

Annexure 6.1
[Section 6: Scope of Work]

SALIENT FEATURES OF DELHI-BAWAL CORRIDOR

0.1 Introduction

Detailed Project Report (DPR) for Namo Bharat RRTS corridor between Sarai Kale Khan (Delhi), Gurugram and SNB (Shahajahanpur – Neemrana – Behror) was presented to Government of Haryana in the meeting held on 5th May 2025 under chairmanship of Hon'ble Chief Minister of Haryana. The need of Namo Bharat RRTS corridor only up to Dharuhera was emphasized in the meeting. However, subsequently Government of Haryana vide HMRTC letter no. HMRTC/2025/AO/654 dated 26.09.2025, conveyed the consent of extending the Namo Bharat RRTS corridor up to Bawal, in place of the earlier proposed location at Dharuhera.

This is the executive summary of the revised DPR for Namo Bharat corridor between Sarai Kale Khan to Bawal via Cyber City with a length of about 93.12 km.

0.2 Proposed Alignment & Route Connectivity

Alignment of Delhi (Sarai Kale Khan) – Bawal Namo Bharat Corridor: The brief description of the proposed route alignment is given below:

1. The proposed alignment of corridor kicks-off from Sarai Kale Khan Namo Bharat Station in Delhi, after which the alignment gets underground while passing through proposed Namo Bharat Stations at INA, Munirka and Aerocity in Delhi.
2. After crossing Delhi/Haryana Border along NH-48 (on Right-hand-side), the alignment passes through Cyber City Namo Bharat Station. Further alignment traverses along NH-48 with shift from the Right-hand-side to Left-hand-side of the NH-48 and gets elevated.
3. The alignment further runs on the Left-hand-side of NH-48 and crosses the IFFCO Chowk Intersection of NH-48 with MG Road.
4. After IFFCO Chowk, the alignment again shifts from LHS to RHS and gets underground before Rajiv Chowk.
5. After Rajiv Chowk station on the Namo Bharat Corridor, the alignment again shifts on the Left-Hand-side of NH-48 and continues to run Underground with stations at Hero Honda Chowk. Further, the alignment again shifts back to Right-Hand-side with Underground station at Kherki Daula. The alignment after crossing Kherki Daula station while running underground shifts across NH-48 on Left-Hand-side and gets elevated for a small segment and again gets underground before Manesar Namo Bharat Station.
6. Further the alignment runs Underground but shifts on the Right-hand-side of NH-48 and then negotiating the Aravali ridge area, the alignment gets elevated before reaching Panchagon Namo Bharat station. Further the alignment continues to run elevated passing through areas with stations at Bilaspur chowk, Dharuhera and Bawal. In addition, two

stations (MBIR & Rewari) will be developed in future.

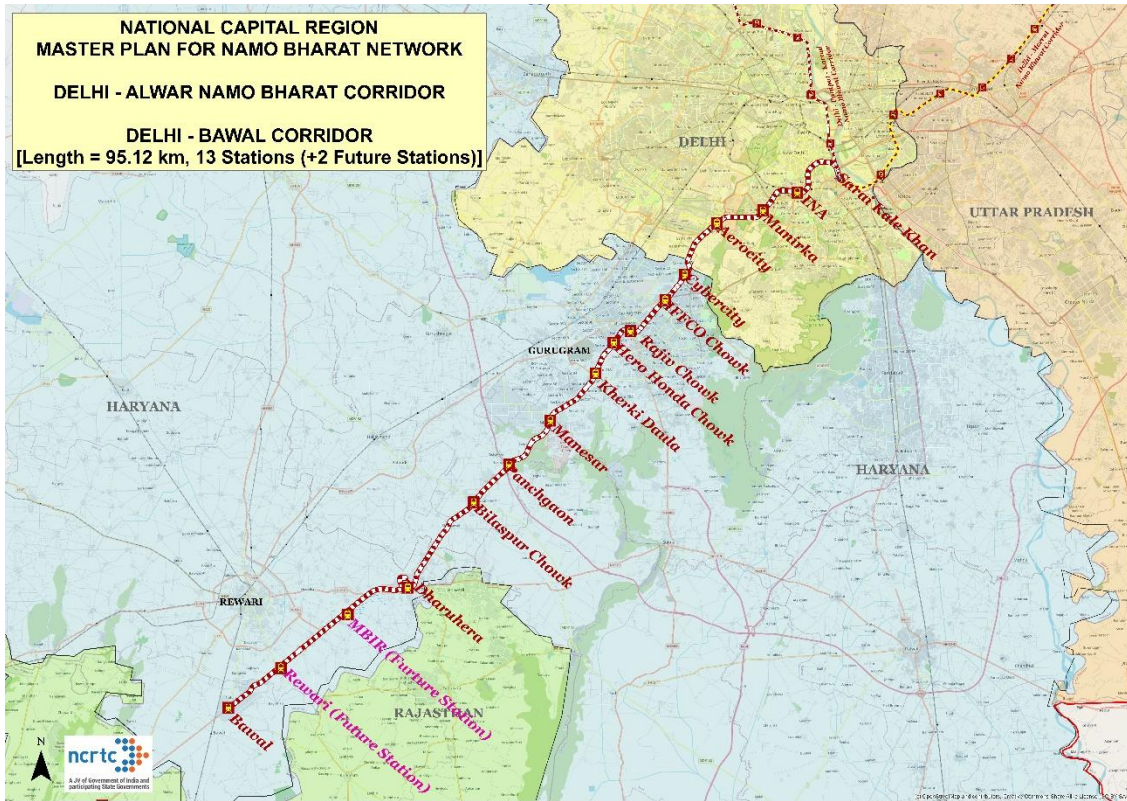


Figure shows Namo Bharat corridor alignment from SKK to Bawal via Cyber City

Route Length of Delhi-Bawal: The route length of the Namo Bharat corridor alignment from Sarai Kale Khan to Bawal is 93.12 km. Table below shows the details of route length. One maintenance depot at Panchgaon/Dharuhera is planned which will be at-grade. There can be minor adjustments in the alignment including locations of stations at the time of execution.

Route Length

Corridor	Underground (km)	Elevated (km)	Total (km)
Route Length	37.87	55.25	93.12
Percentage of Route Length	40.67	59.33	100.00%

Terminal Stations: Sarai Kale Khan Station and Bawal (both elevated) stations are the main line terminal station with arrangement to extend the alignment at both of these stations in future.

Integration with other Namo Bharat Corridor Tracks: Sarai Kale Khan is designed as an interoperable station for other two Namo Bharat corridors namely Delhi – Panipat & Delhi – Meerut and hence integration and interoperability among all three corridors will be provided at Sarai Kale Khan.

Route Length of Delhi-Panipat-Karnal: The route length of the Namo Bharat corridor alignment from Sarai Kale Khan to Karnal is 136 km. Table below shows the details of route length. Two maintenance depots are planned which will be at-grade. There can be minor adjustments in the alignment including locations of stations at the time of execution.

Route Length

Corridor	Underground (km)	Elevated (km)	Total (km)
Route Length	11.48	124.82	136.30
Percentage of Route Length	8.42%	91.58%	100.00%

0.3 Permanent Way

- 1. Track Gauge:** Standard Gauge of 1435 mm.
- 2. Speed & Axle Load:** The track should fit for 160 kmph operational speed and 180 kmph design speed. The design axle load is finalized as 17 tonnes and track structure is designed accordingly.
- 3. Rails:** For ballast less, track 60 kg (UIC)/60E1 Head Hardened rails procured on 18m or longer length shall be provided. These rails shall be joined by mobile flash butt welding plant at site to provide CWR track. Switch expansion joints shall be provide as required.
- 4. Sleepers/Slab:** The track on main line shall be designed to be laid as ballast less track over a suitably designed track structure at a uniform spacing of 600 mm centre to centre of fastenings.

In Depot area PSC sleepers at 650 mm spacing on ballasted track are proposed.
- 5. Ballast:** In depot area, ballasted track with 250 mm (minimum) cushion of stone ballast below sleepers as per specifications will be provided.
- 6. Ballastless Track in Tunnel:** The tunnels bored mechanically are usually of circular type. The invert of the tunnel will have to be concreted to achieve flat horizontal surface and ballast less track with necessary drainage system will be laid.

The track structure is proposed to be ballastless, proven for design speed of 180 kmph and above for main line and for connecting lines to depot is plinth type. Further, it is proposed to use suitable elastic fastening system for both types of ballastless and ballasted track structure complying with laid down standards. The toe load design for the clips is to be finalized at the detailed design stage.

Apart from the slab track, two more proven track technology namely Pre-Cast sleeper and bi-block-booted sleeper are available for the speed range suitable for Namo Bharat Corridor. Track technology may be adopted in such a manner so as to ensure that major governing parameters of civil structures are optimised. Moreover, it is possible to use the same/different track technologies on elevated & underground sections, to achieve the best results & meet the desired objectives.

Proposed Track Structure

S. No.	Item	Description
1	Rails	60 kg UIC head-hardened rails on main line and 60 kg 90 UTS rails for the depot area
2	Track Structure	Ballast less track will be provided on elevated and tunnel sections with fastening spacing at 600 mm centre to centre or as per detailed design. In depot area, Ballasted track with 250 mm (minimum) cushion of stone ballast below sleeper as per RDSO specifications (as applicable)
3	Sleepers	PSC Sleepers at 650 mm centres on ballasted track in depot area
4	Points and Crossings	1 in 9 Points and Crossings, canted on running lines. 1 in 7 points and crossings canted in depot lines and yards All turnouts will be provided with weldable CMS crossings and thick web switches.
5	Rail Cant	Canted (tilted inward) at a slope of 1 in 20

0.4 Stations and Transit Oriented Development

0.4.1 Station Planning

6-Coach Stations are planned for the corridor. Station box dimensions would be approximately 140 m in length for elevated stations and approximately 187 m (including 1 m Diaphragm walls on both sides) in length for underground stations, which may vary as per site context and operational requirement. The width of every station varies depending on the peak hour passenger traffic figures, operational requirements, and number of rail tracks provided.

Stations Details of Delhi-Bawal Namo Bharat Corridor

#	Station Names	Station Type	Centre line Chainage in (km)	Inter Station Distance in (km)	No of Tracks	Platform Type
-	Sarai Kale Khan	Elevated	(-) 0.51	Developed as part of Delhi – Meerut Namo Bharat Corridor		
1	INA	Underground	7.20	7.71	2	1 Island
2	Munirka	Underground	11.59	4.39	2	1 Island
3	Aerocity	Underground	17.13	5.54	3	1 Island
4	Cybercity	Underground	23.61	6.48	2	1 Island
5	IFFCO Chowk	Elevated	27.16	3.55	4	2 Side & 1 Island
6	Rajiv Chowk	Underground	32.14	4.98	2	1 Island
7	Hero Honda Chowk	Underground	34.72	2.58	2	1 Island
8	Kherki Dhaula	Underground	38.61	3.89	2	1 Island
9	Manesar	Underground	45.51	6.9	3	1 Island
10	Panchgaon	Elevated	52.22	6.71	2	2 Side
11	Bilaspur Chowk	Elevated	57.56	5.34	2	2 Side
12	Dharuhera	Elevated	69.33	11.77	3	1 Side & 1 Island
F1	MBIR (Future Station)	Elevated	77.00	7.66	2	2 Side
F2	Rewari (Future Station)	Elevated	85.05	8.05	2	2 Side
13	Bawal	Elevated	93.05	8.00	2	2 Side

Stations Details of Delhi-Panipat Karnal Namo Bharat Corridor

#	Station Names	Station Type	Centre line Chainage in (km)	Inter Station Distance in (km)	No of Tracks	Platform Type
-	Sarai Kale Khan	Elevated	Developed as part of Delhi – Meerut Namo Bharat Corridor			
1	Indraprastha		3.27	3.78	2	2 side
2	Kashmere Gate	Underground	9.46	6.19	2	1 island
3	Jharoda Majra	Elevated	16.40	6.94	2	2 side
4	Bhalaswa	Elevated	20.77	4.38	2	2 side
5	Alipur	Elevated	30.02	9.25	2	2 side
6	Narela	Elevated	33.73	3.71	2	2 side
7	Kundli	Elevated	39.36	5.63	2	2 side
F1	KMP (Future)	Elevated	43.93	4.57	-	-
8	Bahalgarh	Elevated	47.89	3.96	2	2 side
9	Murthal	Elevated	55.37	7.48	2	2 side
F2	Barhi (Future)	Elevated	64.08	8.71	-	-
10	Gannaur	Elevated	68.48	4.40	2	2 side
11	Samalkha	Elevated	80.52	12.04	2	2 side
12	Panipat ISBT Sewah	Elevated	91.64	11.11	2	2 side
13	Panipat	Underground	97.24	5.60	2	1 island
F3	Panipat Sector-18”(Future)	Elevated	102.31	5.07	-	-
14	Ganjbar-Badauli-Kohand	Elevated	107.49	5.18	3	1 side & 1 island
15	Gharaunda	Elevated	113.93	6.43	2	2 side
F4	Karnal Bypass (Future)	Elevated	120.33	6.41	-	-
16	Karnal Sector-7	Elevated	130.27	9.93	2	2 side
17	Karnal new ISBT	Elevated	135.83	5.56	2	2 side

At the concourse level, all stations have ticketing facilities and entry/exit turnstiles at extremities along the length to enable division into unpaid and paid areas. The unpaid area is where commuters enter the facility, and use retail services like ticketing on ground level, whereas the paid area in the concourse and the platforms are the areas where the passengers can go only after purchase of tickets. The paid area begins with entry/exit turnstiles at extremities along the length. Additionally, the restricted zone comprises station operational areas such as the Station Control Room, Station Master's Office, Staff Accommodation, Plant, Signalling and Operations Rooms, Heating Ventilation Air Conditioning (HVAC) handling units, etc.

Station Typologies: The type of station at each location is determined based on specific requirements. Various facilities have been identified and incorporated at each station. Platform size is assessed at each station considering passenger load and expected train length. Stations are designed to include provisions for commercial spaces to generate revenue. Public areas, comprising platforms, concourse, vertical circulation, and property development, have been envisaged within the station layout along with

operational areas. Additionally, planning consideration for Multimodal integration, interchanges with existing transit modes parking, drop-off points, entry/exits, subways, and foot overbridges/ Subway have been envisaged within the station premises.

0.5 Multimodal Integration of Delhi-Bawal Namo Bharat Corridor:
Integration with other modes of transport will be provided at the following locations:

Table showing integration with other modes of transport for Delhi-Bawal Corridor

Namo Bharat station	Mode of transport with which integration provided
Sarai Kale Khan	Sarai Kale Khan Metro Station on Pink Line of Delhi Metro network, Hazrat Nizamuddin Station of Indian Railway network and ISBT Sarai Kale Khan.
INA	INA Metro Station on Yellow Line & Pink Line of Delhi Metro network
Munirka	Munirka metro station on Magenta Line of Delhi Metro network
Aerocity	Aerocity metro station on Airport Express Line (Orange Line) & under-construction Golden Line of Delhi Metro network
Cyber City	Cybercity Metro station on Gurugram Rapid Metro corridor and upcoming Millenium City Centre – Cyber City Line of Gurugram Metro network
IFFCO chowk	IFFCO chowk station of Delhi Metro network
Rajiv Chowk	Proposed ISBT at Rajiv Chowk
Hero Honda Chowk	Hero Honda Chowk metro station of Gurugram Metro network
Kherki Daula	Planned Khirki Daula metro station of Gurugram Sector-56 – Panchgaon metro corridor and Proposed Bus terminus, Southern Peripheral Road (SPR)
Panchgaon	Planned Panchgaon Metro Station of Proposed Gurugram Sector-56 – Panchgaon metro corridor, Proposed ISBT and proposed Orbital rail station.
Bawal	Bawal Bus Stand

Feeder System: Feeder System: Provision of 329 AC electric buses with facilities of a bus-based feeder system has been made in the DPR to enhance the ridership of the Namo Bharat Corridor.

0.6 Rolling Stock

After examining various options for the size, seating capacity, number of doors etc, the broad details of the EMU type rolling stock were finalized for Namo Bharat corridor. These are given in the table below:

Details of the proposed Namo Bharat System's Rolling stock

S.No.	Parameter	Details
1	Gauge (Nominal)	1435 mm
2	Traction system	
2.1	Voltage	25kV AC
2.2	Method of current collection	Overhead Current Collection System

S.No.	Parameter	Details
3	Train composition:	
3.1	6-car Train:	DMC-TC-MC=MC-TC-DMC
4	Coach Body	Stainless Steel/Aluminium
5	Coach Dimensions	
5.1	Height	4.12 m (approx.)
5.2	Width	3.2 m
5.3	Length over body (approx)	
	Driving Motor Car (DMC) / Trailer Car (TC) / Motor Car (MC)	22.34 m
	Maximum length of coach over couplers/buffers:	23m (depending upon Kinematic Envelop and SOD) *The length of the driving cars may increase beyond the specified value by maximum 2.5 m
5.4	Locked down Panto height (if applicable)	4120 mm (approx.)
5.5	Floor height (approx.)	1180 mm (to be decided during design stage)
6	Designed- Passenger Loading	
6.1	Design of Propulsion equipment	8 Passenger/m ²
6.2	Design of Mechanical systems	10 Passenger/m ²
7	Carrying capacity- @8 standees/sqm	
7.1	Coach carrying capacity	
	DMC	300 (seating – 60; standing – 240)
	TC/MC	332 (seating – 72; standing – 260)
7.2	Train Carrying capacity	
	6-Car train (Namo Bharat Train)	1928 (seating – 408; standing – 1520) (without premium coach)
8	Weight (Tons)	
8.1	Tare weight (approx.)	
	Driving Car	44
	Non-Driving Car	44
8.2	Passenger Weight in tones	@0.065 T per passenger Further 0.015 T Luggage weight to be considered for 1/3 rd of passengers
	DMC	21.00 (@ 8persons per sqm of standee area)
	TC/MC	23.24 (@ 8persons per sqm of standee area)
8.3	Gross weight in tonnes (approx.)	
	DMC	65.00 (@ 8persons per sqm of standee area)
	TC/MC	67.24 (@ 8persons per sqm of standee area)
9	Axle load (T) (@8 persons per sqm of standee area)	16.62 (System should be designed for 17T axle load for carrying passenger @8 person/sqm of standee area during peak hour between certain sections)
10	Maximum Train Length – Approximate	
10.1	6-car trainset	≈138m
11	Speed	
11.1	Maximum Design Speed	180 kmph
	Maximum Operating Speed	160 kmph
12	Wheel Profile	Wheel profile shall be decided by the

S.No.	Parameter	Details
		manufacturer/supplier
13	Noise Limits (ISO 3381 and 3095 -2005) Vibration (ISO-2631-1 1997, ISO 2631-4 2001)	
13.1	Interior Noise Level	
	Stationary (Elevated and at grade)	
13.1.1	(a) All cars except in driving console	LpAeq20sec 68 dB(A)
	(b) Driving console	LpAeq20sec 68 dB(A)
	Stationary (Underground)	
13.1.2	(a) All cars except in driving console	LpAeq20sec 75 dB(A)
	(b) Driving console	LpAeq20sec 72 dB(A)
	Running at 160 kmph (Elevated and at grade)	
13.1.3	(a) All cars except in driving console	LpAeq20 sec 75 dB(A)
	(b) Driving console	LpAeq20 sec 78 dB(A)
13.2	External Noise Level (At 7.5 m from centreline of track)	
	Stationary	LpAeq20sec 67 dB(A)
	Running at 160 kmph	LpAeq20sec 89 dB(A)
14	Average Acceleration (0-40 kmph) (0-120 kmph) (0-160 kmph)	1.00 m/s ² @8person/sqm 0.50 m/s ² @8person/sqm 0.35 m/s ² @8person/sqm
15	Service Brake Deceleration	1.0 m/s ² @8 persons/sqm
	Emergency brake	1.2 m/s ² @8 persons/sqm
16	Type of Bogie	Fabricated
17	Secondary Suspension springs	Air
18	Brakes	<ul style="list-style-type: none"> • An electro-pneumatic (EP) service friction brake • An electric regenerative service brake • Provision of smooth and continuous blending of EP and regenerative braking • A fail safe, pneumatic friction emergency brake • A spring applied air-release parking brake. • Tread Brakes/disc brake • Brake Electronic Control Unit (BECU)-Independent for each bogie
19	Coupler	
	Driving Cab end of cars	Automatic coupler with mechanical & pneumatic coupling but without electrical coupling head
	Between cars of same Unit	Semi-permanent couplers
20	Detrainment Door	Saloon Doors nearest to the end coach
21	Type of Doors	Bi-parting plugged type
22	Lighting	LED based with dimmer control
23	Passenger Seats	Cushioned
24	Cooling	
24.1	Transformer	Forced
24.2	CI&SIV	Self/Forced
24.3	Traction Motor	Self-ventilated/Forced Cooled

S.No.	Parameter	Details
25	Control System	Train based Monitor & Control System (TCMS)
26	Traction Motors	3 phase VVVF controlled
27	Temperature Rise Limits	
27.1	Traction Motor	Temperature Index minus 70°C
27.2	CI&SIV	10°C temperature margin for Junction Temperature
27.3	Transformer	IEC specified limit minus 20°C
28	HVAC	-Cooling, Heating & Humidifier (as required) -Automatic controlling of interior temperature throughout the passenger area at 25°C with 60% RH all the times under varying ambient conditions up to full load.
29	PA/PIS including PSSS (CCTV)	Required
30	Passenger Surveillance	Required
31	Battery	Ni-Cd
32	Headlight type	LED
33	Coasting	10% (Run time with 10% coasting shall be the 'Run Time in All out mode plus 10%')
34	Gradient (max)	3% (Normal) 4% (Exceptional)
35	Sharpest Radius	Bogie shall be able to negotiate 300 m (in Mainline)
36	Signalling	ETCS Level-2 with hybrid Level-3 functionality

0.7 Signalling & Train Control System

Signalling CATC system will be ETCS Level 2 with Hybrid Level 3 functionality over LTE Communication Backbone in 700 MHz band. The spectrum for LTE Communication is 5 MHz (paired) in 700 MHz band (Band 28).

Hence all references of GSM-R/TETRA/LTE-R to be replaced with LTE.

ETCS Level-2 and LTE support interoperability, which ensures interoperability of Rolling Stock across corridors and enables International Competitive Bidding for future corridor extensions. ETCS Level-2 with LTE radio is already implemented on Delhi Meerut Corridor, hence ETCS Level-2 with LTE will ensure seamless movement of trains between both corridors. The track layout of terminal stations and intermediate stations is also a key parameter for the minimum headway feasibility.

The latest available version of above technologies will be finalized at the time of tendering.

0.8 Telecommunication System

All references of GSM-R/TETRA/LTE-R to be replaced with LTE. The spectrum for LTE Communication is 5 MHz (paired) in 700 MHz band (Band 28).

Namo Bharat System's LTE Architecture

- LTE System Components
- LTE system comprises of 3 main components:

- Evolved Packet Core (EPC): The EPC is a framework for providing converged voice and data on an LTE network.
- Radio Access Network (RAN): The RAN is the latest evolution of the 3GPP network architecture. eNodeB comprises of RRU and BBU.
- User Equipment (UE): The end user of the LTE infrastructure, which supports all Mission Critical functionalities and can work with other vendor's EPC & RAN.

0.9 Fare Collection

The proposed AFC system will be of QR code based printed tickets / Contactless smart Card type.

It is proposed, the smart NCMC (National Common Mobility card) for implementation of AFC system in Namo Bharat System. The AFC system as per the guidelines issued by Govt of India will enable seamless travel by different metros and other transport systems across the city besides retail shopping and purchases.

The AFC system will support the EMV (Europay, MasterCard, and Visa) and RuPay based open loop ticketing following the NCMC standard model for interoperability with other operators by use of non-proprietary standard so that the interface is scalable to other networks (transit operator/ retail outlets/parking/Toll etc) in Delhi (NCR). The AFC equipment's will support EMV, RuPay, QR, NFC (Near field communication) based ticketing, integration of clearing house, smart card host system of Financial.

0.10 Electric Power Supply

The Namo Bharat system requires electrical power for operation of the trains, running the station services like lighting, lifts, escalators, operating the signal & telecommunication system, depots and other infrastructure. The most important requirement is the traction power supply. For Delhi – Bawal Namo Bharat Corridor 1x25 kV AC overhead traction system is proposed.

Projected Power Requirement (in MVA)

Description	Unit	Year			
		2031	2041	2051	2054
Traction Power requirement	MVA	42.03	52.08	80.16	91.81
Auxiliary Power requirement	MVA	31.46	33.93	37.09	42.72
Total Power requirement	MVA	73.49	86.02	117.25	134.53
Rounded off	MVA	73	86	117	135

Total Energy requirement (Energy requirement in Million kWh)

Purpose/Year	Unit	2031	2041	2051	2054
Traction requirement	Million Unit	199.84	244.35	369.01	426.50
Auxiliary requirement	Million Unit	62.49	68.33	75.77	89.06
Total requirement	Million Unit	262.33	312.68	444.78	515.56
Rounded off	Million Unit	262	313	445	516

Source of Power Supply

The Electric Power required for train operation and auxiliary purposes is required to be sourced from the 06 RSS which will be fed from Electric Power Supply Authorities of relevant States i.e., Delhi & Haryana.

Proposed Locations of RSS at Delhi-Bawal corridor

S.No.	Grid Substation (GSS)	Proposed Receiving Substation (RSS)
1.	66 kV Substation, Maharani Bagh, DTL	Sarai Kale Khan RSS
2.	66 kV Substation, DIAL DTL	Aerocity Station RSS
3.	220 kV Substation, Sector-33, Gurugram, HVPNL 66 kV Substation, Sector-34, Gurugram, HVPNL	Rajiv Chowk RSS
4.	220/132/66 kV Substation, Panchgaon HVPNL	Panchgaon RSS
5.	220/132/66 kV Substation, Mau, Dharuhera, HVPNL	Dharuhera RSS
6.	220/132/66 kV Substation, IMT Bawal, HVPNL	Bawal RSS

0.11 Ventilation and Air-Conditioning System

Ventilation System: Tunnel Ventilation Shafts & Mid Ventilation Shafts will be provided at each underground station and tunnel sections respectively. Tunnel Ventilation Nozzles will be required based on simulation study results at detailed design stage.

Air-Conditioning System: For elevated stations, VRV shall be used for air conditioning of technical and operational rooms. For the underground stations, chillers shall be used.
