

Section 6

Scope of Work (Terms of Reference-TOR)

1. Project Background

- 1.1** The National Capital Region Transport Corporation (NCRTC) (the “Employer”) was incorporated in August, 2013 with a mandate to implement Nammo Bharat projects. NCRTC is a Joint Venture Company formed under the Companies Act 1956 comprising of Central Government (through the Ministry of Urban Development) and State Governments of Delhi, Uttar Pradesh, Haryana, and Rajasthan. NCRTC shall undertake design, construction, operation and maintenance of the Nammo Bharat corridors in NCR region.
- 1.2** In order to enhance the connectivity within the National Capital Region, the National Capital Region Planning Board (NCRPB), proposed to connect the Urban, Industrial (SEZs/Industrial Parks), regional and sub-regional centers in Delhi-NCR through a Nammo Bharat Transit System. The Integrated Transportation Plan 2032 had identified eight rail based Nammo Bharat corridors to enhance the efficacy of the transportation system in the NCR in addition to providing other facilities including road network enhancements. The eight identified Nammo Bharat corridors are:
- (i) Delhi – Ghaziabad – Meerut
 - (ii) Delhi – Gurugram – SNB – Alwar
 - (iii) Delhi – Sonapat – Panipat – Karnal
 - (iv) Delhi – Faridabad – Ballabhgarh – Palwal
 - (v) Ghaziabad – Khurja
 - (vi) Delhi – Bahadurgarh – Rohtak
 - (vii) Ghaziabad – Hapur
 - (viii) Delhi – Shahadra – Baraut
- 1.3** Out of the proposed eight (8) corridors, three corridors viz Delhi-Ghaziabad-Meerut, Delhi-Gurugram-SNB-Alwar, and Delhi-Panipat have been prioritized for the implementation in the first phase. The Delhi-Meerut Corridor has been completed and section has been opened for public. The implementation of Delhi-Karnal Nammo Bharat (RRTS) corridor is approved by Govt. of NCT of Delhi and Govt. of Haryana.
- 1.4** **Delhi-Panipat-Karnal Nammo Bharat Future Corridor** originates from Sarai Kale Khan in Delhi and ends at Karnal in Haryana. As per the alignment, out of 136.30 km, 11.48 km is underground and 124.82 km is elevated. Two maintenance depots at Murthal/ Barhi and Ganjbar/ Karnal have been planned which will be at-grade. The details of stations along the above corridor have been tabulated below. The design elements and alignment including locations of stations may undergo some changes. The kmz/kml files of alignment is attached with Annexure 6.1.1. The details of stations along Delhi-Panipat-Karnal Nammo Bharat Corridor are as under:

Table-1

S. No.	Station Name	Description	Centre line Chainage (km)	Inter-station Distance (km)	Effective Interstation Distance (km)
-	<i>Sarai Kale Khan</i>	Elevated	-0.51	-	
1	Indraprastha	Elevated	3.27	3.78	3.78

S. No.	Station Name	Description	Centre line Chainage (km)	Inter-station Distance (km)	Effective Interstation Distance (km)
2	Kashmere Gate	Underground	9.46	6.19	6.19
3	Burari Crossing is relocated and renamed as " Jharoda Majra "	Elevated	16.40	6.94	6.94
4	Mukarba chowk is relocated and renamed as " Bhalaswa "	Elevated	20.77	4.38	4.38
5	Alipur	Elevated	30.02	9.25	9.25
6	Narela (New Station)	Elevated	33.73	3.71	3.71
7	Kundli	Elevated	39.36	5.63	5.63
F1	KMP (<i>Future</i>)	Elevated	43.93	4.57	-
8	RGEC is relocated and renamed as " Bahalgarh "	Elevated	47.89	3.96	8.54
9	Murthal	Elevated	55.37	7.48	7.48
F2	Barhi (<i>Future</i>)	Elevated	64.08	8.71	-
10	Gannaur	Elevated	68.48	4.40	13.12
11	Samalkha	Elevated	80.52	12.04	12.04
12	Panipat South is renamed as " Panipat ISBT Sewah "	Elevated	91.64	11.11	11.11
13	Panipat North is renamed as " Panipat "	Underground	97.24	5.60	5.60
F3	Panipat Depot is renamed as " Panipat Sector-18 " (<i>Future</i>)	Elevated	102.31	5.07	-
14	Ganjbar and Badauli is relocated and renamed as " Ganjbar-Badauli- Kohand "	Elevated	107.49	5.18	10.26
15	Gharaunda	Elevated	113.93	6.43	6.43
F4	Madhuban is relocated and renamed as " Karnal Bypass " (<i>Future</i>)	Elevated	120.33	6.41	-
16	Karnal Sector-7	Elevated	130.27	9.93	16.34
17	Karnal new ISBT	Elevated	135.83	5.56	5.56

Future stations will be elevated and constructed as per need. The construction cost of future stations has not been considered at present to reduce capital cost.

- 1.5 Delhi- Bawal Nam0 Bharat Future Corridor** originates from Sarai Kale Khan in Delhi and ends at Bawal in Haryana. As per the alignment, out of 93.12 km, 37.87 km is underground and 55.25 km is elevated. One maintenance depot is planned at Panchgaon/Dharuhera which will be at-grade. The details of stations along the above corridor have been tabulated below. There can be minor adjustments in the alignment including locations of stations at the time of execution. The kmz/kml files of alignment is attached with Annexure 6.1.2. The details of stations along Delhi-Bawal Nam0 Bharat

Corridor are as under:

Table-2

S. No.	Station Name	Description	Centre line Chainage in (km)	Inter Station Distance in (km)	Effective Inter-station Distance (km)
-	Sarai Kale Khan	Elevated	(-) 0.51		
1	INA (U/G)	Underground	7.20	7.71	7.71
2	Munirka (U/G)	Underground	11.59	4.39	4.39
3	Aerocity (U/G)	Underground	17.13	5.54	5.54
4	Cyber city (U/G)	Underground	23.61	6.48	6.48
5	IFFCO Chowk	Elevated	27.16	3.55	3.55
6	Rajiv Chowk (U/G)	Underground	32.14	4.98	4.98
7	Hero Honda Chowk (U/G)	Underground	34.72	2.58	2.58
8	Kherki Daula (U/G)	Underground	38.61	3.89	3.89
9	Manesar (U/G)	Underground	45.51	6.90	6.9
10	Panchgaon	Elevated	52.22	6.71	6.71
11	Bilaspur Chowk	Elevated	57.56	5.34	5.34
12	Dharuhera	Elevated	69.33	11.77	11.77
F1	MBIR (Future Station)	Elevated	77.00	7.67	-
F2	Rewari (Future Station)	Elevated	85.05	8.05	-
13	Bawal	Elevated	93.05	8.00	23.72

Future stations will be elevated and constructed as per need. The construction cost of future stations has not been considered at present to reduce capital cost.

- 1.6** The route length, number of stations, other salient features of Delhi-Panipat-Karnal Namo Bharat corridor and Delhi-Bawal corridor are given in **Annexure-6.1.1 and Annexure-6.1.2**. The kmz/kml files of these alignments are attached with Annexure-6.1.1 and 6.1.2. There can be minor adjustments in the alignment of both the Namo Bharat corridors including locations of stations at the time of execution.

2. Optimization of Parameters

System parameters adopted for Delhi-Meerut Namo Bharat corridor are proposed to be optimized for future Namo Bharat corridor.

2.1 Broad System Parameters of Existing Delhi-Meerut Corridor:

Table-3

S. No.	Item	Details
1	No. of Tracks	2 Nos. (UP & DN)
2	Track Gauge	1435 mm (Standard Gauge)
3	Axle Load	17 T
4	Design Speed	180 Kmph
5	Maximum Operational Speed	160 Kmph for Elevated Viaduct 140 kmph for underground section
6	Tunnels	Twin Tube Single track Tunnels of 6.50 m internal Diameter with Cross passage
7	Type of Track	Main line and Spur line- Ballastless track

S. No.	Item	Details
		Depot Line- Ballasted track on Concrete Sleepers
8	Rolling Stock	AC Coaches (Stainless Steel) Length- 22.34 m Width- 3200 mm Height- 4350 mm (from Rail to Panto Locked down position) Passenger Doors - Plug-in type Saloon Doors. Floor Height: a) Maximum height above rail level for floor 1180 mm of any unloaded vehicle b) Minimum height above rail level for floor 1150 mm of fully loaded normal vehicle Highest earth points from top of rail on Delhi-Meerut rolling stock: 4289 mm
9	Traction	OHE (1x25 kV AC)
10	Adopted Track Centre	4500 mm

2.2 The broad system specifications proposed for future Nam0 Bharat corridors are as under:

Table-4

S. No.	Item	Design parameters
1	No. of Tracks	2 Nos. (UP & DN)
2	Track Gauge	1435 mm (Standard Gauge)
3	Max. Axle Load	17 ton
4	Tunnels	Twin Tube Single track circular Tunnels of “5.80 m internal Diameter” with Cross passage
5	Design Speed	180 Kmph
6	Operational Speed	160 Kmph for Elevated Viaduct 140 kmph for underground section
7	Type of Track	Main line and Spur line- Ballastless track Depot Line- Ballasted track on Concrete Sleepers Maximum Track Sagitta (in tunnel) = 697 mm
8	Rolling Stock	Car Body: Stainless Steel/Aluminium Maximum Length of the coach body – 22.34 m* Maximum Length over couplers – 23.0 m* Width of Car - 3.2 m Maximum Height of the Car (from top of rail to maximum height of the roof equipment) – 4.12 m Maximum Height of Car (from top of rail to panto lock down position) - 4.12 m Minimum Passenger Capacity Total (Seating +Standing @ 8Passengers/m ²) – ~1928 No. for six car train Provision of Luggage rack and Bulk luggage Acceleration 1 m/s ² (for 0-40 kmph) Traction Motor Power ≥ 300 KW Powering 66% or more Emergency evacuation - Side evacuation at coach floor level Train Configuration: 6-car Passenger Doors - Plug-in type Saloon Doors. All coaches to be air-conditioned suiting ambient conditions with doors at each vestibule. Pressure comfort criteria: Pressure change < 3000 Pa within a period of 4 s

S. No.	Item	Design parameters																					
		<i>*The length of the driving cars may increase beyond the specified value by maximum 2.5 m subject to the condition that nosing should be designed in such a way that End throw/Mid throw should be within the value calculated for coach body length as indicated above.</i>																					
9	Traction	<p>OHE – 1x25 kV, AC</p> <p>Vertical and lateral distance between 25 kV live parts and earthed parts of fixed structures or moving loads/rolling stocks shall be as large as possible. Minimum clearances to be maintained under worst condition of temperature, wind etc. in different sections shall be as given below :</p> <p>Underground sections: Minimum clearances between live parts and bodies of structures /vehicles:</p> <p>Air clearance between any live un-insulated parts of the contact lines, feeders or current collectors and bodies of structures/vehicles shall be as under:</p> <table><tr><th>S. No.</th><th>Condition</th><th>Minimum clearance between live parts and bodies of structures/vehicles</th><th>Absolute minimum Dynamic clearance between live parts and bodies of Structures/vehicles</th></tr><tr><td>1.</td><td>Long duration (Static)</td><td>250 mm</td><td>Not applicable</td></tr><tr><td>2.</td><td>Short duration (Dynamic)</td><td>170 mm</td><td>150mm</td></tr></table> <p>Elevated and at-grade sections:</p> <p>(i) 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.) shall be as follows :</p> <table><tr><th>S. No.</th><th>Condition</th><th>Minimum clearance</th></tr><tr><td>1.</td><td>Long duration (Static)</td><td>320 mm</td></tr><tr><td>2.</td><td>Short duration (Dynamic)</td><td>270 mm</td></tr></table> <p>Note : [A minimum vertical distance of 340 mm shall be provided between rolling stock and contact wire to allow for a 20 mm temporary rising 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.]</p>	S. No.	Condition	Minimum clearance between live parts and bodies of structures/vehicles	Absolute minimum Dynamic clearance between live parts and bodies of Structures/vehicles	1.	Long duration (Static)	250 mm	Not applicable	2.	Short duration (Dynamic)	170 mm	150mm	S. No.	Condition	Minimum clearance	1.	Long duration (Static)	320 mm	2.	Short duration (Dynamic)	270 mm
S. No.	Condition	Minimum clearance between live parts and bodies of structures/vehicles	Absolute minimum Dynamic clearance between live parts and bodies of Structures/vehicles																				
1.	Long duration (Static)	250 mm	Not applicable																				
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S. No.	Condition	Minimum clearance																					
1.	Long duration (Static)	320 mm																					
2.	Short duration (Dynamic)	270 mm																					

S. No.	Item	Design parameters									
		(ii) Minimum lateral distance between any live bare conductor (overhead equipment or pantograph) and any earthed structure or other bodies (rolling stock, over bridges, signal gantries etc.) shall be as follows : <table border="1"> <tr> <th>S. No.</th><th>Condition</th><th>Minimum clearance</th></tr> <tr> <td>1.</td><td>Long duration (Static)</td><td>320 mm</td></tr> <tr> <td>2.</td><td>Short duration (Dynamic)</td><td>220 mm</td></tr> </table>	S. No.	Condition	Minimum clearance	1.	Long duration (Static)	320 mm	2.	Short duration (Dynamic)	220 mm
S. No.	Condition	Minimum clearance									
1.	Long duration (Static)	320 mm									
2.	Short duration (Dynamic)	220 mm									
10	(a) Minimum Track Centre on Tangent Track (b) Minimum Radius (c) Maximum cant	(a) 4100 mm (b) 300 m (c) 160 mm									

Requirements for interoperability with Delhi- Meerut corridor:

1. Train of D-M Corridor shall be interoperable in the future corridors including Delhi-Bawal and Delhi- Panipat- Karnal.
2. The proposed rolling stock shall be interoperable in Delhi-Meerut Namu Bharat Corridor.
3. Provision of passenger evacuation at rail level from saloon doors in the D-M corridor.
4. Door width, floor height and door location to match with platform height and PSD on Delhi-Meerut Corridor.

The required electrical long duration clearance from bottom of contact wire to highest earth point on the roof of the rolling stock: minimum 250mm.

3. Objectives of the Assignment

The objective of this bid is to select a General Consultant ("GC") to provide expert consultancy services including but not limited to:

3.1 Finalization of Technical Parameters for future Namu Bharat (RRTS) Corridors (under lumpsum component quoted in Schedule-A of BoQ)

- 3.1.1 The objective of the consultancy is to fix technical parameters for various systems without compromise on speed potential and inter-operability of New Rolling Stock to ply on Delhi-Meerut corridor and train of Delhi-Meerut corridor to ply in future corridors.
- 3.1.2 The Consultancy services include detailed design of Kinematic Envelope for given coach dimensions and design speed, revision of SOD & various sub systems for Tunnel of internal diameter of 5.80 m for future Namu Bharat projects based on the broad system specifications laid down in Table-4. The consultant will specify maximum permissible speed in Tunnel considering these boundary conditions and aerodynamic simulation, passenger aural comfort etc.
- 3.1.3 The Consultant is also required to design a suitable type of viaduct super structure for a design speed of 180 kmph, taking into account factors such as economy, constructability in urban environments, and compliance with requirements for

overhead equipment (OHE) along with clearances and the provision of side evacuation walkway at coach floor level.

For the double-track PSC (pre-stressed concrete) segmental box girder type of viaduct, the suitability of uniform deck width of 9.15 m shall be assessed, ensuring adherence to the minimum track center distance on curved track of minimum radius 300 m.

3.2 Implementation of Delhi-Karnal Namo Bharat Corridor including Rolling Stock for Delhi-Bawal Corridor (Schedule B, C, D & E of BoQ)

- a. Detailed design of alignment, planning, preparation of preliminary & concept designs, tender drawings, estimates, BOQ, Outline Construction Specifications (OCS), Outline Design Specifications (ODS), procurement and proof checking of submissions made by Design & Build/Part Design & Build contracts/ DDCs of build only contracts for:
 - (i) Civil & Architectural works (Elevated viaducts & stations, underground stations & tunnels, ramps, cross passages, ventilation shafts, underpass & FOBs etc. including ancillary works, Property Development & other supporting structures, all type of internal & external Signages etc.)
 - (ii) All System works such as tracks, Signaling & Telecommunication, Automatic fare collection, Platform screen doors, LTE systems , Power Supply & Traction system including SCADA, RSS, Maintenance Vehicles, Electrical & Mechanical (E&M), air conditioning & ventilation, BMS, Elevators, Escalators & Travelators, Rolling Stock, Depot M&Ps, Operation Control Center (OCC), Backup Control Centre (BCC) etc.
- b. Supervision & implementation and Contract management of:
 - (i) All Systems works such as tracks, Signaling & Telecommunication, Automatic fare collection, Platform screen doors, LTE systems , Power Supply & Traction system including SCADA, RSS, Maintenance Vehicles, Electrical & Mechanical (E&M), air conditioning & ventilation, BMS, Elevators, Escalators & Travelators, Rolling Stock, depot M&Ps,, Operation Control Center (OCC), Backup Control Centre (BCC) etc. and any other works where GC will act as Engineer.
- c. Proof Checking of documents and Drawings for works related to Depot, staff quarters, police station, barracks etc. as per Scope of Work and any work of Build only nature.
- d. Maintaining quality and safety in respect of Civil & Architectural and all Systems works.

3.3 The GC shall carry out interface management & system integration between civil construction and all system installations, testing & commissioning and any other activities required for the successful implementation & commissioning of the Delhi-Karnal Corridor along with interface requirements with respect to system adopted for Delhi-Meerut Namo Bharat Corridor and Delhi-Bawal Namo Bharat Corridor.

3.4 The GC shall also be responsible for procurement, testing & commissioning of Rolling stock and Depot M&Ps for Delhi-Bawal corridor, for which the interface management and system integration shall be carried out.

3.5 While designing the alignment for Delhi-Karnal corridor, GC shall consider and make necessary provisions for identified future stations and spur requirements, along with detailed methodology depicting feasibility of construction of these future stations at later stage or during implementation phase as per decision and directions of Employer. The methodology shall include necessary provisions for minimal disturbance to train operations, in case of future stations. Accordingly, GC shall submit detailed design of alignment, planning, preparation of preliminary & concept designs, tender drawings, estimates, BOQ, Outline Construction Specifications (OCS), Outline Design Specifications (ODS) for Civil, Architectural works & all System works as defined in Clause 3.2(a) complete.

- 3.6** Integrated Double Decker arrangement has been envisaged in certain section in Delhi portion as per intentions of Stake Holders and Govt Bodies with flyover at first level and Nammo Bharat elevated corridor at second level. In case, the scheme/ proposal has been agreed with concerned Stakeholder/Authority, GC's scope of work shall include all responsibilities defined in this document for such integrated structure as well.
- 3.7** The GC's scope of work shall also include all works pertaining to the Elevated Viaduct of approximately 280m length extending from SKK (excluding SKK Station) to the ramp at Millennium Park, Delhi, for the Delhi–Bawal Corridor. Accordingly, all responsibilities defined in this document for the Delhi–Karnal section shall also apply to this stretch of Delhi–Bawal Corridor which also forms part of **Package Elevated-1**, as detailed in **Annexure 6.4**.

- 3.8** The commissioning of the corridor may be in stages depending upon the progress of the work, which shall be planned by GC in consultation with Employer.

3.9 Role of General Consultant

The General Consultant (or GC) shall be a proactive partner of Employer in successful implementation of the Project. The GC is expected to have adequate experience of delivering similar types of Metro/rail infrastructure projects and knowledge of latest trends in similar types of works. The roles of the GC shall include but not be limited to the following:

- 3.9.1** To plan and assist Employer in implementation of the project while ensuring durability, maintainability and reliability of service, scalability of the Nammo Bharat network, seamless inter-operability among various Nammo Bharat corridors.
- 3.9.2** To undertake detailed design of alignment, preparation of concept & preliminary design, tender drawings, estimates, BOQ, OCS & ODS and any other document required for inviting Bids for Design & Built/Part Design-Built contracts, Design contracts (if required), Construction contracts and scheduling of various bids to ensure completion of the project within timelines. The details about the requirements to be followed while preparing the mentioned documents are attached at **Annexure 6.13**.
- 3.9.3** To plan, design and implement systems along with seamless system integration for this corridor (Delhi-Panipat-Karnal) and with other corridors (with Delhi-Meerut and Delhi-Bawal corridors) to achieve optimal system and ensure safety. This shall include preparation for testing, conducting trials and obtaining all statutory approvals including safety certifications & commissioning.
- 3.9.4** To critically review and supplement the work already done / work under progress, necessary for the successful implementation and efficient operation of the project. The summary of work done so far is attached at **Annexure 6.2**.
- 3.9.5** To adopt appropriate planning approach and procurement strategy taking into consideration the decisions already taken for Delhi-Panipat-Karnal and Delhi-Meerut corridor, to help minimize project life cycle cost, cost and time overruns, disputes and issues related to safety and quality for the part of work for which technology and system have already been frozen (List enclosed as **Annexure 6.3**)
- 3.9.6** For the areas and the parts of the work which are not covered in **Annexure 6.3**, GC to recommend technology solutions compatible with decisions already taken by Employer for the systems to be adopted and to adopt appropriate planning approach and procurement strategy to help minimize project life cycle cost, cost and time overruns, disputes and issues related to safety and quality keeping in view the aspects of durability, efficiency, issues of obsolescence, cost economy, etc. while maintaining compatibility with the part of work and system for which technology has already been finalized and frozen by Employer.
- 3.9.7** To coordinate with Designers (appointed by Employer for Build only contracts/DDCs hired by the contractor for design & build/part design & build contracts) for finalization of appropriate analysis, proof checking of design & drawings for architectural works,

structural works and for all the system works. GC shall also be responsible for value engineering, quantity/cost optimization, energy efficient System, optimum life cycle cost, proof checking of permanent and temporary structure design and drawings, resolving site queries, assist in design approval from agencies/institutions such as Central government organization, state government organization, Railways, NHAI, CPWD/PWDs, irrigation, water supply, sewerage, Forest/Zoo, State Fire Authority, Directorate of Electrical Safety, Lift & Escalator Inspectors any other government/non-government etc.

- 3.9.8 GC shall undertake the contract management, execution and supervision of all systems. They shall ensure Quality, Safety, Health and Environment related to all systems as well as all Civil, Architectural finishing and PEB works, signages etc. To monitor the statutory compliance requirements for environmental and social impact on account of commissioning of the project and interacting with any auditing agencies including funding agencies for the same and compliance of their observations/suggestions. The works shall be planned to keep in view the best practices of the industry for environmental and social aspects of the project during construction as well as operation of the services.
- 3.9.9 Where GC is acting as Engineer, GC shall timely prepare the responses for the claims and disputes raised by the contractors and submit with all logical recommendations along with backup documents within the ambit of the contract as well as latest Arbitration and Reconciliation Act of India.
- 3.9.10 To adopt most appropriate Indian and/or International practices, codes, specifications, and standards in consultation with NCRTC and develop detailed flow chart for the process of analysis, design & prepare the Design Basis Reports (DBR) for Civil, Architecture & Systems aligned with approved layout/ plan and drawing with respect to design parameters finalized by NCRTC for the project after getting approval of statutory/technical bodies. Latest version of all the relevant Standards shall be available with GC.
- 3.9.11 To plan environment-friendly practices taking into account environmental policies of NCRTC, Government of India guidelines and other International practices across the project life cycle including during execution from planning to operation and measures required to mitigate social impacts due to implementation of project. The report for EIA and SIA studies available with NCRTC/or being done by NCRTC shall be taken into account while recommending the requirements for the same.
- 3.9.12 Assist NCRTC in obtaining green certifications such as GRIHA, IGBC, ISO 50001 for RSS/ stations, depot, OCC/BCC, buildings and other structures and assist NCRTC in achieving and obtaining certification for net-zero energy requirement for buildings, wherever possible. The assistance expected from the GC in obtaining ratings/certifications shall include but not be limited to comply with all requirements for the certification, preparing and making and certifying necessary records, attending meetings and making presentations for obtaining the rating certifications.
- 3.9.13 The GC shall assist the NCRTC and coordinate with all relevant internal & external departments to obtain CMRS approval and any other required clearances, as and when necessary, in accordance with the Employer's requirement.
- 3.9.14 GC shall interface with General Consultant of Delhi-Bawal corridor for all interfaces related to Rolling Stock and Depot M&Ps. GC shall ensure there is no lapse in information flow, including resolution of interface/system integration issues.

4. Scope of the Services & Task Components

I. Finalization of Technical Parameters for future Nam0 Bharat (RRTS) Corridors (under lumpsum component quoted in Schedule-A of BoQ)

The consultant will be responsible for finalising parameters which will be used for the

future Namo Bharat corridors including Delhi-Bawal and Delhi-Panipat-Karnal.

4.1 Tunnel Cross-section Design

The consultant shall recommend the Track & Rigid Overhead Catenary System (ROCS) systems suitable for 5.8 m internal diameter tunnel duly accommodating rolling stock and other functional parameters specified in Table-4 so as to achieve maximum speed potential for tangent tracks. Within the tunnel cross-section, the Consultant shall also ensure the integration and spatial accommodation of other essential systems, including Electrical, Signaling, Telecommunication, Tunnel Ventilation, Cross-passages, Drainage, evacuation walkway at coach floor level on one side, fire protection systems, and noise and vibration mitigation measures such as a mass spring system suitable for the design speed. Construction tolerances and adequate clearances, including electrical clearances, must be provided in accordance with relevant Codal provision/ International standards. The consultant shall also recommend the requirements of construction tolerances to be considered by TBM manufacturers in design of TBM.

Consultant shall also attend all the meetings (online/In-Person) required for finalization and approval of the tunnel cross-section.

The consultant shall also provide soft copies (editable) of all designs (Excel, Software models etc.) and drawings to the employer.

4.2 Design of Viaduct Superstructure and its minimum width:

The Consultant shall recommend the technically suitable type of viaduct structure (Enumerating merits and demerits of each type) giving detailed justifications for choosing the same based on the functional parameters outlined in Table-4 and constructability in urban area. The selection shall consider factors such as cost-effectiveness, provision of an evacuation walkway at coach floor level, and ease of construction in urban landscape. Dynamic performance of various alternatives superstructure shall also be analyzed.

If the PSC segmental box girder is proposed for the corridors, the Consultant shall examine the feasibility of viaduct deck width of 9.15 m to meet the functional requirements as specified in Table-4. Detailed cross-sectional drawings of the proposed structural systems shall be provided, incorporating evacuation walkways at coach floor level along the viaduct's side and ensuring compliance with all relevant codes and standards.

In case 4100 mm track center or 9.15 m width of segmental box girder viaduct is not found suitable for the given parameters, the consultant shall recommend optimized track center and deck width which can be adopted for a minimum curve radius of 300 m and 160 mm cant with detailed justification and detailed cross section.

4.3 Track system

- 4.3.1 The consultant will recommend proven Ballastless Track system for design speed specified in Table-4 with continuous welded rail (CWR) for elevated viaduct and underground sections. The track system suggested by consultant may be different for elevated and underground section. However, maintainability may be considered if Two separate track systems are suggested.
- 4.3.2 The suggested track system should be with precast rail seats for ensuring tolerances required for high speed and should have provision of derailment guard.
- 4.3.3 The suggested system shall also be compatible with at least two proven fastening systems. The consultant shall submit a design report covering the ballastless track structure to be adopted for elevated section suitable with the design parameters specified under Table-4.

- 4.3.4 The Consultant shall provide detailed dynamic analysis of Ballastless track with the various proposed viaduct structures.
- 4.3.5 For the Underground tunnel of 5.8 m internal diameter and for viaduct, provenness of track system for 180 kmph or higher design speed shall be established as under:
 “Project details with speed and period of operation, where such proposed system is in operation for 5 years on at least 10 Km length, with proposed track system suitable for the design speed of 180 kmph or higher and minimum Axle load of 17T.”
- 4.3.6 Arrangement of derailment Guard in the proven track structure shall also be made.
- 4.3.7 The consultant shall also recommend suitable Vibration mitigation measures **to meet the requirement of RDSO CT-38 and provide the minimum mitigation values of the system** for tunnel section at 40 Hz frequency required for parameters mentioned in Table-4 considering average depth of tunnel as 15-20 m in urban transit system. The Alignment of Delhi-Bawal corridor passes through INA, Munirka, Aerocity & Manesar where rock is also expected to be encountered at shallow depth beyond Munirka.
- 4.3.8 The submission shall include the design calculations confirming the requirements specified in accordance with applicable National/International standards/Codes.
- 4.3.9 The consultant will specifically mention if the proposed track system is patented and if so, how the track system may be adopted for Namo Bharat System (RRTS).
- 4.3.10 The consultant to also furnish design life and approximate cost of proposed track structure per track km (initial as well as life cycle cost).

4.4 Rolling Stock Maximum construction gauge

Based on the design parameters specified in Table-4 above and construction parameters specified, Contractor will finalize the Rolling Stock Maximum construction gauge (Refer UIC 505). International norms and UIC norms in this regard should be adhered to.

Universal Rolling Stock construction gauge is required to be developed by the consultant with standard clearances for 25 KV traction.

This will be the basis of deliberations by the Consultant along with NCRTC with major leading Rolling Stock manufacturers. After deliberations with the Rolling Stock manufacturers, a feasible Rolling stock construction gauge will be finalized.

It has to be understood that this Rolling Stock will also be operating on Delhi -Meerut Corridor.

Design should also cater to safety clearances for passengers and physically challenged persons as mandated by accepted norms for both proposed future corridor and existing Delhi-Meerut corridor.

4.4.1 Rolling Stock Kinematic Gauge

The rolling stock Kinematic gauge as defined in UIC 505 represents the maximum dynamic displacement of a vehicle outline from track center line and from rail level. This is an envelope comprising:

- (i) Rolling Stock profile.
- (ii) Track and vehicle tolerances.
- (iii) Allowances for curvature and super elevation.
- (iv) Dynamic effects.

The Kinematic gauge of the Train shall be calculated in accordance with UIC-505 and will have to be worked out separately for three different locations

KE1 For movement on viaduct at 180 kmph between stations

KE2 For Station platform locations with max. permissible speed (Refer para 4.6.2)

KE3 For movement in the tunnels at speed potential determined after Aerodynamic studies (refer sub-para 4.7.5.1 of Para 4 (I)).

Track effects to be considered for working out the kinematic gauge are:

- (a) Rail wear (Vertical and Lateral).
- (b) Lateral track movement – (separately for straight track and for curved track).
- (c) Cant on curves.
- (d) Track tolerances.
- (e) Horizontal curvature effects:
- (f) End throw; and mid throw.

Vehicle effects to be considered for working out the kinematic envelope are:

- (a) Tolerance of vehicle dimensions.
- (b) Surging and lurch (including the effect of wheel and undergear wear).
- (c) Tilting due to cant.
- (d) Vehicle roll.
- (e) Vehicle bounce.

Other dynamic effects are:

- a) Unequal loading of vehicles
- b) Deviation due to wind loading.

Wind speed of 70 kmph to be considered for the platform area on at-grade, elevated stations and NIL wind speed for underground station and underground section outside the station area. At all other locations, wind speed of 100 kmph shall be considered.

Where values or parameters, required for calculating the Kinematic profile, as per international standards are not available and not specifically mandated in the technical details, these values can be taken from the data of Delhi-Meerut Corridor. Kinematic envelope of the Delhi-Meerut corridor will also have to be considered for safe movement of the proposed Rolling stock in Delhi- Meerut corridor to ensure interoperability.

It should comply with international norms mandated for Rolling Stock manufacturers and UIC 505 for standard gauge and ballastless track.

KE design should be supported with assumptions made, design calculations and codal provisions considered.

4.5 Traction System

4.5.1 The consultant shall recommend suitable dimension of ROCS system for finalizing tunnel cross section.

4.5.2 Consultant shall recommend suitable 25 kV AC traction system for entire corridor for underground, elevated and at grade sections for adoption as per the design parameters mentioned in Table-4.

- 4.5.3 The recommended ROCS (Rigid Overhead Catenary System) shall be proven system with all its components including structures, switching stations, sectioning, neutral sections, transition with FOCS, crossovers/turnouts etc. and in operation for at least 3 years on a track length of at least 05 km for an operational railway system at operating speed of not less than 140 kmph. Neutral section should be avoided inside tunnel. However, if it is essential, it should be preferably without the need for provision of cut&cover exclusively catering to neutral section requirement. This may involve slight modification at this location in (i) Neutral section design (ii) Track (iii) Tunnel.

Similarly, the recommended FOCS (Flexible Overhead Catenary System) shall be proven system with all its components including structures, switching stations, sectioning, neutral sections, crossovers/turnouts etc. and in operation for at least 3 years on a track length of at least 10 km for an operational railway system at operating speed of not less than 160 kmph.

Details of referred systems for proven-ness and available OEMs shall be provided.

- 4.5.4 The requisite clearances for 25 kV traction components shall be ensured considering respective conditions in underground and elevated sections based on the civil structures, track centre and traction components selected in the study.
- 4.5.5 The Consultant shall submit Design Basis Report on the recommended traction system.

4.6 Schedule of Dimensions (SOD) and Design Basis Report (DBR):

- 4.6.1 The consultant shall submit Schedule of Dimensions (SOD) to be followed for the implementation of future Namoo Bharat Corridors for underground section (tunnel and stations), elevated section (viaduct and Stations) and at grade section in depots/connection to the depots for the stipulated design speeds, requirements of rolling stock, PSD, systems, utilities etc.

All drawings and sketches etc. which are part of SOD are to be prepared by the Consultant.

The above Schedule of Dimensions shall be prepared following the global/national standards and shall be adequately supported by design calculations additional drawings, wherever necessary. The modifications proposed from existing SOD of RRTS shall be submitted with calculations in details alongwith the reasons/benefits of the modification.

- 4.6.2 The consultant shall review and suggest modifications in SOD to relax the speed restriction of 100 Kmph on platform.
- 4.6.3 The approved DBRs for Delhi-Meerut section shall be made available to the consultant and it shall be reviewed by the consultant by incorporating suitable changes required for future Namoo Bharat Corridors considering the modification in technical parameters and revised DBR shall accordingly be submitted by the consultant for Viaduct, Tunnels and stations.

The consultant will assist NCRTC to get the SOD and DBR for the future corridor approved by RDSO/Ministry of Railways.

4.7 Reports and studies to be conducted by the consultant

4.7.1 Rail Structure Interaction (RSI) Analysis of Track and Sub-structure interface

The consultant shall submit a report covering the RSI analysis of interface between the ballastless LWR/CWR track and structure for the standard span of the proposed superstructure.

4.7.2**a) Confirmatory Report of new Rolling stock on existing D-M corridor**

The new rolling stock for both the future Namu Bharat corridors shall be able to run in existing Namu Bharat corridor of Delhi-Meerut. Confirmatory report shall be given by the consultant to this effect.

b) Confirmatory Report of running existing D-M corridor Rolling stock on new corridors.

The existing rolling stock for D-M Namu Bharat corridor shall be able to run in future Namu Bharat corridors with the parameters as proposed by the Consultant. Confirmatory report shall be given by the consultant to this effect.

4.7.3 Design of viaduct Structures.

Based upon the selected type of viaduct, the consultant shall submit the detailed design of super structure along with detailed drawings for **Standard (Most economical) span and atleast four numbers of alternate feasible spans**. The alternate feasible span shall be decided by NCRTC in consultation with the consultant.

The following points should be considered by the consultant while designing the superstructure:

- i. The consultant shall be responsible for detailed design of standard superstructure for radius ≥ 300 m as per approved SOD and DBR.
- ii. The consultant shall be responsible for getting approval of the design and drawings of superstructures from a proof checking agency (List as mentioned in BDS clause ITB 4.3 (j)) or institution as directed by the Employer. **The cost of proof checking agency shall be borne by the Consultant.**
- iii. The Consultant shall also attend all the meeting (online/In-Person) required for finalization and approval of superstructure.
- iv. Consultant shall also submit dynamic Analysis of the superstructure. The report shall cover the safety of track & its components during operation.
- v. Along with the design/drawings, the consultant shall also provide 'to the scale' drawing of the recommended viaduct with KE/Structure Gauge for rolling stock for straight and curve portions showing track centers & clearances on the viaduct.
- vi. Based on available geotechnical data, the consultant shall design typical substructures and foundations for arriving cost per Km of the viaduct.
- vii. The Consultant shall also provide per km cost of the viaduct along with detailed calculations along with editable soft copy.
- viii. The consultant shall also provide soft copies (editable) of all design (Excel, Software models etc.) and drawings to the employer.

4.7.4 Optimum Track Centers based on detailed analysis and calculation

The consultant shall determine the suitability of minimum Track Center of 4100 mm for viaduct for minimum radius of horizontal curve of 300 m based on detailed analysis and calculation.

The consultant shall submit a report on suitable optimum track centre taking into consideration the parameters mentioned in Table-4, other system requirements, clearance from all the utilities etc. The report shall cover detailed design calculations as per applicable international standards wherever necessary.

4.7.5 Aerodynamic simulation study

4.7.5.1 Evaluation of speed potential for tunnel cross section of 5.8 m dia. with proposed track & traction system and rolling stock height of 4120 mm, width 3200 mm and aerodynamic nose (as in Delhi-Meerut corridor) shall be done by the consultant. The proposed simulation study shall be carried out in two stages as per the following:

(i) Stage-I: For Most Critical Section:

The consultant shall identify the most critical underground section of Delhi-Bawal alignment and take approval of NCRTC.

Thereafter, Simulation study (aerodynamic and 1-D simulation) shall be carried on the approved most critical section for 5.8 m internal dia. of tunnel for the parameters mentioned in Table-4 and suitable track & catenary system.

(ii) Stage-II: For Entire Corridor:

On the basis of experimental/critical section, simulation study shall be carried on the entire underground corridors for which go ahead is given by NCRTC to finalize the location and number of mid vent shafts/buildings and portal design.

Note for (i) & (ii): The details of the study to be carried out are as follows:

- (a) 1-D Simulation (SES/IDA or equivalent) & Aerodynamics Simulation (ThermoTun or equivalent) for all underground stations and associated tunnel sections as per the consultant scope of work.
- (b) Aerodynamics Simulation for assessment of pressure transient studies (ThermoTun or equivalent)
 - Pressure transient study shall include micro pressure wave propagation at portal entry,
 - Tunnel Portal entry/exit options of alternate portal designs or any other alternatives shall be explored to achieve speed of 140 Kmph but not less than 110 Kmph at entry/exit.
 - Assessment of air pressure acting on platform screen doors for possible train operations scenario i.e. Normal train stopping at station & Train by passing station.
 - Assessment of Infiltration and exfiltrated airflow through platform screen door and impact of station cooling load.
 - Pressure transient study on Platform screen gates at underground stations in all operating conditions (Full speed operation, Normal operation).
 - Pressure transient study inside the tunnels & station areas for different operating speeds up to maximum permissible speed inside tunnels (para 4.7.5.1).
- (c) Requirements, sizing and Location of Mid ventilation shaft/buildings for Concept/tender design.

4.7.5.2 Essential Requirements to be performed for work in para 4.7.5.1:

- a) 1-D simulation tool (like SES, IDA-Tunnel or equivalent) for assessment of preliminary sizing of TVS & TES system including determining the location of Mid ventilation buildings/shafts etc.
- b) 3-D simulation tool (like FDS6, ANSYS or equivalent) for assessment of relevant boundary parameters of ECS & TVS system.

- c) Aerodynamics simulation tool (like Thermotun or equivalent) for assessment of pressure loads on tunnel services, pressure change for the aural comfort for passengers in tunnel diameter of 5.8 m with the parameters mentioned in Table-4, optimized design of all tunnel portals and location wise detailed recommendations/drawings for mitigation measures for maximizing the design speed at entry/exits and inside tunnels. 'To mitigate the aural discomfort and speed restrictions arisen at tunnel entry/exits, funnel shape tunnel entry/exits may be provided or any other better solution be provided without increasing width of ramp portion'.

II. Implementation of Delhi-Karnal Namo Bharat Corridor including Rolling Stock for Delhi-Bawal Corridor (Schedule B, C, D & E of BoQ)

- 4.1** The services of the GC, shall be broadly covered under the following heads and described subsequently for all Architectural, civil structures including PEB (roof & façade), complete internal & external signages, Bearings, plumbing & drainage system, alignment & complete geometrical rail profile, Tracks, Signaling & Telecommunication, Automatic fare collection, Platform screen doors, LTE systems , Power Supply & Traction Systems, Maintenance Vehicles, Air conditioning & Ventilation, Rolling stock, Depots including depot M&Ps along with incidental M&Ps which may be relevant for the project, Stations, Automatic Fare Collection, Operation Control Centre, Operation planning including degraded modes of operation required for detailing of the project and implementation stage, Offices, residential and commercial complexes, Station integration areas, Bridges, Flyovers, Elevated, surface and underground sections over the project routes, integration with other modes of transport, Mechanical, Electrical & Plumbing (not limited to lightning, cabling, earthing & Lightning protection, LV power distribution, fire detection & alarm and fire suppression system, seepage & sewage pumps), Ventilation and Air Conditioning system, EOT cranes, Air compressor, ECS, TVS, Elevators, Escalators & Travelators, BMS (Elevated/Depot station, Depot), BMS & TVS SCADA, Solar, public health & environment, review of BIM model for project execution activities and any other systems services and infrastructure etc. required for successful completion, Operation and Maintenance of the project:
- (1) Critical study of DPR (including amendments thereon) of Delhi-Panipat-Karnal & relevant chapters of Delhi-Bawal Namo Bharat Corridors and submit the detail report with suggestions for architecture, structure & other systems over & above provisions of these studies for optimization.
 - (2) Detailed design of alignment, preparation of preliminary & concept design, tender drawings, estimates, BOQ, OCS & ODS for inviting Bids for Design & Built/Part Design-Built contracts, Design contracts (if required), Construction contracts and scheduling of various bids to ensure completion of the project within timelines.
 - (3) Preparation of procurement strategy and bid process management for selection of Contractors, Suppliers, Lead Design checkers, Independent Safety Assessor (ISA) etc. incorporating already procured works for site data collection, utility diversion and other miscellaneous works, and surveys etc.
 - (4) Proof-checking and approval of designs, drawings, technical Specification/ proposals submitted by Design & Built/Part Design & Built contractors/DDCs of build only contracts along with ensuring system integration and interface management, formulating and freezing guidelines. Proof checking shall include all design, drawings and submittals related to Temporary Structures also, which are required for construction and implementation of the Project.
 - (5) Supervision and Project management of all implementation activities for Systems including but not limited to Track, Rolling Stock, Depot M&Ps, Electrical & Mechanical, Plumbing, Elevators, Escalator & Travelators/Moving-walks, Solar systems, Power Supply & Traction Systems, Maintenance Vehicle, Signaling & Telecommunication, Automatic fare collection, Platform screen

doors, LTE systems etc.

- (6) Review, updation and implementation of Quality Assurance Plan. For this purpose, GC shall deploy two tier teams, one shall be deployed with implementation teams for civil works at field level and other shall be associated with Employer's corporate office quality team.
- (7) Review, updation and implementation of Employer's Requirements on Safety, Health and Environment (SHE) of NCRTC for the project. GC shall ensure the compliance of approved Method statement of contractor as well as other applicable Indian legislation. For this purpose, GC shall deploy two tier safety teams, one shall be deployed with implementation teams for civil works at field level and other shall be associated with Employer's corporate office safety team.
- (8) Inspection, testing at Site & at Factory premises, trials, compliance to regulatory bodies, design and safety certification from ISA, statutory approvals/ Environmental certifications, and commissioning of the Namo Bharat Corridor.
- (9) GC shall also be responsible for resolving all site related issues during implementation of project. In addition, GC shall validate and recommend modification in design and drawings (if any) of the viaduct girder during construction considering site constraints on case-to-case basis for build only portion of the contract.

For design & build contracts GC shall check the design and drawings (Permanent and Temporary) submitted by the contractor and suggest necessary changes and recommend design and drawing (Permanent and Temporary) for approval of the Employer for further construction at site.

- (10) GC shall proof check the design of launching girder, shutters, method statements for launching, construction methodology of elevated/ under-ground station/viaduct/ tunnel.
- (11) For standard superstructure, GC shall ensure that additional load on account of launching girder / launching scheme is within the permissible loads considered in the design of permanent structures. However, if the contractor proposes to use launching girder / launching scheme which will require change in design of permanent structures, such design shall be approved/validated with the undertaking from the contractor that additional cost of design and construction of permanent structures shall be borne by the contractor.
- (12) GC shall review and approve geotechnical investigation & geological reports, foundation systems (shallow and deep foundation), design of tunnels and retaining structures, pile capacity design, methodology for piling, pile load test scheme, pile load test reports including static pile load test, pile integrity test, high strain dynamic load test, cross hole sonic test, soil resistivity test, deep excavation design & schemes etc. GC shall conduct site visits / laboratory visits during geotechnical investigation, piling works, deep excavations, tunneling works etc. whenever is required.
- (13) GC shall ensure that pile capacity submitted is adequate.
- (14) GC shall also be responsible for checking of all as-built drawings prepared by contractor.
- (15) GC shall ensure the standardization of designs for bearings and restrict the inventory to minimum (say 8-12 nos.) for standard superstructure. Further the scope include, the checking and approval of design & drawing for bearings, method statement for installation, maintenance and rectification work procedure, installation support and any other documents submitted by contractor/ manufacturer for installation of bearings etc.
- (16) Modification of alignment and alignment plans, if any, due to site constraints

including the details of the horizontal and vertical curves (to be supported by detailed calculations, wherever necessary). Checking & approval of best fit alignment submitted by contractor based on as built details of civil structure.

- (17) Checking of design, drawings, specifications, method statement, Quality Management Plans, Inspection Test Plan (ITP), Standard Operating Procedures, Audit & Test reports for various types of track structure proposed by contractor. Witnessing tests for the track components in OEM premises/outside lab, if required. Also support in appointment of 3rd party inspection agency.
- (18) Review of quality manual, ITP of Bearing and resolve technical issues arising during manufacturing/testing of bearings.
- (19) GC shall also be responsible for site visits to resolve all issues arising during construction as and when required by employer.
- (20) Witnessing and checking of bearing inspection and test at manufacturer's facility as required by Employer.
- (21) Review and update Emergency Evacuation Scheme and Disaster Management Scheme for Underground Stations, Tunnels, Viaducts, Elevated Stations, other related buildings and Depot in conformity with international standards and codes including managing and supervising implementation of approved Schemes.
- (22) GC shall coordinate, review, monitor and report the defects occurring during the defect liability period of Construction and System contracts, till currency of GC contract.
- (23) Preparation of Services, Electrical and Mechanical (SEM), Combined Services Drawings (CSD), Building Opening Wall (BOW) drawings by considering the requirements of all systems in order to ensure effective system integration and to meet all commissioning requirements.

4.2 Critical study of DPR (incl. amendments thereon) of Delhi-Panipat-Karnal and relevant Chapters of Delhi-Bawal Namo Bharat Corridors, other documents such as preliminary investigation, studies & design and value engineering over & above provisions of these studies

A. Study of documents

- (i) GC shall collect the Detailed Project Report (DPR), any amendments to DPR, work done so far or under progress and any other relevant material/reports/etc.
- (ii) The GC shall study in detail the project holistically as well as each of the project components with respect to the following aspects but not be limited to:
 - a) Commuter experience
 - b) System Design and Optimization, Design criteria, System Integration
 - c) Standards and Specifications
 - d) Technology and Best Practices
 - e) Layouts / Drawings
 - f) Reports
 - g) Constructability
 - h) Interoperability and Scalability
 - i) Interface Management and Project timelines
 - j) Cost Estimate and Controls

- k) Financial and physical phasing
- l) Operation and Maintenance planning, etc.
- m) Overall project integrity, durability and adequacy
- (iii) The study shall contain assessment of various sub-components presented in the DPR and its related amendments and reports. Apart from the sub-components mentioned in these documents, other relevant material related to Multi Modal Integration with other modes of transport, physical integration at various stations, last mile connectivity feeder system and other technical aspects etc. and interoperability at Sarai Kale Khan need to be critically reviewed.

B. Value Engineering

- (i) The GC shall undertake based on standards, world-wide best practices, market scenarios, sustainable & high efficient system with optimum life cycle cost available in the market, and gap analysis for different sub-components and technology options taking into consideration approved design parameters (DBR, SOD), technologies adopted by NCRTC for the systems such as S&T, PSD, LTE and AFC, track, Rolling stock, Power Supply, traction & systems, Maintenance Vehicle, (Electrical & Mechanical, Electrical Plumbing), HVAC, ECS, TVS, Elevators, Escalators, Travelators, BMS (Elevated/Depot Station, Depot) and TVS SCADA etc. and compatibility & integration with the system being installed with **Delhi-Meerut and Delhi-Bawal and other Namoo Bharat Corridors** for interoperability. Based on this analysis and gap assessment conducted by GC, the GC shall suggest value engineering proposal in different project components, sub-systems and suggest appropriate technology options and solutions.
- (ii) The GC shall provide recommendations for such areas of improvement by way of supplementing or modifying existing details with additional/new details with detailed specifications, preliminary design and drawings for all civil structures, steel structures, special spans etc. This shall include a detailed comparative evaluation and value for money analysis over the project life cycle, wherever applicable.
- (iii) The GC shall give detailed planning for implementation of the project based on concepts beneficial for the overall success of the project based on their national and international experience as well as through due diligence.
- (iv) GC shall assist NCRTC in preparation of the proposal for Clean Development Mechanism to achieve maximum energy efficiency for Delhi-Karnal corridor.
- (v) The GC shall identify and assist in obtaining necessary approvals and clearances from relevant/statutory authorities for the supplemented/modified parameters or deviations (if any) and assist NCRTC in obtaining the same. The assistance expected from the GC shall include but not be limited to preparation of draft documents with justification, technical presentations, technical documents etc.
- (vi) The GC shall identify key risks, propose risk mitigation measures and prepare and/or update detailed risk management plan, including disaster management plan for the complete project in consultation with NCRTC.
- (vii) The GC shall prepare an updated implementation plan including financial and physical phasing for approval of NCRTC. The GC shall be responsible for monitoring project progress in accordance with the approved plan (including amendments/revisions thereon, if any) and for highlighting any non-conformity or deviations.

5. Deliverables

I. Finalization of Technical Parameters for future Namoo Bharat (RRTS) Corridors (under lumpsum component quoted in Schedule-A of BoQ)

5.1 Inception Report:

The inception report for finalization of technical parameters for future Nammo Bharat corridors will be prepared in consultation with and presented to the National Capital Region Transport Corporation (NCRTC) for approval. This report will include the following components:

(i) Methodology:

- Describe the specific methods and procedures that will be employed to carry out this consultancy work.

(ii) Assumptions:

- List any assumptions made in planning and executing this consultancy work.
- Provide justification for these assumptions where applicable.
- Explain the criteria for selecting the best option.

(iii) Deliverables and their breakdown:

- List the deliverables that will be provided at each stage of the project.
- Describe the format and content of each deliverable.
- Outline the scope of work for each task.

5.2 Design of Kinematic Envelope**5.3 Submission of drawing/cross-section of 5.8 m dia. tunnel duly accommodating all components & systems of Nammo Bharat (RRTS).****5.4 Submission of study report on Viaduct superstructure options and recommendation for suitable type of superstructure. Submission of all design and drawings of standard span of adopted superstructure.****5.5 Reports and Analysis mentioned under sub-para 4.7 of Para 4 (I) above.****5.6 Submission of Final Report on Final Technical parameters of future Nammo Bharat (RRTS) corridor along with all Annexures**

The final report will comprise of executive summary, salient features of findings, comparative analysis of various options with data to support the same. The final report will include but not limited to:

- (i) Executive Summary** - will provide a concise overview of the report's main points, ensuring that key information containing:
 - Key findings and insights for Tunnels, Viaducts, Track, Rolling Stock, OHE works.
 - Major recommendations
- (ii) Salient Features of Findings** - will summarize the most important findings of the project, highlighting the critical data and insights that have been gathered. This will consist of:
 - Key results from the data analysis and research.
 - Important analysis carried out.

- Market Trends/International Best Practices in each domain.
 - Summary of how these findings align with the objectives of the study.
- (iii) **Benchmark Costing of major recommendations**
- Detailed calculations, Methodology etc.
- 5.7 Submission of Schedule of Dimensions (SOD) and Design Basis Report (DBR).**
- The consultant will assist NCRTC to get the SOD and DBR for the future corridor for approval by RDSO/Ministry of Railways.*
- 5.8 Aerodynamic simulation report for entire underground section of 5.8 m internal diameter**
- 5.9 Terms of Reference (TOR) and Study Report on cost optimization of Namu Bharat Corridors and technical details of existing Namu Bharat Corridor (refer Clause 4.3.1 of BDS of ITB).**

II. Implementation of Delhi-Karnal Namu Bharat Corridor including Rolling Stock for Delhi-Bawal Corridor (Schedule-B, C, D & E of BoQ)

5.1 Inception Report

- (i) An Inception Report (6 copies in English) shall be submitted by the GC to the Employer presenting an initial technical appreciation of the services requirements and identifying both the overall work plan and the analytical steps (and associated assumptions) to reach solutions. It should prescribe the implementation of the proposed service methodology, approach and provisional programs for completion of the Project.
- (ii) The revised deployment plan of Key Experts (International and National/Local) and Non-Key Experts, if any, shall be submitted with the inception report which shall be finalized in consultation with the Employer. The deployment schedule (On site as well as Core office) will be flexible & will be monitored on monthly basis & can be amended as per need & requirement of the project.

5.2 Project Planning, Progress & Schedule Management and monitoring

The GC shall proactively assist NCRTC in overall project management and monitoring. The aspects where proactive support is envisaged include but not be limited to the items detailed below:

A. Approvals

- (i) The GC shall assist NCRTC in obtaining all necessary approvals and clearances from statutory and relevant authorities throughout the project implementation. These shall include but not be limited to design and drawings of civil structures including stations, PD area & other related buildings, environment clearances, safety, EIG, PTCC, REPC, Fire clearance /NOC of all buildings & systems, Lift & Escalator license, certifications from ISA, RDSO, CMRS etc. for all systems. The following shall be ensured by GC:
 - a) The GC shall prepare a detailed roadmap for obtaining various clearances required for implementation of the project. This shall include list of clearances, approvals, permits, compliances related to the development and implementation of the project. The road map needs to contain documentation requirement, dependencies and timelines that need to be adhered to for timely approvals.
 - b) The GC shall ensure that the process for obtaining the approvals is properly followed for obtaining approvals from appropriate regulatory agencies. The GC shall monitor the progress in these matters and report to Employer proactively.

- c) In regard to co-ordination of activities to be carried out with the local authorities and other Government departments, the role of GC would be to frame and put up to Employer, detailed proposals for being discussed and resolved by Employer, in various co-ordination groups set up by Central / State Government(s). The GC shall provide NCRTC all technical data, sketches, drawings and also attend the co-ordination meetings along with NCRTC for obtaining approval of proposals from these co-ordination groups.
 - d) The GC shall provide inputs on comments and opinions sought by the departments / financing / regulatory agencies under the State / Central Government with respect to the project being developed / implemented.
- (ii) The GC shall assist NCRTC, as required, in contract administration, disputes and claims management in the following:
- a) GC shall prepare contractual correspondences for contractors, manufacturers and suppliers etc. in consultation with NCRTC.
 - b) The GC shall assist NCRTC in reviewing and drafting of responses, participating in meetings with NCRTC with respect to disputes and claims in contracts where GC acts as an Engineer, till the duration of Contract Period.

B. Project Schedule Management

- (i) The GC shall prepare a detailed integrated schedule / project timeline for the entire project including procurement stages which shall include but not be limited to the order in which NCRTC should carry out each stage of design, procurement, manufacture, delivery to site, construction, erection, testing and commissioning. All major events and activities in these stages and their sequence should be clearly described.
- (ii) The GC shall use Primavera P6 software for scheduling.
- (iii) The GC shall review the detailed schedule submitted by the contractors and highlight the inconsistencies in line with the overall integrated schedule and recommend corrective measures.
- (iv) The GC shall regularly undertake planned vs actual analysis with respect to agreed implementation schedule and create early warning system to identify any red flags, and need for any proactive actions to be taken by NCRTC. The GC shall update overall project schedule in line with the discussion with NCRTC.
- (v) The GC shall undertake analysis of critical path and near critical path for the project on a regular basis and suggest corrective measures in order to ensure timely completion of the project in line with the overall integrated schedule.

C. Cost controls including Budgeting and Accounting

- (i) The GC shall create baseline program cost, budget and cash flow schedule and shall track it as per actual.
- (ii) The GC shall assess the financial position and project long-term financial statements.
- (iii) Creating a Cost Breakdown Structure (CBS) that encompasses the overall project as well as the CBS for each individual project to be delivered covering requirements mentioned in bidding documents during execution of the project.
- (iv) Developing and maintaining, on an individual project basis, the Master Budget for all projects.
- (v) Regularly review estimates, forecasts, code of accounts, and cost allocation criteria for the project, updating as needed.

- (vi) Ensure that all design submissions include cost estimates to support informed decision-making by the Employer.
- (vii) Develop and maintain budget re-forecasting procedures along with updated cash flow projections.
- (viii) Identify and design appropriate earned value reporting requirements and communicate this information clearly to the Employer and stakeholders.

D. BIM Implementation Plan

- (i) NCRTC intends to implement Building Information Modelling (BIM) enabled Common Data Environment (CDE) across its project cycles of design, construction, planning/monitoring and O&M including asset management.
- (ii) GC shall prepare BIM implementation plan within one month from the commencement date by performing current state assessment to understand NCRTC's current and future requirement. The plan shall include but not limited to:
 - (a) Assessment of current state of the project and requirements of NCRTC.
 - (b) Maturity assessment of the supply chain including readiness and desire to accept changes and identification of key stakeholders to be included in the BIM.
 - (c) Identification of the Engineering & Design and management processes that take advantage of BIM technologies and methodologies in consultation with NCRTC.
 - (d) Define implementation of a roadmap for the BIM.
 - (e) Recommendation of appropriate detailing to be undertaken for defining information sub-component wise along with interdependency between the information.
 - (f) Organization roles and staffing including delegation of authority, trainings required, manpower planning, job descriptions required for implementation and operations & maintenance phase in consultation with NCRTC.
 - (g) Identification of policy provisions, terms and conditions specifically relating to BIM to be incorporated in all bid documents to ensure desired implementation of BIM in consultation with NCRTC.
 - (h) Preparation & updation of all documents but not limited to Employer Information Requirement (EIR), Organizational Information Requirement (OIR), Asset Information Requirement (AIR), master delivery list, master information delivery plan in line with PAS 1192 or latest amendments/international standards.
 - (i) Collaboration/interface procedures between various key stakeholders involved including system integration.
 - (j) Defining communication protocol between various key stakeholders.
 - (k) A detailed review and recommendations regarding intellectual property rights (IPR), copyright and ownership of BIM data.
 - (l) Recommendations and guidance regarding design liabilities, duty of care and responsibilities of all key stakeholders working in a collaborative BIM environment.
 - (m) The end-state requirements such as handover, testing/commissioning and integration with NCRTC's current/future asset management systems including the level of information required for each asset.
 - (n) Change management plan including communication mechanisms and related supporting materials.

- (o) Identification of BIM performance parameters for various stakeholders and monitoring their adherence by the stakeholders.
- (iii) The GC shall monitor the BIM implementation plan and highlight any red flag to NCRTC along with the recommendations of mitigation measures. The GC shall assist NCRTC in proper operations and maintenance of the BIM interface including all techno-managerial assistance.
- (iv) GC shall review the existing system and support NCRTC in GIS integrations for various assets but not limited to alignment, stations, depot, utilities including finalization of information details to be added to 3D model in consultation with NCRTC.
- (v) The GC shall ensure integration of their own tool/software and workflow processes with the existing platform/systems of CDE adopted by NCRTC.
- (vi) The GC shall review existing system and support NCRTC in implementation of policies, processes, procedures and systems for the collection, storage, protection, integration and dissemination of all via CDE across all stakeholders such as employers, contractors, consultants.
- (vii) The GC shall recommend latest and robust security features so as to avoid any type of hacking or loss of data.
- (viii) The licenses for CDE shall be procured and provided by NCRTC, however the tool for BIM shall have to be obtained by the stakeholders.

5.3 Preparation of tender documents, drawings for Tunnels & Stations {Underground, Elevated (incl. future ones), At-grade}, Viaduct, At-Grade portion and roads, culverts etc.

- 5.3.1 GC shall prepare the concept & preliminary designs, drawings, design basis reports, specifications, Estimates, BOQ etc. covering all aspects relevant to the implementation of Elevated viaduct, At-Grade portions, Ramps, Elevated stations, Underground stations, MMI planning and Tunnels along with other associated structures such as cross passages, ventilation shafts, ventilation-cum-evacuation shafts, ancillary buildings, fire safety, steel structures and other structures (like roads, culverts, underpass, FOBs) including PD etc. and in the degree of detail as required in tender documents for Design & build and Part Design & Build contracts. This will include but not limited to:
- (a) Geometric designs of final alignment plans and its profile to appropriate scale.
 - (b) General Consultant shall review geotechnical investigation report and additional geotechnical data provided by the Employer/Design consultant. Design for soil stabilization/improvement and required disaster prevention system taking into consideration geotechnical data.
 - (c) Architectural and Engineering design for elevated, underground & at-grade stations / Elevated Viaduct/Property Development areas & other supporting buildings including related details of finishing, façade & roofing (PEB) structures, pedestrian accesses, staircases, elevators, escalators, moving walk, FOB/ skywalk/ subway, entry/exits, air-conditioning equipment, platform screen doors (if provided), evacuation facilities, façade development and aesthetic lighting, external site development and public realm, signages, sustainable features etc. GC would also suggest alternative to conventional air conditioning to achieve climate control i.e. reduction in dust & temperature.
 - (d) Right of way plans on topographical and cadastral maps provided by the Employer.
 - (e) Preparation of Outline Design Specification (ODS), Outline Construction Specifications (OCS) and Estimate.
 - (f) Review of Field instrumentation for monitoring the performance of tunnels &

underground stations and Elevated stations during and after construction.

- (g) The recommended design criteria, specifications, standards and codes of practice will be in accordance with the relevant Indian codes of practice/ specifications. Where the standards and specifications are not available in the Indian Codes of practice/specifications, International codes of practice/ specifications will be adopted with the approval/consultation with the Employer. The recommended criteria, specifications, etc. will become part of tender design, on acceptance by the Employer.
 - (h) The recommended specifications, and design criteria will also cover the methods of construction, design of temporary works and disposal of excavated materials, as also the external environment under which the work would be required to be executed. The specifications will also prescribe the tests and acceptance standards for various components of work.
 - (i) It is to be ensured that the designs and specifications will meet the project requirement at reasonable cost, without imposing any limitations regarding competitive bidding. The Employer intends to go green and would be harnessing solar energy at station, Depot, viaduct etc. Design approach should take into account of this.
 - (j) All recommendations given by GC in value engineering/cost optimization/Value addition shall be supported by design calculation done by GC shall be submitted to NCRTC.
 - (k) Any other relevant details/data
- 5.3.2 Tenders for underground portion will be on 'Design and Build' basis; Elevated viaduct and stations shall be 'Part Design and Build' basis. Service buildings and any other structures, Depot etc. will be on Build Only basis. The tender packages shall be as per the **Annexure- 6.4**, i.e., Indicative packages.
- 5.3.3 Tenders for Elevators, Escalators & Travelators would be separate and would be on Design and Build basis. This would include entire section including elevated at-grade and underground stations and depot and ancillary building and staff quarters.
- 5.3.4 Tenders for Solar System for entire corridor would be on suitable commercial model mutually decided with NCRTC based on best practices.
- 5.3.5 Separate tender for (i) Design, Supply, installation, testing and commissioning and maintenance during specified period of proven Ballastless track system for design speed of 180 Kmph and above including supply of HH rails & proven fastening system, system specific material of the proven ballastless track system and proven Ballastless Turnouts compatible with proposed ballastless track system ; Installation of turnouts; supply and providing MSS to reduce effect of noise and vibrations for elevated and underground section as per recommendation of vibration consultant (ii) Supply, installation, testing and commissioning of Ballasted track including supply of Rails, fastening system, ballast, Turnouts and PSC sleeper; installation of Turnouts for Depots.
- 5.3.6 Separate tenders for (i) E&M including Fire Detection & Suppression Systems, ECS, TVS, BMS and TVS SCADA OCC & BCC Systems for underground the underground section shall be on design & built basis. (ii) E&M including Fire Detection & Suppression Systems for elevated section on design and build basis.
- 5.3.7 Tenders for Power Supply & Traction System works shall be on Design & Build basis.
- 5.3.8 Separate tender for (i) Signaling & Telecommunication , (ii) Platform Screen Doors and (iii) Automatic Fare Collection system on design & Build basis.
- 5.3.9 Separate tenders for signages are proposed to be invited.

5.4 Review of documents /drawings for Depots, Housing and other supporting buildings like police stations/ post, barracks etc. and multi-storied / service/ residential buildings etc.

- 5.4.1 GC shall review/ validate/approve the concept design, preliminary designs/drawings/ specifications and Tender designs / drawings/ Specifications covering all aspects relevant to the implementation of Depot/Ramps, Housing and other supporting buildings like police stations/ post, barracks etc. and other structures (like multi-storied / service/ residential buildings) including standalone Property Development etc. and in the degree of detail as required in tender documents for such projects. Review/ validation/approval of Tender designs / drawings/ Specifications will include but not limited to:
- (i) Geometric designs of final alignment plans and its profile to appropriate scale.
 - (ii) General Consultant shall review and approved geotechnical investigation report and additional geotechnical data provided by employer/Design consultant. Design for soil stabilization/improvement and required disaster prevention system taking into consideration geotechnical data.
 - (iii) General consultant shall review / validate detailed survey data provided by employer while ensuring value engineering / cost optimization while designing.
 - (iv) Architectural and Engineering design for Depots & other supporting buildings like housing, police stations/ post, barracks, public convenience structures etc. including related details of finishing, façade & roofing (PEB) structures, pedestrian accesses and public facilities, staircases, elevators, escalators, FOB/ skywalk/ subway, entry/exits, air-conditioning equipment, platform screen doors (if provided), evacuation facilities, façade development and aesthetic lighting, external site development and public realm, signages, sustainable features etc. Consultant would also suggest alternative to conventional air conditioning to achieve climate control i.e. reduction in dust & temperature.
 - (v) Right of way plans on topographical and cadastral maps provided by the client.
 - (vi) Review of Field instrumentation for monitoring the performance of Depots during and after construction.
 - (vii) The recommended design criteria, specifications, standards and codes of practice will be in accordance with the relevant Indian codes of practice/ specifications. Where the standards and specifications are not available in the Indian Codes of practice/specifications, International codes of practice/ specifications will be adopted with the approval/consultation with the client. The recommended criteria, specifications, etc. will become part of tender design, on acceptance by the client.
 - (viii) The recommended specifications, and design criteria will also cover the methods of construction, design of temporary works and disposal of excavated materials, as also the external environment under which the work would be required to be executed. The specifications will also prescribe the tests and acceptance standards for various components of works.
 - (ix) GC shall also be responsible for proof checking of all structural quantities submitted by DDC and shall recommend for value engineering followed by quantity and cost optimization. All recommendations given by GC in value engineering/cost optimization/Value addition shall be supported by design calculation done by GC shall be submitted to client/ employer.
 - (x) Any other relevant details/data

5.5 Preparation of Tender documents /drawings for Procurement of E&M, ECS & TVS, BMS, SCADA and stabling yards, Rolling Stock, Track, Power Supply & Traction, Signaling & Telecommunication, Automatic fare collection, Platform screen doors, LTE systems , complete Signages etc.

- (i) GC shall prepare complete bidding document which should also include the design criteria/specifications, tender drawings, BOQ, OCS and ODS for below mentioned systems:
 - a) E&M, ECS& TVS, BMS, SCADA
 - b) Stabling Yards
 - c) Rolling Stock including depot equipment etc. and all types of Maintenance Vehicles in Rolling Stock combined package of Delhi-Panipat-Karnal and Delhi-Bawal Corridors
 - d) Signaling and train control system.
 - e) Telecommunication system.
 - f) Automatic Fare Collection system.
 - g) Platform screen door / gate system.
 - h) Power Supply & Traction systems
 - i) Elevators, Escalators & Travelators.
 - j) Track works for elevated/at grade and underground section including Depot.
 - k) Solar System.
 - l) All type of internal & external Signages etc.
- (ii) The tender design for the Rolling Stock and Depot shall take into account the project parameters for Signaling & Telecommunication, Automatic fare collection, Platform screen doors, LTE systems, traction power system, desired operational system, transport capacity etc. The recommended design and performance requirements shall consider the criteria of economy in initial cost, optimal operating & maintenance cost and life cycle cost. Energy saving measures, passenger comfort, counter measures required against temperature rise etc. in complete corridor including tunnel should also be a guiding criterion.
- (iii) The tender design for all internal & external Signages shall include (but not limited to) design criteria, design & drawings, graphics in cdr format, fabrication & fixing drawings with item-wise specifications, BoQ for each and every signage to be installed in the stations/ depot/ other relevant buildings along the viaduct, tunnel, corridor wherever required in consultation with Employer.
- (iv) The Signage Guidelines and Brand Manual shall be provided to the GC for the preparation of tender drawings. These guidelines to be reviewed by the GC and recommendations along with reports for necessary value engineering & modifications, improvements, or changes may be proposed to incorporate a commuter-centric approach, site-specific conditions, and global best practices, in coordination with the Employer's Requirements and in line with operational criteria for taking approval from the Employer.
- (v) All font sizes and signage locations shall be determined to ensure clear legibility and visibility as per MMI and operational requirements.
- (vi) The tender design is required to spell out the basic system design covering the propulsion, brake and auxiliary power supply system in addition to the main structure and safety aspects, in sufficient detail, so as to enable the bidders to make competitive

bids.

- (vii) The tender documents shall provide the appraisal standard for evaluation of technical proposals from the tenders for supply of Rolling stock.
- (viii) GC shall be responsible for complete bid process Management from preparation of bid document to award of works.

5.6 Preparation of Procurement Strategy and Bid Advisory Services for Selection of Contractors, Suppliers, Detailed Design Consultants (if required) and other Related Services taking into account the purpose for procurement strategy for indicative packages provided in Annexure-6.4.

A. Preparation of Procurement Strategy

- (i) The GC shall suggest the governance structure to be followed for approval at different stages of bid process management for various types of bids. The same shall be established in consultation with Employer. At a minimum, the stages shall contain:
 - a) Procurement strategy and further detailing of the same including time schedule taking into consideration the commissioning of the project.
 - b) Preparation of Bidding documents and invitation of Bid.
 - c) Participation in Pre-bid meetings, preparation of pre-bid replies and addendum/corrigendum
 - d) Evaluation of Bids including preparation of Evaluation report – technical and financial
 - e) Letter of Acceptance (LOA) & Contract Agreement
- (ii) The GC shall prepare and recommend a detailed procurement strategy for the consideration of Employer. This shall include but not be limited to;
 - a) Compliance with guidelines/policies/regulations of Employer, Government of India and funding agencies
 - b) Structure of bid packages for selection of contractors/suppliers/DDCs/other consultants–number of bid packages, bundling/unbundling of various project components, cost analysis and estimates, scope of work and boundary conditions, etc. taking into consideration the proposed structuring of bid given in **Annexure-6.4** and market analysis.
 - c) Interface requirement and planning among various project components, bid packages and contracts
 - d) Market analysis to ascertain sufficient number of bidders for each bid package
 - e) Impact of selected option(s) on estimated project economics (incl. cost and time)
 - f) Risk assessment and mitigations measures
 - g) Procurement schedule

B. Preparation of Bids

- (i) The GC shall prepare bid documentation as per approved procurement plan and review the bid documents prepared by DDC for the BOQ/item rate based contracts. These shall include but not be limited to preparation of bid documents, letter of acceptance, contract agreements, etc. Bid documents shall be prepared in line with the guidelines/policies of the Employer, Government of India as well as the project funding agencies.
- (ii) The bid documents for the approved bid packages shall include but not limited to:
 - a) Invitation For Bid (IFB)

- b) Instructions to Bidders (ITB)
 - c) Bid Data Sheet (BDS)
 - d) Evaluation & Qualification criteria
 - e) General Conditions of Contract (GCC)
 - f) Particular Conditions of Contract (PCC)/Special Conditions of Contract (SCC)
 - g) Bidding and Contract Forms including Form of Contract Agreement
 - h) Section of Nationality, if required
 - i) Bid Estimate and Price Bid including Bill of Quantities (BOQ)
 - j) Employer's requirements which includes:
 - (i) Employer's Requirement including General, Functional, Design, Construction, other requirements etc., Detailed Terms of Reference / Scope of Work, including any milestones/ team members and their qualifications, Machinery equipment/key performance indicators (KPIs), Machinery equipment and/or service level agreements (SLAs). Terms of Reference will also consider the recommendations of the Environmental and Social Impact Assessment Report.
 - (ii) Outline Design Specifications (ODS) and Design basis report etc.
 - (iii) System wide specification (General Specification)/ Outline Construction Specification (OCS)/Technical Specification
 - (iv) Particular Specifications (PS)
 - (v) Bid Drawings including alignment drawings, general arrangement drawings, plans & sections of stations at platform, concourse and ground level, land plan, entry & exit plan etc.
 - k) Reference documents including Schedule of Dimensions (SOD), Geotechnical reports, Design Basis Report (DBR).
 - l) Employer's Requirements on Safety, Health and Environment (SHE) including checklists & formats
 - m) Quality Assurance Plan
 - n) Any other requisite documents as applicable.
- (iii) GC shall prepare all the above documents as per the Standard Bidding Documents (SBD) and guidelines of the MDB funding the packages. In case the packages funded by Govt. of India, documents are required to be fulfilling the policy and guidelines of Govt. of India.
- (iv) For item rate bid packages particular specification, bid drawings and bill of quantities shall be prepared by DDC and shall be proof checked/validated by GC.
- (v) The GC shall prepare employer's requirement and pricing document for Design & Built and part Design & Built bid packages covering all aspects relevant to the implementation of the corridor and in the degree of detail as required in bid documents for such projects so as to enable the bidders to make competitive bids.
- a) The GC shall prepare and finalize outline design criteria, outline construction specifications, standards and codes of practice to be followed and submit to Employer for approval. Further GC shall obtain approval of Employer for necessary corrections and modifications.
 - b) The approved specifications, etc. will become part of Employers Requirement for bid invitation.

- c) The approved specifications and design criteria shall cover aspects related to the methods of construction, design of temporary works and disposal plan for excavated materials, and also the external environment under which the work would be required to be executed. The specifications will also prescribe the tests and acceptance standards for various components of works.
- d) It is to be ensured that the designs and specifications will meet the project requirement at reasonable cost, without imposing any limitations in regard to competitive bidding. Employers intend to go green and adopt international best practices in relation to harnessing renewable (solar, etc.) energy, rainwater harvesting, other initiatives (as required under law/statutory obligations) in line with government policies/programs and initiatives, etc. at stations, depots, viaducts, tunnels and other Nammo Bharat project components/establishments.

GC shall prepare and submit for acceptance of Station Planning and Design Criteria (such as level of service, station sizing and evacuation plan, fire and accessibility norms, etc.) for stations and property development area.

- (vi) GC shall prepare and submit bid drawing and design & construction criteria, specifications and drawings in the manner that is consistent with the final design requirements/specification of the project components and interfacing requirements. The Employers Requirement shall be sufficiently detailed so as responsive and competitive bids can be obtained. In case of Architectural bid drawings, it shall also cover all aspects of station design such as spatial modelling, overcrowding controls, information signages, multimodal exchanges, green building features, traffic movement, parking facilities, entry/exit and evacuation facilities, public amenities, etc.
- (vii) Based on the approved Employer's Requirement covering outline design criteria, outline construction specification, bid designs, design criteria, specifications, standards and codes of practice, the GC shall prepare a suitable Price bid/BOQ and estimated cost for the various design and build tender packages. GC shall review the Price bid/ BOQ and estimated cost prepared by DDC for various BOQ and item rate based packages planned for the work. GC shall prepare Standard Schedule of Rates with Rate Analysis for design and build contracts. For the BOQ and item rate contract, the GC shall review and approve pricing document/BOQ and estimated cost including analysis of rates for the items. The Schedule of Rates shall also be accompanied by the Standard Specifications and the Method and mode of Measurement for these items.

C. Bid Process Management

- (i) The GC shall conduct entire bid process management till signing of contract for selection of Contractors/Suppliers/DDCs (if required)/others on behalf of Employer. However, the public face for Bid process management will remain with NCRTC. The activities to be rendered by the GC in this regard shall include, but not be limited to the following:
 - a) The GC shall prepare the complete Bid document to invite the bids through the designated procurement portal which will be uploaded by the designated official (s) of Employer. GC shall follow the rules and regulations of the designated procurement portal in their bid process management.
 - b) If pre-qualification of contractors/suppliers/DDCs (if required)/others for bidding is required by Employer, GC shall undertake all necessary works regarding process of evaluation of contractor's documents and recommend to Employer the pre-qualified list for their acceptance wherever prequalification is considered necessary with prior approval of Employer.
 - c) GC shall organize pre-bid conferences/meetings, make presentation(s), prepare responses to the queries of the bidders and prepare the associated addendum/corrigendum to bid document(s) which will be issued by designated official of Employer.

- d) Employer shall make appropriate arrangements for receiving bids and opening of the same at the scheduled dates.
- e) Employer shall form appropriate bid evaluation committee(s) and/or working group(s) which shall oversee the bid process and give necessary approvals at various stages of bid process.
- f) GC shall evaluate the bid proposals through nominated committee and furnish recommendations for the selection of the contractors etc. for all bid packages including ranking of the bidders. This includes post bid clarification, wherever required. For this, GC shall prepare a confidential evaluation report with detailed analysis and justification and prepare presentation materials as per the requirement of Employer as well as funding agencies. This report/presentation should contain a concise set of basis and justification for ranking of the bids. GC shall be required to make a presentation pertaining to the recommendations to a committee and/or a working group that may be set up by Employer.
- g) Assist in negotiations with Bidders
 - (i) Prepare information and data to be used in the negotiations/clarifications.
 - (ii) Co-ordinate and assist Employer in negotiations/clarifications with the selected bidder(s) and record minutes of all meetings.
- h) Any other relevant details, as deemed necessary.
- i) GC shall prepare and submit draft Letter of acceptance for acceptance by the Employer.
- j) The GC shall assist Employer in finalization of Contract agreements duly incorporating all addenda and corrigendum
- (ii) The GC shall recommend and assist Employer in implementing appropriate strategy/mechanism to deal with bid disqualifications, negotiation, discharge and fall back options.
- (iii) The GC shall ensure proactive monitoring and management of approved procurement schedule, highlight triggers for ongoing/next set of activities to be initiated on rolling basis. The GC shall highlight any nonconformity or deviations from the approved procurement schedule and need for amendments, if any.
- (iv) The list of indicative packages is as given in **Annexure-6.4**. The list is tentative and same shall be reviewed and proposed by GC in the procurement strategy for approval of Employer. There shall not be any financial implication on any increase/decrease in the number of packages.

5.7 Interface Management & System Integration

A. Interface Management

- (i) The planning, designing, procurement, construction, testing and commissioning of the Namo Bharat project involves various activities related with civil engineering, architecture, track works, power supply & traction systems including SCADA, Signaling & Telecommunication, Automatic fare collection, Platform screen doors, LTE systems, depot & workshop, electrical and mechanical systems, elevators, escalators & moving walks, rolling stock, depot M&Ps, operation & maintenance, Building Information Modelling (BIM), Common Data Environment (CDE) etc., which will be handled separately by different consultants/contractors. The sub-groups managing these activities shall communicate and work coherently in the context of individual requirements of all the sub-groups and of the project in totality. Interface document preparation for integration of all contracts (wherever applicable) with owner's CMMS (Computerized Maintenance Management System)/ AMS (Asset Management System) shall be finalized and made part of tender document.

- (ii) GC shall work closely with all sub-groups and act as bridge between them to ensure there is no lapse in information flow, including resolution of interface/system integration issues.
- (iii) GC shall prepare interface management plan which shall include technical and operational activities etc., in consultation with the respective contractors and Employer. Interface management plan shall also include Rolling Stock & Depot M&P works of Delhi-Bawal Corridor in consultation with the respective contractors, general consultant of Delhi-Bawal corridor and Employer. The interface management plan thus prepared shall ensure:
 - a) Identifying/defining all the potential interfaces among various components of the project.
 - b) Outlining the process for coordination and management of parties involved across various interfaces.
 - c) Preparation of an interfacing platform where all requests can be registered.
 - d) Defining the process of registering and resolution of an interface request.
 - e) Establishing monitoring process for the interfacing of the registered request.
 - f) Identify information to be exchanged, define the precise division of responsibilities amongst the stakeholders and identification of integrated test to be performed at each stage
 - g) All contract packages shall contain single and common interface document.
 - h) Develop and incorporate necessary provisions in respective tender documents
 - i) Monitor the work program of each contractor so that all key/access dates are met by the individual contractors, by coordinating with all interfacing contractors and highlight any program risk requiring NCRTC attention.
 - j) Interface requirements with respect to the system adopted for Delhi-Meerut Namo Bharat Corridor.
- (iv) The GC shall identify and provide proper interface coordination so as to ensure the completion of all works and commissioning of the various sections (including Rolling stock works on Delhi-Panipat-Karnal corridor) within optimum time schedule according to the approved implementation schedule. The GC shall conduct site inspections to monitor any inconsistencies in the System Integration at a reasonable frequency in consultation with NCRTC.
- (v) The GC shall furnish their comments after review of the details to the concerned Contractor/Consultant/designated Engineer/nominated person and ensure compliance with the concerned designated contractors/nominated person/consultant, etc.
- (vi) In case of non-compliance of the requirements of the interfacing, the proposal shall be furnished to NCRTC along with GC's final recommendations for further line of action to ensure execution of interfacing requirements for approval of NCRTC.
- (vii) GC shall conduct regular site visits/meetings along with relevant stakeholders to review and monitor any interface related issues as per approved interface management plan in consultation with NCRTC.
- (viii) Incorporate and coordinate changes in design and drawing due to system wide interfacing with other DDC, Architects, contractors etc.
- (ix) Incorporate changes in design resulting from NCRTC design review/recommendation.
- (x) Any other relevant task

B. System Integration

- (i) The GC shall be responsible for coordination and act as a facilitator to ensure assimilation of requirements of all phases i.e. planning, designing, procurement, construction, testing and commissioning among various consultants/contractors/suppliers/other stakeholders and thereby prepare, manage and control, the overall system integration processes which will lead to successful implementation and operations of Delhi-Panipat-Karnal corridor (including Rolling stock works on Delhi-Bawal corridor).
- (ii) GC shall take all reasonable steps to ensure that the works are coordinated and integrated with the design, manufacture, installation, execution and testing of such other works and in particular (but without limitation).
- (iii) Participate in integrated testing and commissioning and demonstrate to the satisfaction of NCRTC that the system has been designed and constructed in a compatible manner
- (iv) Demonstrate to the satisfaction of NCRTC the system readiness for commercial operations and interoperability (including Rolling Stock work on Delhi-Bawal corridor) with respect to the system adopted for Delhi-Meerut Namo Bharat corridor.
- (v) Comply with any direction which NCRTC may give for the integration of the design of any part of the project

5.8 Contract Management and Supervising Implementation of all systems

- (i) GC shall supervise all implementation activities and shall undertake contract management for Systems which shall include but not be limited to:
 - a) Electrical and mechanical system such as air conditioning, ventilation, firefighting & detection, earthing system of all civil structures, buildings, stations, Depot, RSS/AMS/TSS etc. piping, pumps, auxiliary power distribution, SCADA/BMS system including OCC/BCC, access control system, generators, Elevators Escalators & Travelator and Solar all components related to low voltage power distribution, illumination for the project and tunnel ventilation etc.
 - b) Power Supply & Traction systems etc.
 - c) For Delhi-Panipat-Karnal and Delhi-Bawal Namo Bharat Corridors, procurement, installation & commissioning of Rolling Stock, Catenary & Engineering Maintenance Vehicles (CMV & EMV) and Depot M&Ps shall be through single package. The interfacing required for testing & commissioning of Rolling Stock shall be the responsibility of GC for both the corridors.
 - d) Signaling and Telecommunication, LTE system
 - e) Track design, supply & associated contracts, installation & associated contracts, Noise & Vibration studies related contract & system management. GC shall facilitate smooth handing over of site to O&M and also attend DLP meetings to complete punch points within stipulated time.
 - f) Automatic fare collection system
 - g) Platform screen door
- (ii) GC shall monitor and assist NCRTC in implementation of activities of Architectural works including Finishing & Signages works and Coordinate with site supervision team during construction stage for periodical review of ongoing Architectural works with respect to approved design/drawing, material submissions, method statements, mock-ups and shop drawings. Periodical coordination between Architecture and other services to highlight issues if any and resolve the same in consultation with NCRTC to ensure smooth functioning at construction site.

- (iii) GC shall develop systems and procedures to administer the contracts and ensure that the contractual requirements, with respect to both quality and quantity of work, are respected and the works are executed in accordance with the provisions of the contract. GC shall develop systems to professionally manage the project implementation. In consultation with NCRTC, GC shall make all engineering decisions required for the successful and timely implementation of the contract by ensuring achievement of various key dates and project timelines where GC will act as Engineer.
- (iv) GC shall supervise the contractor's performance on regular basis in consultation with NCRTC, to ensure that Contractors are observing due diligence and prevailing standards in the performance of the assignment in accordance to the contract including but not limited to timely completion of works, quality of materials, execution of work as per approved methodology and work plan, work site safety, project monitoring as per approved work plan, compliance to SHE plan, interface management with other contractors, inspection and acceptance of work, report submission, record keeping, testing and commissioning including integrated testing of work for successful start of commercial operations.
- (v) GC shall undertake regular site visits to ensure contractor's compliance to the required standards, design and requirement specified in the Contract Agreement. GC shall ensure Labour related compliances like License (Validity and Renewal), return filing on government portal, site inspection etc. for all system contracts in consultation with NCRTC.
- (vi) GC shall assist/advise NCRTC timely regarding handing over the site by concerned contractor which they will hand over in stages, in the advance actions required to be taken for the handing over of the site and to achieve the milestones for completion of works.
- (vii) GC shall supervise and certify completion of each activity for installation, testing and commissioning including training provided in the contract of the systems mentioned in Clause 5.8 (i) above in consultation with NCRTC as per the milestones defined by NCRTC.
- (viii) GC shall witness all Request for Inspections (RFIs), request for testing & request for commissioning raised by the contractor and shall provide its approval/comments in a timely manner so that necessary changes are made by contractors in timely manner and the project progress is not hampered. GC shall ensure review and approval of ITP, witnessing Factory Acceptance Tests/ Independent Lab testing, necessary audits, if required, consignee inspection, receipt of materials at site, accountal and issue of materials to works Contractors, (including materials procured through Supply contractors) and proper storage by Works Contractor.
- (ix) GC shall supervise installation, mock-up of all systems including testing of complete system installation as per the various provision in the codes, manuals and instructions and recording of complete testing data and submission of the same to NCRTC. The testing includes indoor testing like functional test, testing of panel with reference to approved locking table, square sheet, break test of circuits. Outdoor testing includes testing of points for obstructions, track circuits voltages, signals, axle counter, block working etc. to ensure safe working. During testing, GC will liaison with concerned statutory authorities/Operator/ISA for any correction/modification, if required in the approved drawing to ensure safety in Train operation.
- (x) GC shall undertake checking, reviewing, certifying accurate measurement of work done for payment, record and verification, certification of bills for above mentioned systems in a timely manner in line with the duration mentioned in the contract agreement of contractor. The distribution of the test checks shall be done in consultation with NCRTC. GC shall review the completeness of the documents required for submission of contractor's payment in line with the contractor's contract agreement. GC shall provide fair and independent view of the verification of contractor's bills. In its determination, the GC may certify full or partial payment, depending on its assessment of the system

contractor's payment request and documentation.

- (xi) GC shall certify, and process issue interim certificates for the progress payment of the Contractors in line with the contract requirements ensuring various recoveries of advances, various securities, liabilities, validity of all insurances as per contract requirement and statutory recoveries. GC shall also process contractor's variations and claims and will submit to the Employer with complete analysis as per contract provisions and recommendations to the Employer for approval.
- (xii) GC shall undertake inspection and certification of all materials/equipment/assets received at the project site against the desired quality, design and specification to meet the project requirement. GC shall supervise and certify all tests as per the various provisions in the codes, manuals and guidelines to ensure successful commissioning of the system in totality. GC shall highlight any discrepancy in the quality, design and specification of the materials/equipment/assets received at the project site to NCRTC in a timely manner.
- (xiii) GC shall undertake regular site visits to monitor and measure the financial and physical progress of systems and report any non-compliance with respect to time and cost to NCRTC so that timely corrective measures can be taken.
- (xiv) GC shall highlight any non-compliance with respect to scope, quality and SHE for the implementation activities of the systems to NCRTC as per the required guidelines/standards
- (xv) GC shall certify any Extension of Time/variation /claims/New rate item/extra item by the system contractors and provide its recommendations to NCRTC along with the justification and required details.
- (xvi) GC shall assist NCRTC in identification of key interface issues/requirements from the civil & system contractors to ensure timely completion of the project.
- (xvii) GC shall issue completion certificate/provisional certificate to the system contractors in consultation with NCRTC
- (xviii) The GC shall prepare and submit a regular report including significant events, if any, on the previous day for systems mentioned in this document. The report shall be sent by e-mail or fax to NCRTC's head office and to the site office. This report will also include any event/happening which is likely to affect the progress, quality of work and safety.
- (xix) GC shall maintain copies of all reference documents, specifications, and drawings including working/as-built/completion drawings, test data, details of variations and other correspondence in a systematic manner so as to ensure that all relevant personnel are equipped with the latest documents and all data is available as and when required by NCRTC.
- (xx) GC has to implement and ensure Custom Duty Exemption Certificates (if applicable) and reconciliation of imported material on SAP/ any other database. GC shall review and certify payments to be made by the client, in accordance with the terms of the corresponding contracts.
- (xxi) GC shall assist and recommend Employer for vendor and sub-Contractor (if applicable) approval as per criteria given in system contract in consultation with Employer.
- (xxii) During currency of this contract, GC shall ensure DLP management of sections commissioned and opened for revenue services for ensuring smooth train operation.
- (xxiii) GC shall exercise such authority, in his capacity as the 'Engineer' defined in all the system contracts subject to the General Consultant having no authority for:
 - a) Amending the 'Contract for Works' awarded to the Contractor.
 - b) Instructing a variation or Approving a proposal for Variation submitted by the

Contractor

- c) Agreeing or determining an extension of time and/or additional cost for any reason.
- d) Issue of Performance Certificate.
- e) Agreeing or determining a new rate/extra item
- f) Relieving the Contractor of his duties, responsibilities and obligations stated in their contract agreements.
- g) Exercising authority for items other than those provided in these Scope of Work and stipulated in the General consultant's contract agreement.
- h) Notwithstanding the obligations, as set out above, to obtain approval, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he may, without relieving the Contractor of any of his duties and responsibility under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Engineer shall determine an addition to the Contract Price if the emergency has not occurred due to contractor's fault, in respect of such instruction, in accordance with provisions of contract.

5.9 Review, Update and Implement Quality Assurance Plan (QAP)

- (i) GC shall prepare a detailed Quality Assurance & Control Plan (QAP) including ITP (Inspection & Test Plan) for all project components (civil & system packages) containing but not limited to:
 - a) Brief on team members along with roles and responsibilities of each personnel of GC and the contractors/suppliers/manufactures/other agencies to meet the desired quality standards
 - b) List of codes/standards/best practices to meet the quality for various project components
 - c) Details of various tests to be carried out as per the provisions of Codes/standards for various project components
 - d) Frequency of tests to be undertaken by various agencies
 - e) Specification of various materials to be used during implementation of the project
 - f) Details/procedure to ensure quality adherence by the contractor which include the procedure of receiving the material at site and procedure for regular third-party quality audits to be carried out by the contractors.
 - g) Quality hold points which will require inspection by GC/NCRTC
 - h) Details and specifications of the site laboratories.
- (ii) GC shall also review and monitor the individual Quality Assurance Plan submitted by the individual contractors/suppliers/others and shall highlight any inconsistency with the overall Quality Assurance Plan to NCRTC along with mitigation measures.
- (iii) GC shall deploy a two-tier quality team for quality assurance. First tier Quality team consisting of Sr. Site Quality Engineer shall be deputed with an implementation team for civil & system works at field level and shall directly report to field HOD. This team shall visit the site of works as directed by the field HOD and conduct the necessary checks with NCRTC site supervision team, where the work is in progress. The team will submit daily report to the field HOD of the inspections/observations carried out during

the day. GC site quality engineers shall point out defects, suggest remedial action and ensure compliance in a timely manner to ensure quality. Any defect pointed out along with remedial action required, shall be rectified by contractor in a time bound manner as decided jointly by GC quality team and NCRTC Dy. HOD.

A second-tier quality team of GC shall conduct audit inspections at periodic intervals and report to GC in charge of quality and to NCRTC corporate office officials. HOD in charge of implementation of project in consultation with HOD in charge of quality at corporate office level shall ensure the quality standards.

GC shall highlight any major non-conformity within a reasonably short time with the corrective action so that timely corrective measures can be undertaken. Report of nonconformity and compliance after corrective measures to be submitted to NCRTC. GC shall monitor all non-conformance reports generated till their closure. NCRTC may separately undertake Quality Audit Inspections, at periodic intervals or as required, through its own personnel or through a third-party.

- (iv) GC shall organize quality assurance/quality control training at reasonable frequency in consultation with NCRTC.
- (v) GC shall coordinate, review, monitor, report and arrange the rectification of the defects occurring during the defect liability period of Construction and System contracts. GC shall prepare Audit plans, Project Quality Risk Register (as per ISO) and mitigation plan, Inspection plans, Reports (daily/weekly/monthly/annual) on any platform (physical/digital or both), formats, checklists, work methodology (if required) etc. and their implementation in the entire project as per the Employer's requirement.
- (vi) GC shall review and monitor the implementation of Quality plans, ITPs (inspection & test plan), work methodologies and standard operating procedures of the Contractors, regularly.
- (vii) GC shall prepare & establish standard quality assurance procedures (SQPs) & tools for Quality assurance and control in line with project specifications, standards, and ISO 9001 for all the departments.
- (viii) GC shall review, assist, approve and coordinate for CMRS compliances / documents related to the quality for the project.
- (ix) GC shall prepare presentations and assist Employer to prepare presentations related to technical documents for civil and system works, project quality assurance / quality control / quality excellence etc.
- (x) GC shall provide trainings on the topics as required/defined by the Employer, to all the stake holders as per the requirement of Employer.
- (xi) GC shall conduct inspection/s of works against the compliance/s submitted by contractor to ensure the proper closure of NCN/NCR/Observation (i.e. to ensure quality work at site after the rectifications of non-compliance as raised in NCN/NCR/Observation) as per set procedure.
- (xii) GC shall schedule and attend visits/inspections, meetings related to quality of the project at any platform/place as instructed by the Employer. GC shall prepare detailed report of the visit/inspection and also the minutes of all the meetings.
- (xiii) GC shall attend factory inspections, site inspections, laboratory and other inspections, wherever required in India or abroad, as instructed by the Employer, to ensure the quality standards.
- (xiv) GC shall conduct comprehensive audit/s of works as and when required by the Employer to ensure the quality standards of the material, process and product to the desired levels of the specification.

5.10 Review, Update and Implement Safety, Health and Environment (SHE)

Plan

- (i) GC shall review, update and implement Employer's Requirements on Safety, Health & Environment (SHE) for overall project components.
- (ii) GC shall review and monitor the individual SHE and Environmental Plans submitted by contractors/suppliers/others and shall highlight any inconsistencies with the overall SHE Plan to NCRTC. GC shall also provide mitigation measures.
- (iii) GC shall deploy a two-tier safety team for safety assurance. First tier safety team consisting of Sr. Site safety Engineer shall be deputed with an implementation team for civil & system works at field level and shall directly report to field HOD. This team shall visit the site of works as directed by the field HOD and conduct the necessary checks with NCRTC site supervision team, where the work is in progress. The team will submit daily report to the field HOD of the inspections/observations carried out during the day. GC site safety engineers shall point out safety lapses, suggest remedial action and ensure compliance in a timely manner to ensure safety. Any lapses pointed out along with remedial action required, shall be rectified by contractor in a time bound manner as decided jointly by GC safety team and NCRTC Dy. HOD.
- (iv) A second-tier safety team of GC shall conduct audit inspections at periodic intervals and report to GC in charge of safety and to NCRTC corporate office officials. HOD in charge of implementation of project in consultation with HOD in charge of safety at corporate office level shall ensure the safety standards.
- (v) GC shall highlight any major non-conformity within a reasonably short time with the corrective action so that timely corrective measures can be undertaken. Report of nonconformity and compliance after corrective measures to be submitted to NCRTC. GC shall monitor all non-conformance reports generated till their closure. NCRTC may separately undertake safety Audit Inspections, at periodic intervals or as required, through its own personnel or through a third-party.
- (vi) GC shall organize SHE training sessions once in a month at each CPM (Chief Project Manager) office of NCRTC and at reasonable frequency in consultation with NCRTC.
- (vii) GC shall assist NCRTC in creating a decent working environment for construction workers and help implement the action plan for labour protection. This includes programs for HIV/AIDS and COVID-19 prevention for construction workers.
- (viii) GC shall conduct regular inspections of contractor plant sites and labour camps to ensure compliance with the applicable guidelines and contract conditions. Any non-compliance shall be reported to NCRTC.
- (ix) GC shall conduct site visits, submit non-conformance reports/safety report at reasonable frequency in consultation with NCRTC. However, GC shall highlight any major nonconformity within reasonably short time period so that timely corrective measures can be undertaken. GC shall monitor all non-conformance reports generated till their closure.
- (x) GC shall conduct regular visits to the contractor's plant and facilities including labour's camps to ensure compliance as per relevant guidelines and conditions of the relevant contract. GC shall bring to the notice of NCRTC any non-compliance on this aspect.
- (xi) GC shall ensure the compliance by Contractors regarding all Labour Laws, Labour Returns, BOCW (Building & Other Construction Works), etc. as per relevant guidelines and conditions of the relevant contract. GC shall update NCRTC on regular basis in this aspect.
- (xii) GC shall review documents like method statement, SHE plans, Procedures, Monthly Safety Report and any other document submitted by the contractor in consultation with NCRTC and comments of the same be submitted to NCRTC corporate safety head.
- (xiii) GC shall independently investigate all incidents that occurred at site and submit the report to the NCRTC corporate safety head. Report shall include finding,

recommendation to avoid failure in future, corrective and preventive action. In addition, it should be presented in PPT format in all CPM/Field HOD offices of NCRTC.

- (xiv) GC shall prepare documents like Safety Alerts, Standard Operating Procedures, Formats, Checklists, HIRA etc.
- (xv) GC shall prepare consolidated quarterly safety report for all contractors and submit it to NCRTC corporate safety head.
- (xvi) GC shall prepare Monthly/as and when required Presentation before NCRTC Management on various Safety and Environment issues being faced in the project at that time.
- (xvii) To monitor effective implementation of Employer Requirement on Safety, Health and Environment in every aspect during the entire currency of all contracts including System contracts.

5.11 Testing, Trials, Statutory Approvals and Commissioning

- (i) Inspection and Testing
 - a) GC shall proof check Manufacturing Quality Plan (MQP), testing and commissioning plans submitted and formats by contractors/vendors etc. as per latest relevant standards. Licensed version of all the relevant Standards for view and download shall be available with GC.
 - b) GC shall attend inspection/testing on behalf of NCRTC for various quality hold points. GC shall also undertake Factory Acceptance Tests and Site Acceptance Tests and submit all the reports to NCRTC.
 - c) GC shall proof check results of inspection/testing and commissioning including routine/prototype tests and system tests in accordance with latest relevant standards, submit reports and advise NCRTC on the final acceptance of the system.
- (ii) Integrated Testing and Commissioning along with trial runs and statutory approvals
 - a) The sections intended to be opened for traffic will require requisite trial tests.
 - b) The GC shall prepare integrated testing and commissioning/trial scheme including schedule as per the statutory and system requirements to verify/authenticate suitability and adequacy of the system.
 - c) The GC shall enable NCRTC, giving all necessary assistance, to conduct the integrated tests/trials. Any shortfalls noticed during the tests/trials will be arranged to be rectified by the GC through the contractors/suppliers. In order that the deficiencies are limited to the minimum, the design and construction of the project should take due consideration of the requirements under the relevant laws for opening of Namo Bharat system with design speed for the public carriage of passengers.
 - d) The GC shall assist and prepare all documents with all necessary details/information on behalf of NCRTC to be furnished to the DOT-RE/PTCC/EIG/ISA/CMRS/Railway Board/DFS/Haryana Fire Services/other Statutory Authorities in connection with the section to be opened to traffic. All relevant information as required to be furnished to the CMRS/ Railway Board/DFS/Haryana Fire Services/other Statutory Authorities/Agencies in connection with the section to be opened to traffic shall be furnished by GC to NCRTC.
 - e) The GC shall assist NCRTC in apprising CMRS/Railway Board/DFS/Haryana Fire Services/other Statutory Authorities/Agencies during the design stage and construction stage to obtain all necessary intermediate approvals as well as

certification from the CMRS/Railway Board/DFS/Haryana and Rajasthan Fire Services/other Statutory Authorities/Agencies for successful opening of the section(s) to traffic for commercial operations.

5.12 Proof Checking

The GC shall proof check all the technical submittals including but not be limited to Design Documents, Drawings, Method statement for construction works, Technical Proposals, Vendor Proposals and Specifications submitted by Detailed Design Consultant/Simulation Consultant/Contractors during the Procurement Stage and Construction Stage in a timely manner in line with the duration mentioned in the respective contracts.

- (i) The scope of Proof checking is briefly listed below but not limited to the same which would include all items required for commissioning the project:
 - (a) For all Build only/ Part design & build contracts/Design & built contract for Viaduct, Stations (Elevated, at-grade and Underground), Underground tunnel, Depot, architectural design and finishing etc. and all systems as per scope of work.
 - (b) General consultant shall be responsible for the review and approval of design and drawings of all stages but not limited to – All structural elements of station, viaduct, underground station, tunnel, ramps, depot, drainage arrangement, roads, subways, utility diversions, STP, retaining wall, Sheds, railing, cable trays, crash barrier, view barrier, steel structure, bearing, method statements, repair methodology, building, all miscellaneous items related to implementation of project etc.
 - (c) For Part Design And Built/Build Only/ Design and Built Contract, GC shall proof check and approve analysis, design, drawings for all stages (preliminary, definitive, working, Good for construction (GFCs), shop drawings, and related other documents such as method statement, launching/erection schemes, work procedure, inspection & test procedure, specifications and any other information, etc. to ensure that material and level of quality standards assumed in design are being ensured during construction or vice-versa to validate the design (if required) provided by the Contractor/Consultant to ensure that submittals are complete in all aspects such as proper format, sufficient details of required extent, size and scale and within such timelines as may be required to ensure effective execution of Works and/or as otherwise required by the Employer.
 - (d) All design calculation done by GC during proof checking of structural design and drawing shall be submitted to NCRTC in soft copies i.e. Excel Sheets (unprotected & editable), Design Model Files etc. GC shall also assist in obtaining design approval / proof check from IIT or any other technical institutions
 - (e) For design & build contracts GC shall proof check the design and drawings and all other submissions submitted by the contractor and suggest necessary changes/improvements/value additions and submit the proposal to Employer and for system contracts GC shall also convey requisite response to the contractor.
 - (f) In addition, GC shall validate changes in design and drawing of standard superstructure proposed by the contractor during construction considering changes due to site constraints on case-to-case basis.
 - (g) For standard superstructure, GC shall ensure that additional load on account of launching girder / launching scheme is within the permissible loads considered in the design of permanent structures. However, if the contractor proposes to use launching girder / launching scheme which will require change in design of permanent structures, such design shall be approved/validated by the GC with the undertaking from the contractor that additional cost of design and

construction of permanent structures shall be borne by the contractor.

- (h) GC shall proof check for Track Design which shall include analysis, design, drawings & other submittals of Track Systems including preliminary & detailed design, Good for construction (GFCs), shop drawings, Bar Bending Schedule (BBS) etc. GC shall monitor Track related supplies including finalizing 3rd party agencies for pre-dispatch inspections or witness pre-dispatch inspections/tests, witness tests in labs and provide approvals. Scope of work shall also include review and approval of other documents such as method statement, work procedure, inspection & test procedure, specifications and any other information, etc. to ensure that material and level of quality standards assumed in design are being ensured during construction or vice-versa. Sufficient details of required extent, size and scale and within such timelines as may be required to ensure effective execution of Works and/or as otherwise required by the Employer.
- (i) The GC shall review BIM models / the 'As-Built' drawings for each component of the works as per AMS requirement, prepared by the contractors/suppliers/manufacturers and determine their acceptability under the terms of the relevant contracts.
- (j) The GC shall also submit the inspection report on the structure for further submission to Metro Railway Safety for its safe operations. Also, GC shall convey remedial measures and approve the repair methodology submitted by the contractor.
- (k) To review and approve the procedure for different types of testing and test results.
- (l) Review and approval of various design documents, drawings, operational plans submitted by contractor/consultant for Tunnel Ventilation System and TVS SCADA of the underground section of the corridor required for implementation and commissioning of the project.
- (m) GC shall ensure that there should not be any deviation in design and drawing submitted by contractor with respect to tender drawings/BOQ. Any deviation shall be the responsibility of GC, unless proved otherwise, and be informed to the employer prior to approval of the same.
- (n) GC shall proof check any design, drawing, or document related to the commissioning of the project, as provided by any agency, whenever required by Employer.
- (o) GC shall ensure that all the contractual (Technical as well as non-technical) requirements are met by the contractors and notify Employer on monthly basis or earlier (as required).
- (p) Any other relevant tasks.
- (ii) The GC shall initiate in consultation with NCRTC, and actively pursue and involve itself in all investigations and enquiries, consultations, studies, collection and compliance with pertinent information and data, convening of and attendance at meetings with DDCs/Contractors, and in any other activities related to detailed design and drawings to be produced by DDCs/Contractors, as are or may be necessary for the project.
- (iii) The comments of the consultant on the design/drawings submitted by the DDC shall be supported by sound technical reasoning in accordance with relevant codes/standards.
- (iv) **Time Schedule**

The GC is required to check and advise comments in one go to the designer, if any, within 10 (Ten) days of the submission of the designs/drawings. In case there are no comments on the designs/drawings, GC shall forward these designs/drawings to NCRTC with its certification regarding proof checking for according final approval. In case of observations made by the consultant on the Design and Drawings of the

Designer, on receipt of the design/drawings from the designer incorporating the comments, the designer shall forward these design/drawings to NCRTC with its certification regarding proof checking within 7 (Seven) days of the receipt of designs/drawings from the designer.

(v) **Standard of Services**

(a) General

The GC shall be responsible for the correctness and technical merit of the services provided in proof checking. GC shall ensure that qualified and experienced professionals are employed in sufficient number and that the proof checking is done in timely manner. GC shall comply with the provisions and procedures covering standards and codes, drawings and calculations.

(b) Standards and Codes

The GC shall use the updated versions of prevailing Indian/ international standards and codes for the proof checking services. Copies of these codes shall be available in the GC's office.

(c) Computer Programs

The GC shall submit details and verification of all computer programs it intends to use in checking of the designs. The GC may also be required to perform test calculations using the program so that the results may be compared with those obtained by other means.

(vi) **Checking Procedures**

(a) General: The GC shall establish a Quality Assurance Plan (QAP) and a system of proof checking and certification /approval of all designs, including calculations, drawings and other documents submitted by the designer.

(b) Design Calculations: Each calculation, including any amendments thereto, shall be endorsed as checked and approved prior to issuing to the NCRTC by being signed and dated by both the originator and the checker. Hand-written signature of Authorised personnel will be borne on cover sheet of each design calculation/ Drawings.

(c) Design Review Sheet (DRS): The GC shall provide their comments in design review sheet after review of each design calculation

(d) Drawings and Documents: Each document and drawing, including any revisions thereto, shall be endorsed as checked and approved prior to sending it to NCRTC by being initialed and dated by both originator and checker. In addition to compliance with the requirements of the documentation, each drawing, where appropriate, shall be checked to ensure compliance with the GC's certified design calculations. The GC shall evolve a procedure for traceability of design/drawings including revisions.

(e) Certification: A certificate signed by the Team leader of the GC stating that all drawings and documents have been checked and approved in accordance with the GC's approved Q.A. Plan shall accompany all documents and drawings issued by the GC to the NCRTC for acceptance. The person checking the design and drawing will initial all documents prepared by him. Certification that such a check has been carried out shall be issued to the NCRTC.

(f) Endorsement of Design Calculations: All calculations, including any amendments thereto, shall be endorsed as checked and approved prior to issuing to the Employer/Employer's Representative, being initialed and dated by both the originator, and the proof checker/s. All the signatures on the cover sheet of authorised personnel including the proof checker shall be original handwritten signature.

- (g) Calculations shall be prepared according to the best professional standards and practices compiled into sets that relate to particular aspects of design
1. A brief description of the structure and its assumed mode of action;
 2. The loads that will act upon the structure;
 3. The allowable stresses of the structure;
 4. A brief statement description of the method of analysis used;
 5. A brief statement description of the method of design;
 6. Details of the computer program used;
 7. A key to symbols used: and
 8. A design summary.
- (h) Quality Assurance Plan
1. QAP shall be submitted to Employer/Employer's Representative for approval. The QAP shall identify the personnel, procedures, instructions, records and forms necessary to implement the plan with the following minimum requirements:
 - Certification process of drawings and documents for issue;
 - Organisational structure;
 - Design control - including study and design input/analysis;
 - Checking of documents;
 - Document control;
 - Internal quality audit; and
 - Corrective action.
 2. The GC shall also identify the requirement of Quality Level and incorporate a Quality Level List in the QAP for each construction contract.
 3. The procedures to be applied to manage and control the quality of the design work, with particular reference to the following:
 4. The design and performance requirements which shall be defined in terms of basic data and design assumptions made; relevant codes, standards and regulatory requirements; safety, security and environmental requirements; and commissioning requirements;
 5. The design methods. Software applications to be used in the design, both proprietary and public domain, shall be identified and any requirements for physical and mathematical model testing;
 6. The preparation, checking, issue, distribution, indexing and filing reports, calculations, drawings and specifications along with the means of their revisions;
 7. The formal design review, authorization and approval of design documentation;
 8. The design verification and validation;
 9. The design checks by the Design Checker; and
 10. List of examples of the forms and formats to be used to record the activities under the Design Plan shall be attached at the end of each section or a reference included to existing standard procedures.

(i) Quality Audits/Monitoring

Quality Audits and monitoring of the GC's QAP will be conducted by Employer/ Employer's Representative at intervals commensurate with the GC's activities. Corresponding costs shall not be borne by the GC.

(j) Responsibility

Notwithstanding acceptance by the NCRTC, the GC shall remain responsible for the quality and correctness of the documents submitted by the GC.

(vii) Period for giving 'No Objection' by the Employer

The employer shall accord No Objection or send comments for the designs /drawings submitted by the GC after deliberations along with NCRTC officers within ten working days from the date of receipt of these documents.

(viii) Interaction with The Employer/ stakeholders

(a) During entire period of services, the GC shall assist Employer/ Employer's representative and provide any clarification regarding methods being followed and carryout modification as suggested by the employer/stakeholders.

(b) The Employer and other Government officers may visit the site at any time, individually or collectively to acquaint themselves with the site. GC representative shall be present to clarify, if required.

(ix) Services to be performed by the GC during construction phase:

(a) Any design modification during construction shall be proof checked by the GC.

(b) The GC shall endorse the submissions required under the Contract that all effects of the design comprising the submission on the design of adjacent or other parts of the works have been fully taken into account in the design of these parts.

(c) The GC shall check design modifications of the existing drawings (within 03 days upon request from the designer/ Employer and Employer's Representative).

(x) Design Document Submission Requirements

(a) The GC shall maintain records showing design calculation and data supporting design review activities. The Employer reserves the right to inspect and audit these documents at any time to verify the effectiveness of design reviews.

(b) The GC shall deliver all the drawings and documents produced/prepared in connection with this contract. They will be packaged as directed by the Employer/Employer's Representative.

5.13 Deficiencies of services

Deficiencies on part of the GC should be made good by the GC without any cost and time implications to the Employer to ensure smooth implementation of the project (including Rolling Stock related work for Delhi-Bawal corridor). Deficiencies may include but not limited to:

(a) Not performing the Services as per the Contract for GC Services, undue delay in disposing of submission, indulging in non-exclusive (moon light), corrupt, fraudulent and coercive practices.

(b) Not acting impartially or acting in collusion with the contractor

(c) Failure to give proper and timely advice to the Employer or the contractor to enable correction during execution

(d) Lack of proper coordination with the Employer and the contractor to ensure smooth implementation of the Project

(e) If any substandard work not meeting the specifications has been accepted and

certified for payment to contractor is later detected by Employer or any statutory/ administrative authority, it shall be the responsibility of the GC to get it rectified/ reconstructed at contractor's cost. However, Rs. 2.0 lakh per occasion for accepting such defective work shall be recovered from the GC for deficiency in services.

- (f) If the Employer is satisfied with the non-performance of any obligation/provision as stipulated in the Terms of Reference OR non-compliance of any of the provisions of the contract, a deduction of Rs. 25,000/- shall be applicable for each instance of non-performance/non-compliance. Notwithstanding anything contained above, the GC must ensure to perform/take corrective action on the particular non-performance/non-compliance in a reasonable time frame.
- (g) If at any stage, it is detected that the GC/GC's personnel have/has indulged/done any wrong measurements or accepted sub-standard work, resulting in over-payment to the contractor, the recovery of such excess amount shall be made from the works contractor from the next running bill of the contractor and in case the GC fails to recover the excess amount the same shall be recovered from the GC. Further, if it is detected that any such act has been committed willfully, the concerned personnel of GC shall be removed immediately from the project and he/she shall be debarred to work in any assignment of NCRTC.
- (h) Failure in adhering to the timelines mentioned for Proof Checking in para 5.12 (iv) of this ToR, shall entitle the Employer to a deduction of Rs 5,000/- per day of delay per submittal (set of one or more design and drawings or documents submitted together) or part thereof.
- (i) Failure in adhering to the timelines for making submissions of key deliverables mentioned in clause 8 of this ToR, shall entitle the Employer to a deduction of LD as mentioned therein.
- (j) Notwithstanding anything contained above, the Employer may initiate proceedings for declaring the GC "Poor Performer/Banning of Business Dealings" for the default(s)/failure(s) noted of the GC in performance of their assignment depending upon the gravity/frequency of the default/failure.

No additional claim of the GC for making the deficiencies good shall be admissible. In case of non-compliance of such deficiencies action may be taken by the Employer under relevant clauses of the contract.

5.14 Site Meetings

The Experts assigned for proof checking other than the Experts paid on man-month basis in case of 3rd party proof checking to avoid conflict of interest shall attend site meetings physically / through VC as and when required by the Employer/ Employer's representative, during the design stage and construction phase.

5.15 Monthly report

The GC will, not later than the 10th of each month, should submit monthly report summarizing the status of all the designs including design modifications/ field changes, manpower status, plant & machinery status, material status, physical & financial progress of work, Interface issues and their resolutions, defects & Deficiency and its rectification, report on safety & any other relevant issues to the Employer/ Employer's Representative during the preceding month. The report will also outline any design related technical problems encountered during construction, rectification and repair works methodology related to structures, GC's minutes of meetings (site, interface, etc.) and GC's recommendations on how these problems may be overcome.

5.16 Duties and Responsibilities of General Consultant

- (i) The GC shall initiate the design works, in consultation with Employer/ Employer's representative, and actively pursue and involve itself in all investigations and enquiries,

consultations, studies, and compliance with pertinent information and data, convening of and attendance at design meetings, and in any other activities as are or may be necessary for producing the detailed design, drawings and documents to the specified requirements.

- (ii) The GC shall carry out the Services in accordance with best industry practices, in compliance with the provisions of the Agreement.
- (iii) The GC as a professional and experienced GC providing full consultancy services, shall accept full responsibility for the correctness and technical merit of the services performed.
- (iv) The GC is totally responsible for the accuracy, correctness and technical merits of all approved design and drawings issued for construction. If any mistakes or omissions are found during the execution, the GC will be held responsible and will rectify these mistakes or omissions, such rectification shall not be considered as additional services requested by employer. Any approval of the drawings by the Employer shall not hold the Employer responsible for any lapses or mistakes and the GC shall be wholly responsible for the same.
- (v) General consultant shall ensure all system wide/architectural requirement in approved design and drawings

5.17 Software Support

- (i) The GC shall use licensed version of software for carrying out the work as stipulated in scope of work. GC shall indemnify the Employer against any damage, expense, liability, loss or claim in this regard. GC shall also provide eight nodes/licenses of all software valid for full duration of contract to the employer.
- (ii) Computer Programs: The GC shall submit details of all computer programs and tools it intends to use during proof checking process. The GC may also be required to perform test calculations using the program so that the results may be compared with those obtained by other means.
- (iii) The GC shall submit a software support plan immediately after award of work but before commencement of software installation. The GC shall submit the soft copies of each work (2D-3D) in the desired format and facilitate the employer for easy accessibility of the soft copies.

5.18 Building Information Modelling (BIM)

GC to institutionalize the use of the BIM processes and solutions to use the same as mainstay during design and construction phase and subsequently in operation and maintenance with no change in the platforms envisaged.

It will focus on ease of coordination between different construction documents, clash detection and conflict resolution during construction, ability to link different models, schedules and construction sequencing, cost estimation/ monitoring to produce, manage and maintain data and information about the assets which can be used for operational purpose in future.

All information shall be defined in the MIDP and shall be submitted to NCRTC on CDE in order to provide required level of assurance accordance with Employer's Requirements in following stages:

1. Initiation
2. Concept Design
3. Preliminary Design
4. Detailed Design
5. Construction / Installation

6. Hand over
7. Operation and Maintenance

The BIM shall include activities involving:

1. Preparation & Updation of BIM Documents
 - a. Employer's Information Requirements (EIR) – Item Rate
 - b. Employer's Information Requirements (EIR) - EPC & DnB
 - c. CAD / BIM Standards
 - d. Data Codification Management
 - e. Codification Tables
 - f. BIM Execution Plan (BEP) Template
 - g. Task Information Delivery Plan (TIDP) Template
 - h. Master Information Delivery Plan (MIDP) Template
 - i. Asset Information Requirements (AIR)
 - j. Organization Information Requirements (OIR)
 - k. Level of Definition (LOD)
 - l. Level of Geometry (LOG) Matrix
 - m. Level of Information (LOI) Matrix
 - n. Submission Procedure
 - o. CAD & Revit Templates
 - p. BIM Implementation Plan (BIP) – BIM Road Map
2. Model Review as per Standards & Check lists.
3. All Bid documents to ensure desired implementation of BIM in consultation with NCRTC
4. A detailed review and recommendation regarding Intellectual property right (IPR), copyright and ownership of BIM Data.
5. Recommendations and guidelines regarding design liabilities, duty of care and responsibilities of all key stake holders working in a collaborative BIM environment
6. Assist NCRTC in BIM presentations to be made to the Ministries/statutory approving authorities/ other stake holders as per requirement.
7. Defining communication protocol between various stakeholders.
8. Linking approvals of BIM models and 2D Extraction, in order to maintain and ensure getting BIM models.
9. Collaboration/ Interface procedures between various stakeholders involved including system integration.
10. The end-state requirements such as integrated as-built BIM models as per Asset Management System/ O&M etc.

The EIR of NCRTC for Building Information Modelling is attached as **Annexure-6.5** for reference only.

5.19 Multi Modal Transport Integration (MMI)

- (i) The detailed planning of MMI is to be carried out by DDC/Contractors. GC shall ensure that MMI should be detailed enough to have minimum inconvenience to the Namoo Bharat users taking into account the last mile connectivity.
- (ii) GC shall Ensure that the Architectural, Structural, Building Information Modelling and Multi Modal Integration requirements of the project are complied with.

6. Obligations of the General Consultant

- (i) The General Consultant (GC) shall consistently exercise due diligence, care, and professional expertise in the performance of their duties. The GC shall be responsible for ensuring the accuracy, quality, and completeness of works, including the successful commissioning of Delhi–Panipat–Karnal Namoo Bharat Corridor (including Rolling stock works on Delhi-Bawal Namoo Bharat corridor).
- (ii) The GC shall ensure that all goods and services used in the project are appropriate, cost-effective, and in compliance with the required specifications. The selected specifications must not restrict competition or limit the scope of competitive bidding. The GC must remain objective and impartial in fulfilling their responsibilities.
- (iii) The GC shall carry out all services in close coordination with NCRTC, ensuring alignment with the Employer's objectives and procedures.
- (iv) The GC is required to maintain complete and accurate records of all project-related activities. These records must be made accessible to NCRTC for review at any time. Acceptance of these records by NCRTC does not absolve the GC of their professional duty to rectify any errors at their own expense.
- (v) All project-related documentation, including plans, reports, drawings, specifications, and digital data, shall be treated as confidential by the GC. These materials must not be shared with third parties without NCRTC's written consent. Upon project completion, all such documents shall become the property of NCRTC. However, the GC may retain copies for internal reference.

7. Staffing Requirement of GC**(i) Indicative Deployment**

Requirements of deployment details of International Experts, National/Local Experts & Non-Key Experts are provided in:

- Annexure-6.6 (Man-months of Key Experts - International)
- Annexure-6.7 (Man-months of Key Experts – National/Local)
- Annexure-6.8 (Man-months of Non-Key Experts)
- Annexure-6.9 (Minimum Qualification and Experience of Key Experts)
- Annexure-6.10 (Roles and responsibilities of Key Experts)
- Annexure-6.11 (Minimum Qualification and Experience of Non-Key Experts)
- Annexure-6.12 (Tentative deployment schedule for Key Experts)

(ii) Miscellaneous Cost:

Please refer Part III, Section 8: Additional Clause 18 for Miscellaneous Costs (Schedule-E of BoQ).

8. Key Dates and Deliverables/Milestone

The General Consultant (GC) shall be responsible for submitting the following reports/documents/designs etc. (Unless otherwise specified, 06 bound hard copies along with a soft copy).

The General Consultant (GC) shall plan deployment of Key-Experts so as to achieve key dates of various activities on time and as per the key dates (milestones) indicated below with respect to D: (Here, D is the Date of Commencement).

I. For finalization of Technical Parameters for future Namu Bharat (RRTS) Corridors (under lumpsum component quoted in Schedule-A of BoQ)

Table-5: Key dates and Liquidated damages to be levied for delay in finalization of Technical Parameters for future Namu Bharat (RRTS) Corridors

Key Date	Deliverables / Milestone	Activity Completion Date in days	LD to be imposed for delay
KD-1	Submission of Inception Report	D+ 7	0.05% of Schedule-A of BoQ (Lump-sum component) of accepted contract amount as per LOA per day of delay for the Key-date
KD-2	Submission of Design of Kinematic envelope*	D+ 45	0.05% of Schedule-A of BoQ (Lump-sum component) of accepted contract amount as per LOA per day of delay for the Key-date
KD-3	a. Fixing of parameters of all system components (Track, OHE, walkway etc.) including submission of drawing for internal tunnel cross section.** b. Aerodynamic simulation for critical section (Stage-I)** c. Type & width of Viaduct	a, b & c: D+ 90	0.05% of Schedule-A of BoQ (Lump-sum component) of accepted contract amount as per LOA per day of delay for the Key-date
KD-4	Submission of final report with annexures on system selection & technical parameters	D+105	0.05% of Schedule-A of BoQ (Lump-sum component) of accepted contract amount as per LOA per day of delay for the Key-date
KD-5	Submission of SOD & DBR	D+ 120	0.05% of Schedule-A of BoQ (Lump-sum component) of accepted contract amount as per LOA per day of delay for the Key-date
KD-6	Design and drawings of shortlisted viaduct with proof checking	D+135	0.05% of Schedule-A of BoQ (Lump-sum component) of accepted contract amount as per LOA per day of delay for the Key-date
KD-7	Submission of Aerodynamic Simulation study for the entire underground sections of (a) Delhi-Bawal corridor (~38 km) and (b) Delhi-Karnal Corridor (~11.48 km) to finalize locations and number of ventilation shafts in these Namu Bharat corridors as detailed in scope of work (Stage-II)	D+ 180	0.05% of Schedule-A of BoQ (Lump-sum component) of accepted contract amount as per LOA per day of delay for the Key-date

Note for Table-5:

1. Approval of KE* by NCRTC shall be given in 15 days
2. Total time of the completion of the consultancy work is **180 days** excluding the time of the final approval of the SOD & DBR from RDSO.
3. The Employer shall endeavour to provide approval / comments to the Consultant's submissions for each of the milestones at the earliest and not exceeding **10 days** from the date of the submission provided the submission by the Consultant is complete in all respects.
4. If KD-4 is achieved on time, then any LD imposed on KD-1, 2 and 3 shall be waived off. If KD-7 is achieved on time, then any LD imposed on KD-5 to KD-6 shall be waived off.
5. Consultant shall obtain the in-principle approval from the concerned department within the above mentioned time period for each stage. However, final Approval of the reports (submitted by the consultant) by the competent authority at different stages may take considerable time which shall not be counted in the period of days mentioned in the above table.

II. For implementation of Delhi-Karnal Namo Bharat Corridor including Rolling Stock for Delhi-Bawal Corridor (Schedule-B, C, D & E of BoQ)

Table 6: Key dates and Liquidated damages to be levied for delay in implementation of Delhi-Karnal Namo Bharat Corridor including Rolling Stock for Delhi-Bawal Corridor

Key Date	Deliverables/ Reports to be submitted	Activity Completion Date	LD to be imposed for delay
1.	Inception Report	D+ 90 days	0.001% of Schedule-B, C, D & E of BoQ of accepted contract amount as per LOA per week or part thereof of delay for the Key-date
2.	Project Schedule Management as per sub-para 5.2 (B) under Para 5. II above	D+ 90 days	0.001% of Schedule-B, C, D & E of BoQ of accepted contract amount as per LOA per week or part thereof of delay for the Key-date
3.	Building Information Modelling (BIM) implementation Plan	D+ 90 days	0.001% of Schedule-B, C, D & E of BoQ of accepted contract amount as per LOA per week or part thereof of delay for the Key-date
4.	Submission of "Concept Design" with Design Alternatives on BIM and Concept Design Report as per scope of work for: a. Alignment plan and profile* b. 1 st UG package with associated E&M package*	D+ 150 Days	0.02% of Schedule-B, C, D & E of BoQ of accepted contract amount as per LOA per week or part thereof of delay for the Key-date
5.	Submission of "Concept Design" with Design Alternatives on BIM and Concept Design Report as per scope of work for:	D+ 210 Days	0.02% of Schedule-B, C, D & E of BoQ of accepted contract amount as per LOA per week or part

Key Date	Deliverables/ Reports to be submitted	Activity Completion Date	LD to be imposed for delay
	1 st Elevated packages with associated E&M package*		thereof of delay for the Key-date
6.	Submission of Preliminary design and drawings based on approved concept design (for 1 st UG package with associated E&M package) as per scope of work *	D+ 210 Days	0.001% of Schedule-B, C, D & E of BoQ of accepted contract amount as per LOA per week or part thereof of delay for the Key-date
7.	Submission of Preliminary design and drawings based on approved concept design (for 1 st Elevated packages with associated E&M package) as per scope of work *	D+ 270 Days	0.001% of Schedule-B, C, D & E of BoQ of accepted contract amount as per LOA per week or part thereof of delay for the Key-date
8.	Submission of Employer's requirement, tender drawings, BOQ, Estimates and Specifications as per scope of work for: a. 1 st UG package with associated E&M package b. 1 st Elevated packages with associated E&M package	a. D+ 240 Days b. D+ 300 Days	0.02% of Schedule-B, C, D & E of BoQ of accepted contract amount as per LOA per week or part thereof of delay for the Key-date
7.	Final Report – To be submitted by GC to the Employer. It shall include completion drawings, completion statements, contractors' disputes/claims, and other relevant matters. It should also include a compliance report containing clause-by-clause compliance, clearly indicating conformity against each requirement specified in the TOR.	Within 120 days or 01 month of the receipt of Completion statement by the contractor, whichever is earlier.	0.001% of Schedule-B, C, D & E of BoQ of accepted contract amount as per LOA per week or part thereof of delay for the Key-date

Note:

- * - Approval by Employer in 15 days.
- # - If KD-6 is achieved in time, then any LD imposed on KD-3, 4 and 5 shall be waived off.

9. Communication Management

The GC shall develop and implement a comprehensive Program Communication Plan that includes the following key components:

- Procedures and flowcharts outlining the roles and responsibilities of all project participants—including but not limited to the Employer, contractors, suppliers, and other stakeholders.
- Clear guidelines for the delivery and distribution of various forms of information and communications to the relevant project stakeholders.
- Defined contractual and functional communication protocols to ensure that the Employer is consistently represented in all communications between the GC and other project participants. This includes active participation in project schedule status review meetings and other relevant discussions at all levels.

10. Digital Platform for Project Management

The GC shall be responsible for adopting and implementing the digital platform chosen by NCRTC for comprehensive project management. This platform shall be used to undertake the planning, monitor, and report all project-related activities as directed by the Employer.

11. Duration of the Consultancy Services

The duration of the consultancy services shall be 56 months, ending with the completion of all services envisaged to be provided by the GC. The duration may be extended if required, to complete the services as per Contract provisions.