx(X)/(C_1/2)=13 \times 0.873/10.97=1.03$ mm

Minimum distance 'X' for the nearest edge of an open door from centre line of Bogies is 0.873 metre. Higher of (i) column 4 and (ii) column 7 shall be adopted

(b) Outside of curve:

$V_0=(125C_1^2/R)-(125C^2/R)=34635/R$ for coach end with C=14.4 metres and C_1=2x11 metres

$V_4=125x(19.18x19.18-14.4x14.4)/R = 20064/R$ for farthest edge of end door in open position with C1=2x9.590=19.18 metres and C=14.40 metres for the worst case.

N_2=Nosing at the farthest edge of an open door=N x (X)/(C_1/2) =13x9.59/ 11mm =11.3 mm

R=Radius of curve in metres

Maximum distance (X) for the farthest edge of open door from centre line of two Bogies=9.590 M

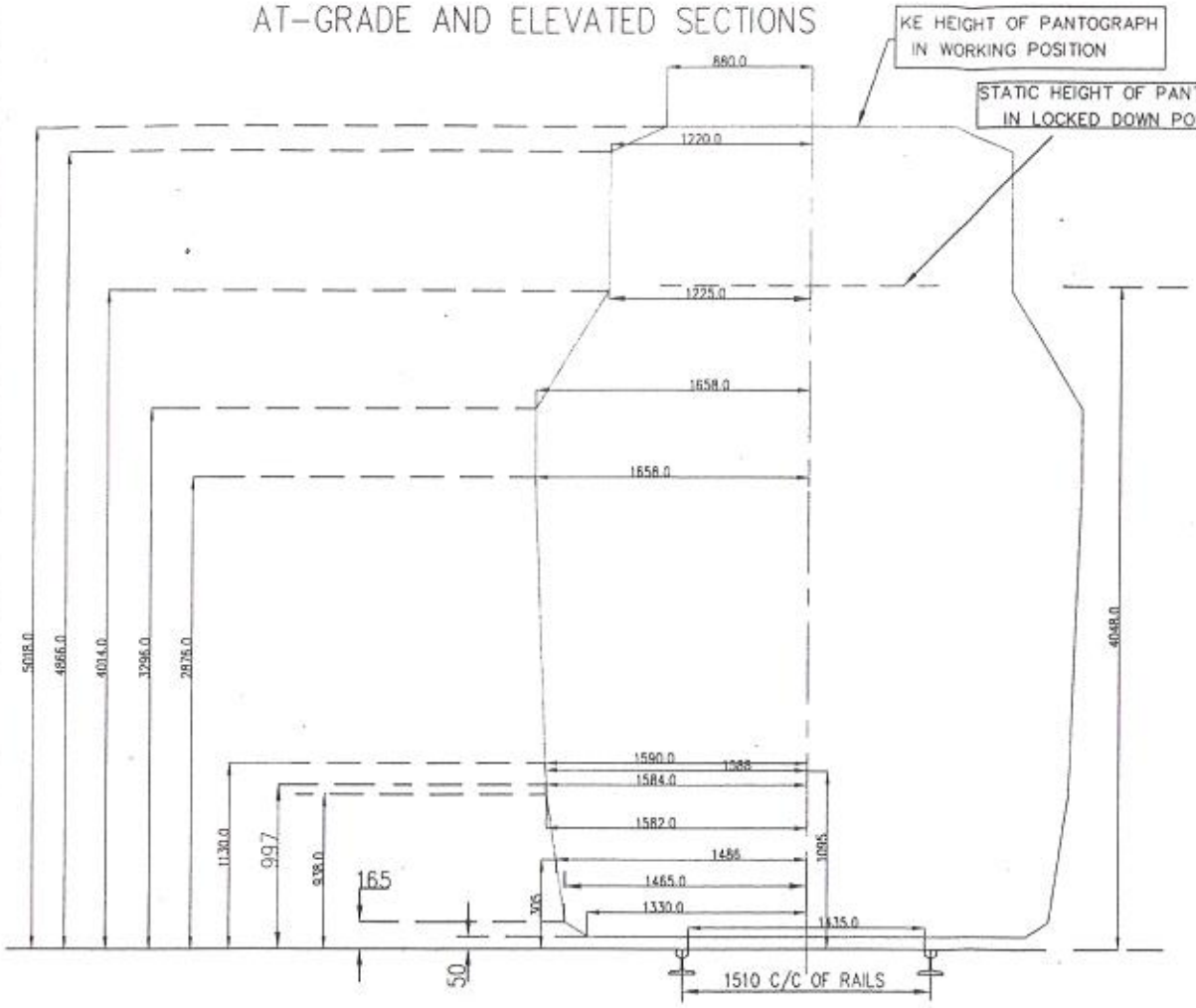
5. There will be no superelevation on curves in platform Portion.

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NGN
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-15,
NOIDA (U.P.)

Project Directorate
Approved on
04/12/12
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

AT-GRADE AND ELEVATED SECTIONS



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. THE CONDUCTOR HEIGHT ABOVE RAIL LEVEL SHALL ALSO TAKE IN TO CONSIDERATION PRESCRIBED ELECTRICAL CLEARENCES BETWEEN ALL LIVE OVERHEAD EUIPMENT AND PANTOGRAPH / VEHICLE AND ALL PARTS THEREOF.
5. A TYRE OR ATTACHMENT OF 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 WHEEL.
5. KINEMATIC ENVELOPE IS VALID FOR OPERATION SPEED OF UPTO 80 KMPH.

Project Directorate Approved on 04/12/17 Railway Board

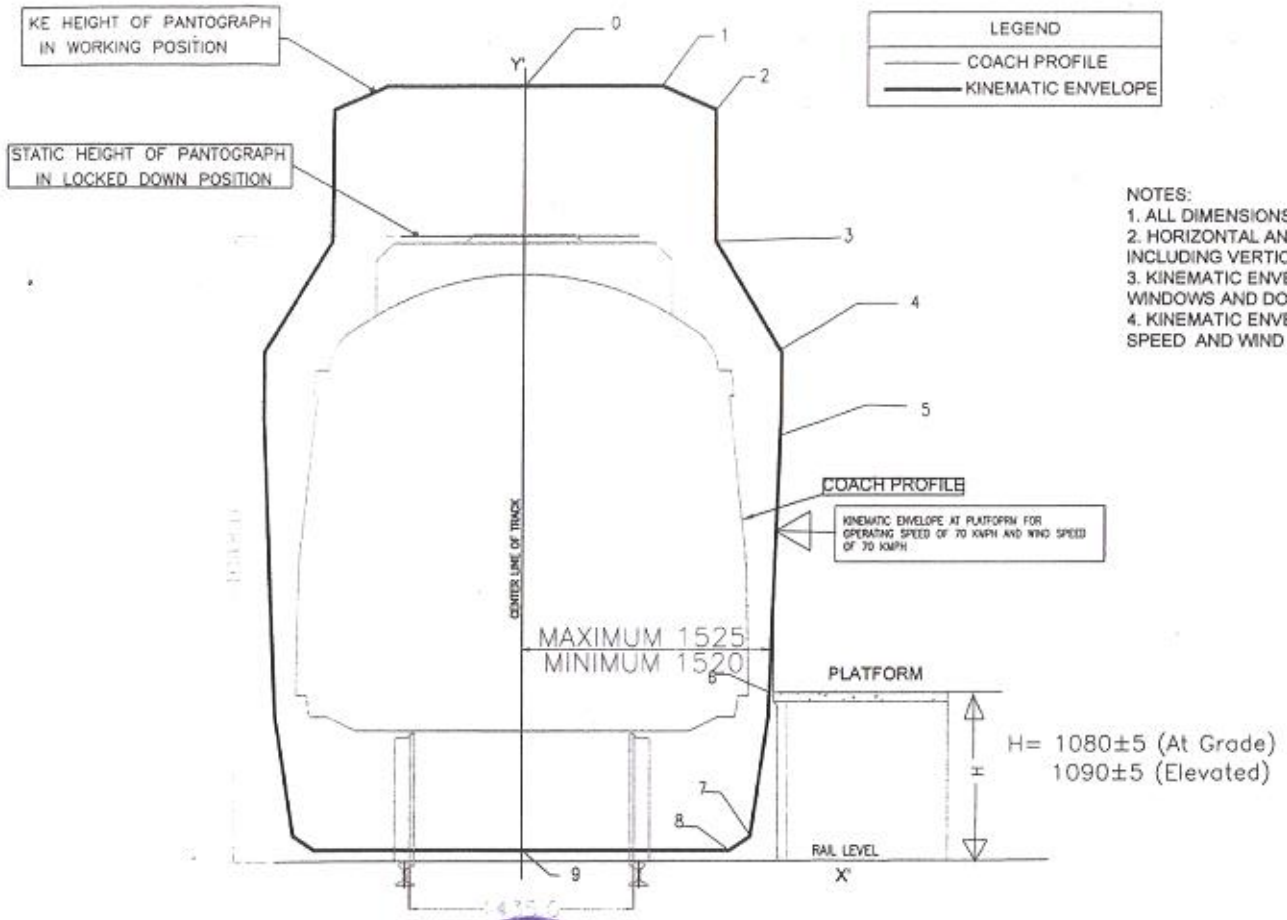
25 kV A.C.TRACTION

KINEMATIC ENVELOPE
AT-GRADE AND ELEVATED SECTIONS
(OUTSIDE STATION)
ON
LEVEL OR CONSTANT GRADE TANGENT TRACK

NOIDA METRO RAIL CORPORATION LTD. ASHOK KUMAR GUPTA Chief Engineer/Consultancy/HQN Delhi Metro Rail Corp. Ltd. Ganga Shopping Complex, Sector-29 NOIDA (U.P.)	STANDARD GAUGE (1435 mm)	DATE: 08-07-2016	FIGURE No. NMSG-1
		SCALE: NOT TO SCALE	REF: PARA 1.5

(ATAL KUMAR RA I.A Executive Director N.M.R.C.

(ATAL KUMAR RAI) I.A.S Executive Director N.M.R.C.



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 WHEN IN MOTION.
4. KINEMATIC ENVELOPE IS VALID FOR FOR 70 KMPH OPERATING SPEED AND WIND SPEED OF 70 KMPH

CO-ORDINATES

	X'	Y'
0	0	5018
1	880	5018
2	1220	4866
3	1225	4014
4	1595	3296
5	1595	2876
6	1515	1090
7	1495	185
8	1330	50
9	0	50

Project Directorate * Railway Board
Approved on 04/8/17

25 kV A.C.TRACTION

KINEMATIC ENVELOPE
AT GRADE/ ELEVATED SECTIONS
ON
LEVEL OR CONSTANT GRADE TANGENT TRACK AT PLATFORM

NOIDA METRO RAIL CORPORATION LTD.

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NSH
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-15

STANDARD GAUGE
(1435 mm)

DATE: 08-07-2016

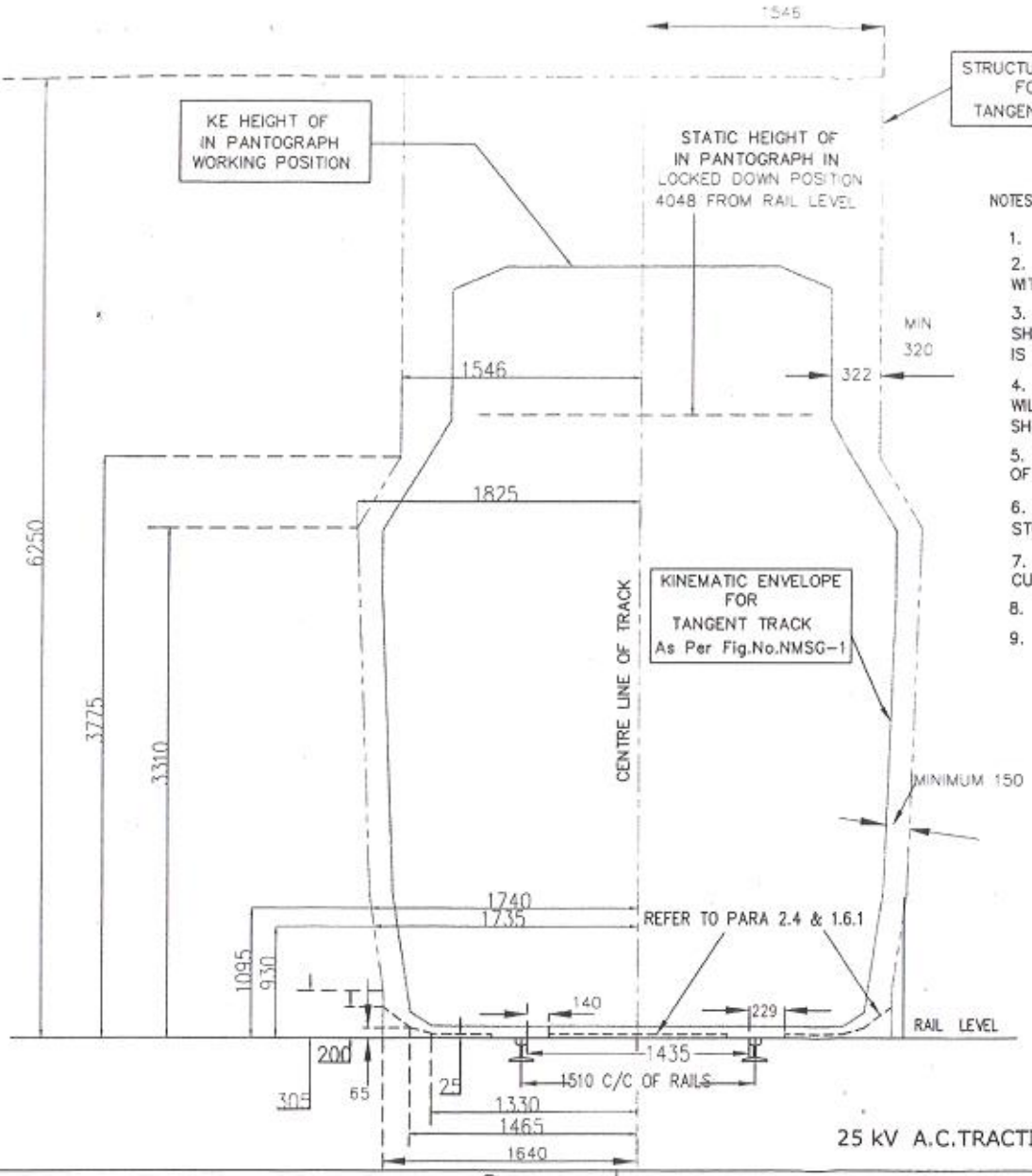
FIGURE No. NMSG-1A

SCALE: NOT TO SCALE

Ref Para 3.1(3)(ii) & 3.2

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.



NOTES

1. ALL DIMENSIONS ARE IN mm.
2. THIS STRUCTURE GAUGE WILL ALSO BE APPLICABLE FOR ROBs/FOBs AT STATIONS WITHOUT THE MAST UNDER THE STRUCTURES.
3. WHERE IT IS NECESSARY TO PROVIDE MAST UNDER THE ROB/FOB,THE HEIGHT SHALL BE INCREASED FROM 6250 mm TO 6290 mm. IN CASE THE CONTACT WIRE IS HIGHER, THE HEIGHT OF THE ROB/FOB SHALL BE INCREASED ACCORDINGLY.
4. MINIMUM CLEARANCE BETWEEN KINEMATIC ENVELOPE AND STRUCTURE GAUGE WILL BE AS STIPULATED IN PARA 1.6.1. MINIMUM ELECTRICAL CLEARANCE OF 320 mm SHALL BE MAITAINED BETWEEN 25 KV LIVE PARTS AND THE EARTHED STRUCTURES.
5. MINIMUM LATERAL CLEARANCE FOR OHE MAST WILL BE 2150 mm FROM THE CENTRE OF TRACK.
6. THE KINEMATIC ENVELOPE AND STRUCTURE GAUGE ARE VALID FOR ROLLING STOCK WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION.
7. HORIZONTAL AND VERTICAL CLEARANCES DUE TO CURVES INCLUDING VERTICAL CURVE AND CANT SHALL BE EXTRA.
8. FOR KINEMATIC ENVELOPE, REFER TO FIGURE: NMSG-1
9. KINEMATIC ENVELOPE IS VALID FOR OPERATION SPEED OF UPTO 80 KMPH.

Project Directorate Approved on 04/12/17 Railway Board

STRUCTURE GAUGE AT-GRADE AND ELEVATED SECTIONS (OUTSIDE STATION) ON LEVEL OR CONSTANT GRADE TANGENT TRACK

25 kV A.C.TRACTION

NOIDA METRO RAIL CORPORATION LTD.

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NGN
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29,
NOIDA (U.P.)

STANDARD GAUGE
(1435 mm)

(ATAL KUMAR RAI) I.A.S Executive Director N.M.R.C.

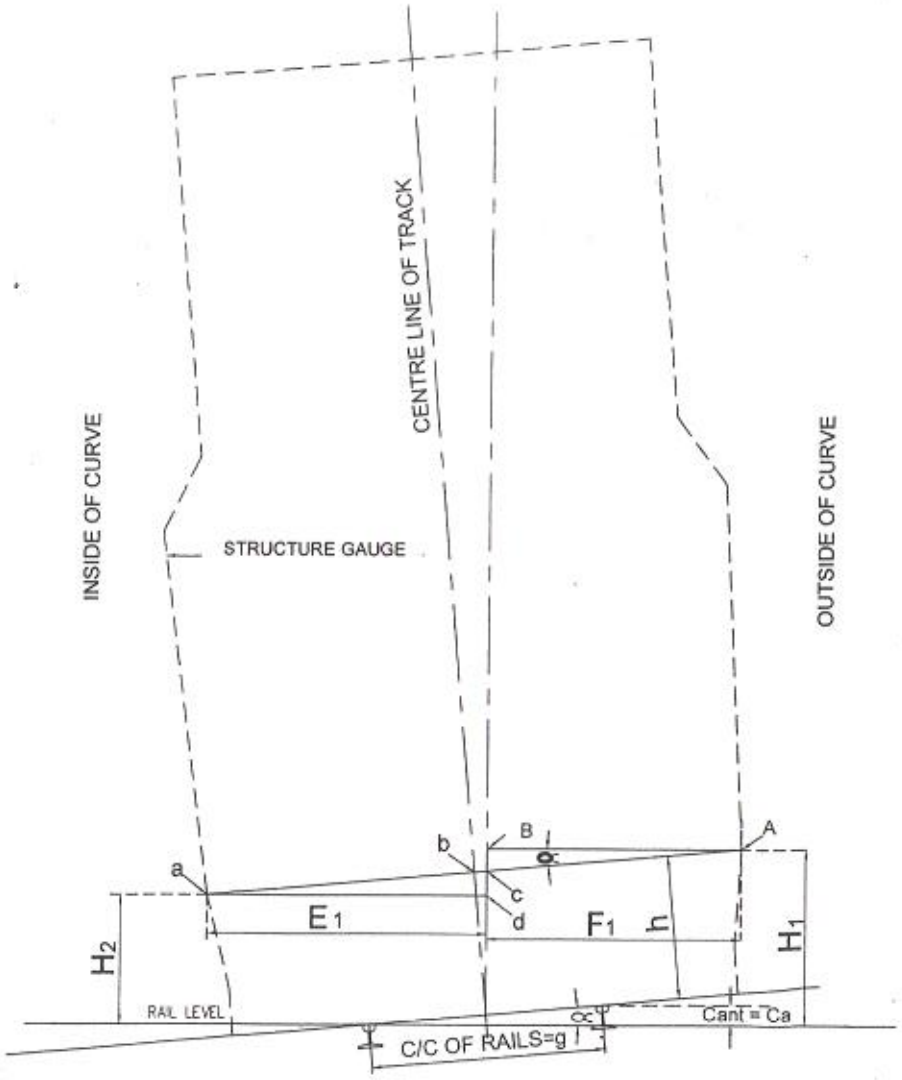
DATE: 08-07-2016

FIGURE No. NMSG-2

SCALE: NOT TO SCALE

REF: PARA 1.6.1 & 1.6.2

(ATAL KUMAR RAI) I.A.S Executive Director N.M.R.C.



ab=Ab= Distance from centerline of track to Structure Gauge for Tangent Track at height 'h'

$\sin\alpha = \text{cant}/g$

g= 1510 mm

Ca = Cant applied

$E_1 = [ab + (h \times \tan\alpha)] \times \cos\alpha$

$F_1 = [Ab - (h \times \tan\alpha)] \times \cos\alpha$

$H_1 = (Ca/2) + (h/\cos\alpha) + (Ab - h \times \tan\alpha) \times \sin\alpha$

$H_2 = (Ca/2) + (h/\cos\alpha) - (ab + h \times \tan\alpha) \times \sin\alpha$

For values of E_1, F_1, H_1 and H_2, refer to Appendix 3.

NOTES:

STRUCTURE GAUGE FOR AT-GRADE/ELEVATED SECTION HAS BEEN SHOWN AS A TYPICAL FIGURE.

Project Directorate
Approved on
04/12/13
Railway Board

25 kV A.C.TRACTION

EFFECT OF CANT ON STRUCTURE GAUGE

NOIDA METRO RAIL CORPORATION LTD.

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NGN
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29
NOIDA (U.P.)

STANDARD GAUGE
(1435 mm)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

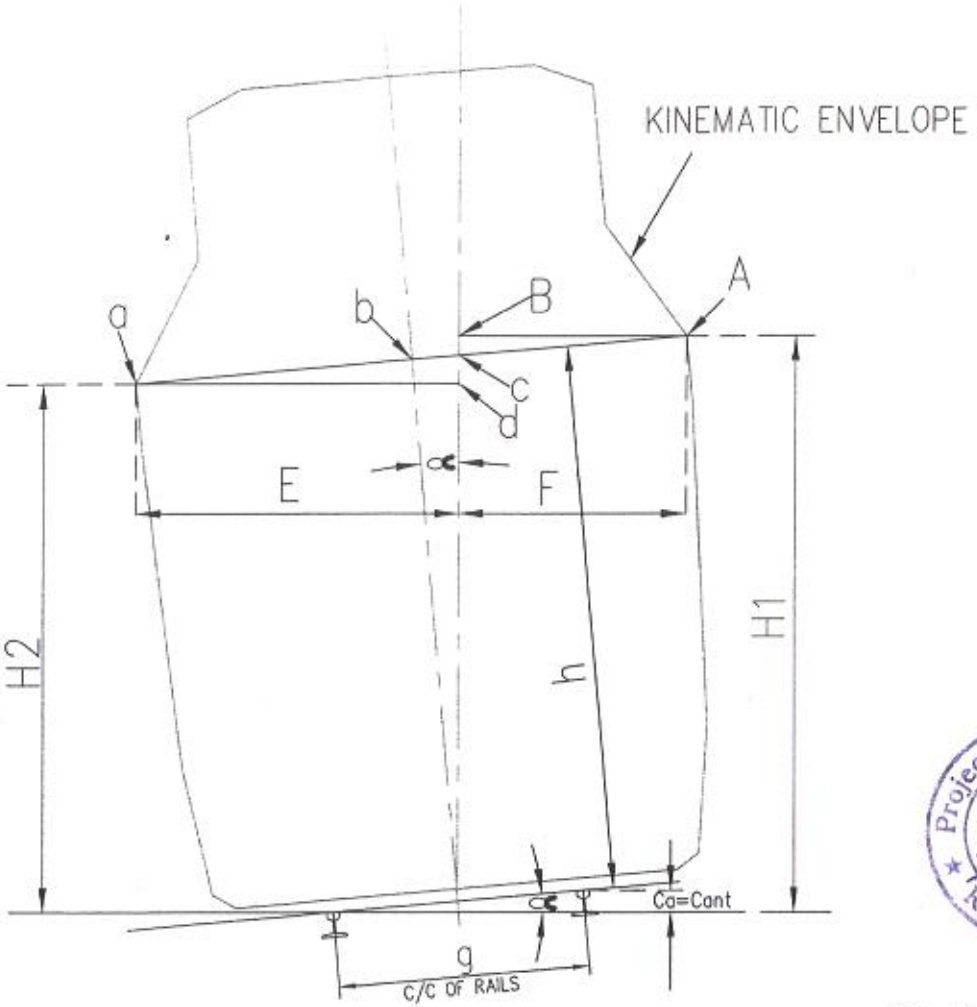
DATE: 08-07-2016

FIGURE No. NMSG-3

SCALE: NOT TO SCALE

REF: PARA 1.8.2

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.



ab=Ab= Distance from centerline of track to Kinematic Envelop for Tangent Track at height 'h'

$\sin \alpha = \text{cant}/g$

g= 1510 mm

Co = Cant applied

$E = [ab + (h \times \tan \alpha)] \times \cos \alpha$

$F = [Ab - (h \times \tan \alpha)] \times \cos \alpha$

$H_1 = (Co/2) + (h/\cos \alpha) + (Ab - h \times \tan \alpha) \times \sin \alpha$

$H_2 = (Co/2) + (h/\cos \alpha) - (ab + h \times \tan \alpha) \times \sin \alpha$

For values of E , F , H_2 and H_1 , refer to Appendix 3A .

NOTES:

KINEMATIC ENVELOPE FOR AT-GRADE/ELEVATED SECTIONS HAS BEEN SHOWN AS A TYPICAL FIGURE.

Project Directorate * Approved on 04/12/17 * Railway Board

25 kV A.C.TRACTION

NOIDA METRO RAIL CORPORATION LTD.

STANDARD GAUGE

(1435 mm)

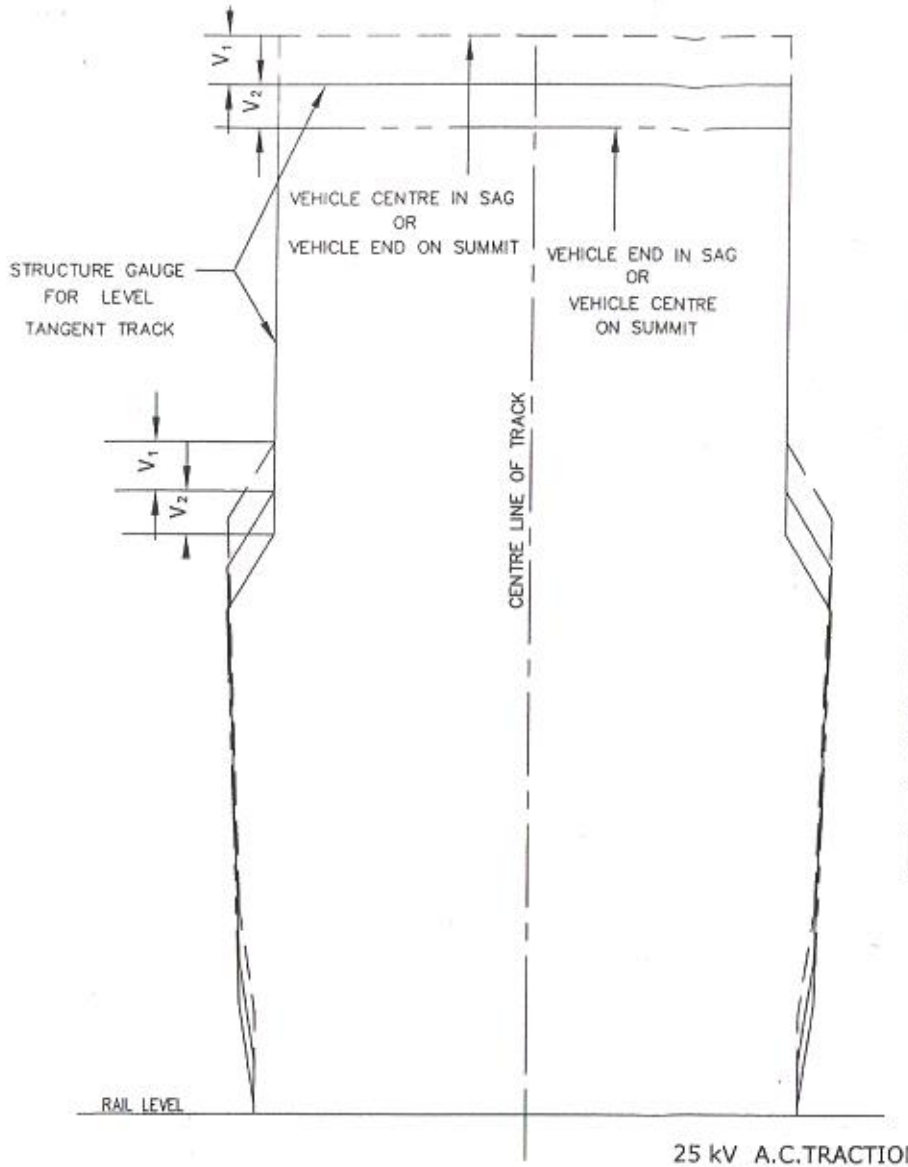
ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NGN
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29, NOIDA (U.P.)

(ATAL KUMAR RAI) I.A.S Executive Director N.M.R.C.

EFFECT OF CANT ON KINEMATIC ENVELOPE

DATE: 08-07-2016	FIGURE No. NMSG-3A
SCALE: NOT TO SCALE	REF: PARA 1.8.1

(ATAL KUMAR RAI) I.A.S Executive Director N.M.R.C.



25 kV A.C.TRACTION

VERTICAL THROW

RADIUS OF VERTICAL CURVE metres	V_1 mm	V_2 mm
1500	19	22
1600	18	21
1700	17	20
1800	16	19
1900	15	18
2000	14	17
2100	14	16
2200	13	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

NOTE:

1. THE FIGURE IS TYPICAL AND WILL APPLY TO ELEVATED AND AT-GRADE SECTIONS.

Project Directorate
Approved on
04/12/17
Railway Board

EFFECT OF VETRTICAL CURVE ON STRUCTURE GAUGE

NOIDA METRO RAIL CORPORATION LTD.

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NGN
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29,
NOIDA (U.P.)

STANDARD GAUGE

(1435 mm)

DATE: 08–07–2016

FIGURE No. NMSG-4

SCALE: NOT TO SCALE

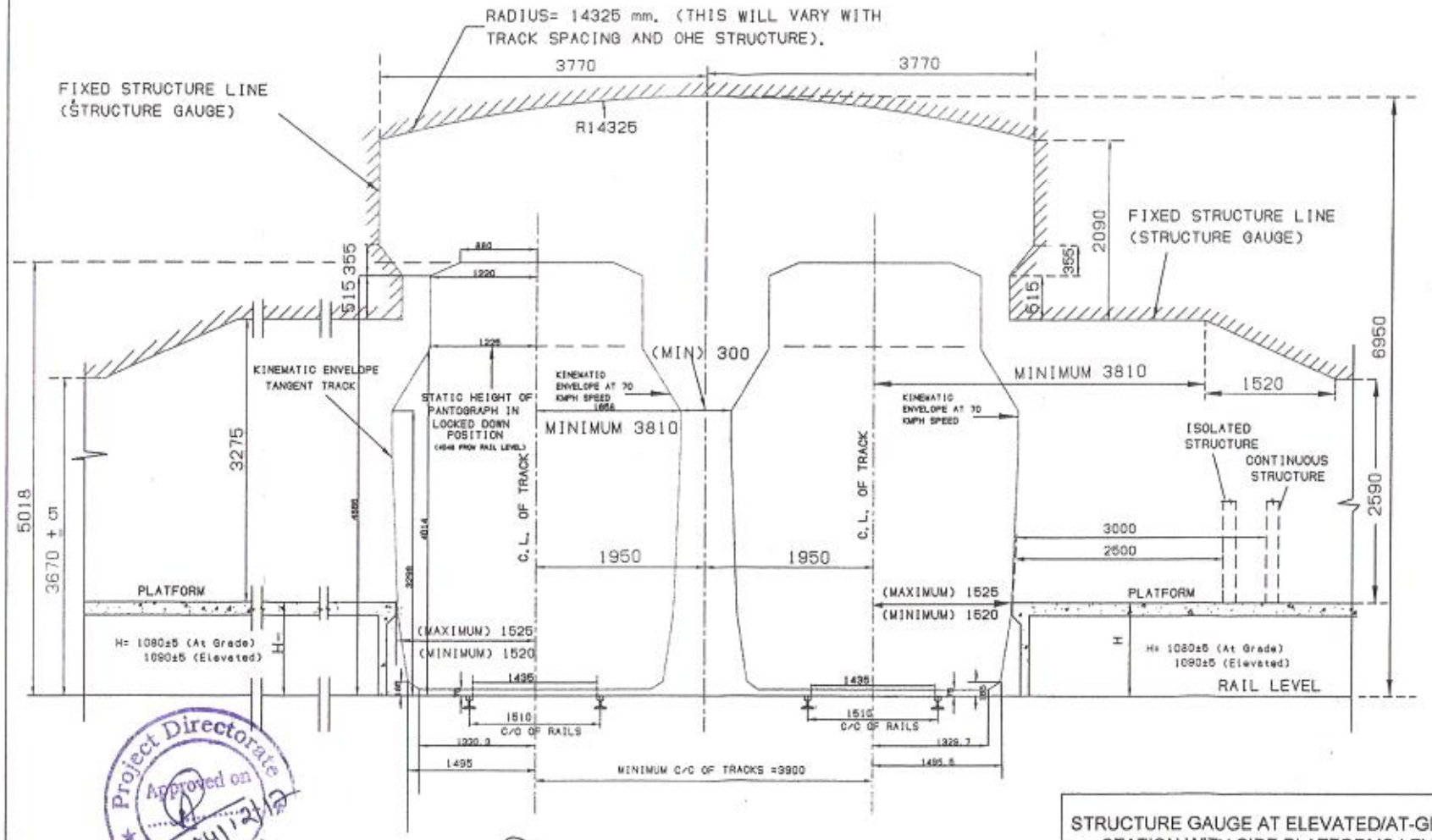
REF: PARA 1.7.1(C)&1.7.2(C)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

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 RADIUS OF 1000 M AND ABOVE.
3. STRUCTURE GAUGE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION
4. OHE IS SUSPENDED FROM CEILING BY DROP ARM.



Project Directorate
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Railway Board

25 kV A.C.TRACTION

STRUCTURE GAUGE AT ELEVATED/AT-GRADE STATION WITH SIDE PLATFORMS LEVEL OR CONSTANT GRADE TANGENT TRACK

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NGN
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29
NOIDA (U.P.)

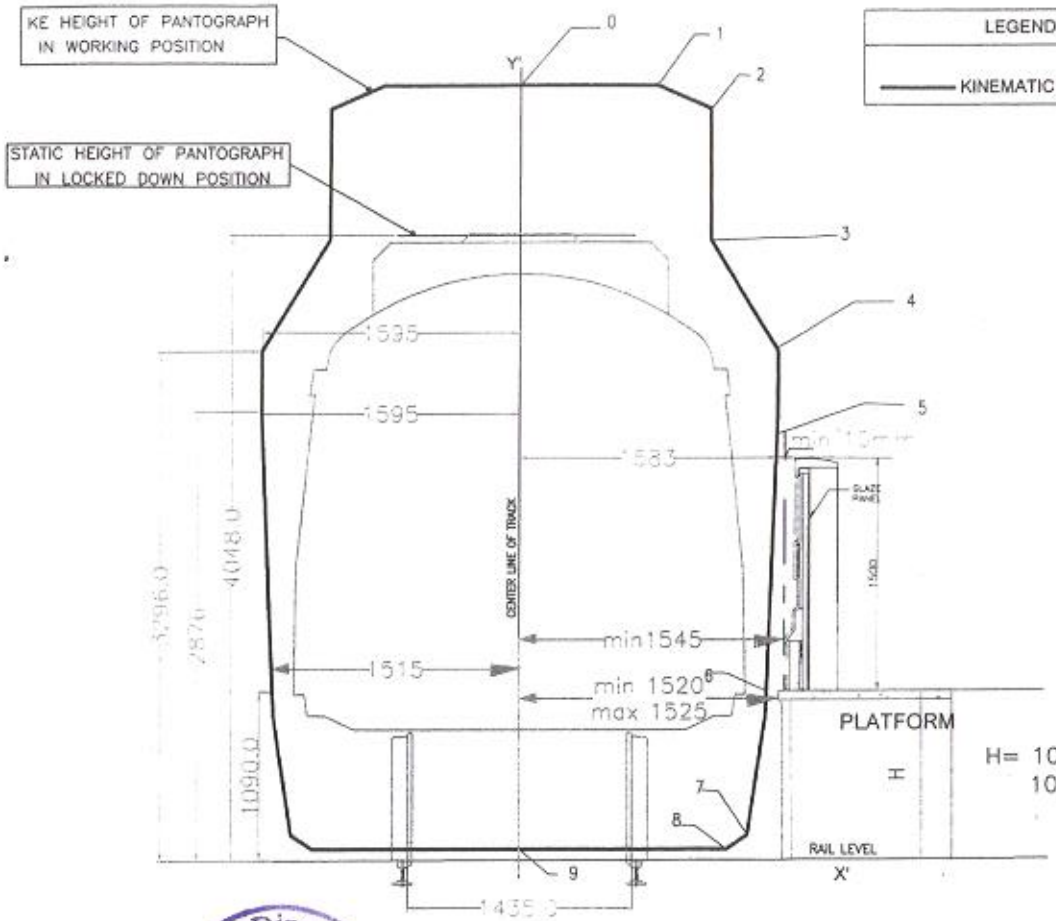
(ATAL KUMAR RAI)
Executive Director
N.M.R.C.

NOIDA METRO RAIL CORPORATION LTD.

STANDARD GAUGE
(1435 mm)

DATE: 08–07–2016	FIGURE No.NMSG-5
SCALE:NOT TO SCALE	REF: PARA 2.2.5

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.



H= 1080±5 (At Grade)
1090±5 (Elevated)

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 WHEN IN MOTION.
4. KINEMATIC ENVELOPE IS VALID FOR FOR 70 KMPH OPERATING SPEED AND WIND SPEED OF 70 KMPH
5.THE LOCATION OF PLATFORM GATE SHOULD BE FIXED SUCH THAT ITS MINIMUM CLEARANCE FROM KE AT ALL LOCATION IS 10 MM.

CO-ORDINATES

	X'	Y'
0	0	5018
1	880	5018
2	1220	4866
3	1225	4014
4	1595	3296
5	1595	2876
6	1515	1090
7	1495	185
8	1330	50
9	0	50

Project Directorate
Approved on
04/12/2017
Railway Board

25 kV A.C.TRACTION

PLATFORM GATE ELEVATED & AT GRADE (STATION PLATFORM) ON LEVEL OR CONSTANT GRADE TANGENT TRACK

NOIDA METRO RAIL CORPORATION LTD.

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NGN
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29,
NOIDA (U.P.)

STANDARD GAUGE
(1435 mm)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

DATE: 08-07-2016

FIGURE No. NMSG-6

SCALE: NOT TO SCALE

Ref Para 3.1(3)(ii) & 3.2

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.