

INSTRUCTIONS FOR COMPLETING THE PRICING DOCUMENT

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1. General Requirement

- 1.1. The Contractor's attention is drawn to the General Conditions of Contract, Special Conditions of Contract, Employer's Requirements (General Specifications and Technical Specifications) and Tender Drawings, which are to be read in conjunction with this document. These Instructions shall serve as a guide to the measurement of quantities and payment.
- 1.2. This Part of the Contract is a fixed Lump Sum Price Contract for "Design, Supply, Installation, Testing & Commissioning of Receiving cum Auxiliary Main Sub Stations Including High Voltage Cabling from Grid Substations, 750 Volts DC 3rd Rail Traction System, 33kV Cable Network, ASS, TSS & SCADA System for East West Corridor (Phase- 1 B) of Lucknow Metro Rail Project at Lucknow, Uttar Pradesh, India."
- 1.3. Scope of work is detailed in Chapter-2 of ERTS, however the fixed Lump Sum Price quoted shall cover all scope given in General Conditions of Contract (GCC), Special Conditions of Contract (SCC), Employer's Requirements (General Specifications and Technical Specifications) and Tender Drawings.

2. Apportionment of Fixed Lump Sum Price to Bill and to Milestones under each Bill

- a. The whole of works including design, supply, erection/ installation, testing & commissioning is divided into bills, primarily on nature of work basis. Each bill is divided into the various items; each item further divided into various milestones activities (i.e. design & supply, Erection/Installation and Testing & Commissioning) according to their general scope of work.

Contractor may raise Interim Payment Certificate (IPC) on completion of each milestone activity i.e., supply or Erection / Installation or Testing & Commissioning
- b. The fixed Lump Sum price for the whole of Works shall be apportioned by the Tenderer among the various milestones activities, separately for foreign currency and Indian Currency. The applicable taxes and duties shall be as per SCC Clause 24.
- c. The sum of amounts shown against Milestones Activities in a bill total that is to be carried forward to the Summary. The division of the respective bill totals between Indian Currency and Foreign currency shall be shown in the said Summary. The addition of bill Summary will be carried forward to the Tender Total.
- d. The scope and extent of the Works are to be ascertained by reference to the Contract Documents as a whole and shall not be limited in any manner whatsoever by the descriptions of the bill or of the Milestones under each bill, as given in the Appendices to the Pricing document.

3. Milestones Achievement Periods

The Milestones Activities under each Bill shall identify verifiable steps towards the completion of the work within that Bill. The Tenderer shall indicate the periods (in weeks from the Commencement Date of the Works) within which he shall achieve each Milestone Activity.

4. Milestone Payment Schedule(MPS)

- a. The MPS completed by the Contractor shall set out the maximum cumulative amount for all Bills put together in relation to each month for which payment may be sought in accordance with Sub-Clause 11.4 of the GCC. This information should also be presented in a tabular

form. Monthly Cash Flows for the Contract will form part of the Pricing Document.

- b. The MPS covers the period, which will commence on the first day of the calendar month next after the month containing the Commencement Date of the Works as per the Contract. The first application for interim payment may be made not earlier than during the month following the calendar month next after the month containing the Commencement Date of the Works, such first application relating to the first month (i.e., month 1) of the MPS.
- c. The price shall not be unbalanced therefore, the price quoted in the Design (Bill No. 12.1) shall not be more than 2% AND Erection/Installation and Testing and Commissioning shall not be less than 15% and 10% respectively, of the price quoted in the Price of Supply.

5. Tender Total

- a. The Tender Total submitted by the Tenderer shall be in the format shown in the Pricing Document.
- b. The Pricing Document contains Bills, Milestone activity under each bill. The Bills and Milestones activity have been prepared to indicate the extent of detail required in the Tender. The Tenderer shall prepare and complete documents, in this format, as being his Tender and submit as part of the Financial Package.
- c. The Pricing Document completed and submitted by the Tenderer, as part of his Tender, should use an indexing and page numbering system such that its extent and completeness is clearly evident.

6. Currency

Bill Totals and Milestone amounts shall be indicated in Indian Rupees and in a Foreign Currency as per clause C16.1 of ITT to Tenderer (Vol.1), wherever required.

7. Milestones

- a. Bills are fixed and shall not be changed by the Tenderer. The Bill represents the major items of the Works for which the Employer will pay the Contractor, and the Tenderer shall ensure that he has allowed for all his costs he requires for the Contract to meet the Employer's Requirements.
- b. If during the course of execution, it becomes necessary, to meet the Employer's Requirements (as indicated in these Tender Documents), to add more Milestones in a Bill, the Lump Sum Price of the whole of Works, which will remain unaltered, will be reapportioned amongst the Bills, and further redistributed under the Bill and the Milestones in each Bill. The liability of the Employer will be limited to the fixed Lump sum Price already accepted and the Contractor will have no right to claim any thing over and above the fixed Lump Sum price for any such addition of Milestones in any Bill. The decision of the Employer will be final and binding in such matters and will not be subject to Conciliation or Arbitration.
- c. The Milestones represent the completion of verifiable activities to be undertaken by the Contractor. A date for the achievement of each Milestone expressed as a number of weeks from the Commencement Date of the Works shall be entered in the column provided. Milestones that lead to achievement of a Stage must always precede the Key Date for achievement of that Stage. Milestones shall be converted to Calendar dates when the Notice to Proceed is issued.
- d. Activities against which no price is entered by the tenderer shall be regarded as covered by other price in the Milestone.

8. Price Variation

Prices quoted by the tenderer shall be fixed throughout the Tenderer's performance of the contract and not subject to variation on any account except for the items mentioned in this clause.

a. Price Variation in Conductor Rail:

For "Conductor Rail" (Bill No. 7.1), the price adjustment shall be linked to spot rate of aluminium quoted at London Metal Exchange (LME), and shall be as per the following formula:

$$V_c = \frac{0.75 * \text{Accepted Price} * (\text{Current Index} - \text{Base Index}) * f}{\text{Base Index}}$$

Where;

V_c = Increase or decrease in the cost of component during the month under consideration due to change in rates for 'Conductor Rail'

Current Index is the spot rate cost of aluminium as given on the L.M.E. (London Metal Exchange) 28 (twenty-eight) days prior to the date of notification to Engineer / Employer for inspection of material;

Base Index is the cost of aluminium as given by the L.M.E. (London Metal Exchange) 28 (twenty-eight) days prior to the latest date of Tender submission;

$$f = \frac{Z_0}{Z_1}$$

Z_0 is the number of units of the currency of the index which is equivalent to one unit of bid currency as applicable on 28 (twenty-eight) days prior to the latest date of Tender submission; and

Z_1 is the number of units of the currency of the index, which is equivalent to one unit of bid currency as applicable on 28 (twenty-eight) days prior to the date of notification for inspection.

Note: The exchange rates to be employed for such conversion shall be the TT selling rate at the close of business of the State Bank of India on the respective date.

b. Positive or Negative variation in quoted fixed Lumpsum price shall be done by Employer in case of following on pro rata basis:

- (i) Addition/Deletion of Stations
- (ii) Increase/ Decrease in the length of the corridors
- (iii) Change in quantity of Inverters, Inverters Transformer along with associated Switchgears
- (iv) Change in the location of RSS/AMS

However, any change on account of meeting the minimum requirements given in General Conditions of Contract (GCC), Special Conditions of Contract (SCC), Employer's Requirements (General Specifications and Technical Specifications) and Tender Drawings and latest applicable standards shall not be treated as variation in the quoted fixed Lump Sum Price quoted.

c. Price variation in 3.3 KV & 33kV cables

It shall be governed by the IEEMA formula is enclosed as Annexure-3 to Pricing Document or latest IEEMA formula at the time of tender submission. It shall be applicable on Bill No 6.1 and 6.2 for the supply of 3.3 kV DC positive cable & Bill 1.1 & 4.1 Supply of 33kV cables.

d. Price variation in 1.1 KV cables

It shall be governed by the IEEMA formula enclosed in Annexure-4 to Pricing Document or latest IEEMA formula at the time of tender submission. It shall be applicable on Bill No 6.1 & 6.2 for Supply of 1.1 KV DC Negative cable.

9. Installation/Construction and Testing & Commissioning:

9.1. Installation/ Construction of all the equipment installed under the contract LKE(02)-01 shall be done as per Specifications given under Chapter 6 of TS.

9.2. Testing & Commissioning: Testing and commissioning of all the equipments installed under the contract LKE(02)-01 shall be done as per Specifications given under Chapter 7 of TS.

10. Explanatory Notes to Bill of Quantities ("BoQ")

These explanatory notes to be read in conjunction with Chapter-2 of ERTS (Scope of Work) & other scope of ERTS, Tender Drawings, SCC/GCC and ERGS. Any other items not mentioned in the explanatory note is considered included.

10.1 DELETED

10.2 33 kV RECEIVING SUBSTATION/AUXILIARY MAIN SUBSTATION

10.2.1 The Bill for Vasantkunj RSS/AMS is presented in BOQ Bill Nos. 2.1. For detailed specifications, the Chapter 12 of TS and tender drawing shall be referred to.

10.2.2 Following notes are explanation of the items under these Bill Nos 2.1 :

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 2.1 – 33 kV RSS)
A	33 kV BAYS	
A.1	33 kV Switchgear Panel	
A.1.1	Supply and erection including testing and commissioning of 33 kV Vacuum switchgear panel board as per Technical Specifications & tender drawings	
	Supply and erection including testing and commissioning of 1250A Protection Vacuum Circuit Breaker Incoming Panel with CT & accessories, complete	Supply: - <ul style="list-style-type: none"> • 3 pole 33 kV switchboard consisting of 01 No. circuit breaker as per specifications & drawings • Protection relays as per specification • CTs, PTs as per specifications • Indoor Lightning/Surge Arrestors • Mounting channels if required • Other items as required for connection to the two bus bars 33 kV incoming cables through lightning arrestor and for completing the intent of work • Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 2.1 – 33 kV RSS)
		Erection/ Installation: <ul style="list-style-type: none"> Erection of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of 1250A Bus Coupling Protection Vacuum Circuit Breaker Panel, complete	Supply: <ul style="list-style-type: none"> 3 pole 33 kV switchboard consisting of 01 No. circuit breaker bus coupler & riser in ASS/TSS as per specifications & drawings Protection relays as per specification CTs, PTs as per specifications Mounting channels if required Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> Erection/ Installation of all above equipment Testing & Commissioning <ul style="list-style-type: none"> Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of Bus PT Panel	Supply: <ul style="list-style-type: none"> 3 pole 33 kV switchboard consisting of 01 No. feeder as Bus PT as per specifications & drawings Protection relays as per specification Mounting channels if required Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> Erection/ Installation of all above equipment Testing & Commissioning: Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of 1250A Protection Vacuum Circuit Breaker Outgoing Panel with CT & accessories, complete	Supply: - <ul style="list-style-type: none"> 3 pole 33 kV switchboard consisting of 01 No. circuit breaker as per specifications & drawings Protection relays as per specification CTs, PTs as per specifications Indoor Lightning/Surge Arrestors Mounting channels if required Other items as required for connection to the two bus bars 33 kV Outgoing cables through lightning arrestor and for completing the intent of work Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 2.1 – 33 kV RSS)
		Erection/ Installation: <ul style="list-style-type: none"> Erection of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> Testing & commissioning of all above equipment
A.2	Control Panel	
A.2.1	Supply, testing & commissioning of Control Panel for 33 kV Bays	Supply: <ul style="list-style-type: none"> Control & protection cubicle Numerical protection relays for incoming bays Numerical protection relays for bus coupler and bus VT bays Numerical protection for bus bar protection Energy Metering for incoming bays Transducers, Auxiliary relays, cables, terminal, fuses and all other components for completion of panel and to meet functional requirements as per specifications and drawings. Erection/ Installation: <ul style="list-style-type: none"> Erection of all above equipment Testing & Commissioning <ul style="list-style-type: none"> Testing & commissioning of all above equipment
A.2.1.1	Incomer Feeder (33kV Incoming AIS Bay)	
A.2.1.2	Outgoing Feeder (33kV Outgoing AIS Bay)	
A.2.1.3	33kV Coupling Bay including busbar coupling bay	
A.2.1.4	Any other item(s) considered necessary to comply with the Scope of Work	
B	Deleted	
C	33kV Switchgear (AMS at RSS)	
C.1.1	Supply and erection including testing and commissioning of 33 kV Vacuum switchgear panel board as per Technical Specifications & tender drawings	Supply: <ul style="list-style-type: none"> 33 kV Vacuum Circuit Breaker switchboard consisting of incomers, bus coupler and outgoing feeder as per tender drawings Control & Protection relays as per specification CTs, PTs as per specifications Energy Meters (Import/Export feature) at the incomers, outgoing feeders Power Quality Analyser (PQA) at incoming feeders Mounting channels if required Castle Lock, Fittings & other components for completion of Job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> Erection of all above equipment Testing & Commissioning <ul style="list-style-type: none"> Testing & commissioning of all above equipment
D	Deleted	
E	LV Power & Control Cables and Cable support structure	

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 2.1 – 33 kV RSS)
E.1	Supply, laying, testing and commissioning of LV Control & Power cables	Supply: <ul style="list-style-type: none"> • LV control and power cables of suitable cross section for entire RSS including the cables from yard to control room, among the equipment, CRP Panel connection, RTU connection cables etc. • Termination lugs, glands, ferrules, ties, markers, etc. with required hardware's for completion of the job. • Cable Cut-outs/openings sealing arrangements as per specifications. • Any other opening for cable entry/exits shall be considered. Erection/Installation: <ul style="list-style-type: none"> • Laying of cable, erection of accessories and all components as indicated above Testing & Commissioning <ul style="list-style-type: none"> • Testing & commissioning of cable & accessories
E.2	Supply, erection of hot dip galvanized steel Cable trays/race ways/ ladders including suspending rods and associated fitting for completion of job	Supply <ul style="list-style-type: none"> • Cable support infrastructure like trays, ladders, brackets, race ways, hangers etc., with required hardware for RSS including 33kV Switchgear equipment and lighting cables, etc. • Suspending rods with required hardware. • GI supports/angles with required hardware. Erection/ Installation: <ul style="list-style-type: none"> • Erection of all above equipment Testing & Commissioning <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
F	EARTHING	
	Supply, laying and Connections of appropriate MS flat / Rod welding, jointing and applying ACB paint to welded portion with complete hardware for completion of the Earth Mat 40 KA Fault current at 33 kV for one second and 0.5 Ohm Earth Resistance Value inside RSS Premises as per drawings/ specifications	Supply: <ul style="list-style-type: none"> • MS Rods for yard earth mat • GI Flats for interconnecting yard earth mat to control room earth mat. • Earth risers • Adequate size of GI Flat for connection to equipment/ structure/ fence/ control room earth mat etc. • Bimetallic joint/Welding/exothermic weld, etc. • Clamps and Other components for completion of job. • Fittings, Terminals and Other components for completion of job as per specifications and drawings Erection/Installation: <ul style="list-style-type: none"> • Laying of earth mat as per approved design • Laying of earth risers as per approved design • GI Flat for connection to equipment/ structure/ fence/ control room earth mat etc • Laying of interconnections, exothermic Weld, etc. Testing & Commissioning <ul style="list-style-type: none"> • Testing & commissioning of complete earthing arrangement inside RSS.
G	AUXILIARIES	

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 2.1 – 33 kV RSS)
G.1	Supply, erection, testing and commissioning of Battery & Battery Chargers at RSS	Supply: <ul style="list-style-type: none"> Two sets of 110 V battery banks of 450Ah as per specification One set of battery charger comprising 3 Battery Chargers (2 Main + 1 Standby) as per specification Battery Monitoring Unit Mounting rack for battery, protection and connections Interconnecting strips for battery Fittings, terminals, shrouds & other components, for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> Erection of all above equipment Testing & Commissioning <ul style="list-style-type: none"> Testing & commissioning of all above equipment
G.1.1	Battery Charger (2 Main + 1 Standby)	
G.1.2	Battery Bank (2 x 100%)	
G.1.3	Fittings, terminals & other components, for completion of job as per specifications and drawings	
G.2	Supply and erection including testing and commissioning of ACDB	Design: <ul style="list-style-type: none"> Two cabinets each containing a Master circuit breaker Copper bus bar as per specification Protection circuit breakers Automatic and normal device for changeover Outgoing feeders with MCBs/MCCBs LV cables from/to designated ACDB panel Locks, interlocks and other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> Erection of all above equipment Testing & Commissioning <ul style="list-style-type: none"> Testing & commissioning of all above equipment
G.3	Supply and erection including testing and commissioning of DCDB	Supply: <ul style="list-style-type: none"> Two cabinets each containing a Master circuit breaker Isolating switch, non-return diodes Copper bus bar as per specification Over current and under voltage protection relays Outgoing feeders with MCBs Automatic and normal device for changeover Locks, interlocks and other components for completion of job as per specifications and drawings Erection/Installation: <ul style="list-style-type: none"> Erection of above equipment Laying power and control cables Testing & Commissioning: <ul style="list-style-type: none"> Testing & commissioning of above equipment
G.4	Supply, erection including testing and commissioning of UPS	Supply: UPS shall comprise: <ul style="list-style-type: none"> One AC/DC converter (Battery charger) 100% standby Ni-Cd Battery – 100% standby One Inverter (100% standby) One static bypass switch

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 2.1 – 33 kV RSS)
		<ul style="list-style-type: none"> • One emergency switch (Automatic/manual change over switch, transfer push button) • One AC output protection circuit breaker • Locks, interlocks and other components for completion of job as per specifications and drawings Erection/Installation: <ul style="list-style-type: none"> • Erection of above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of above equipment
G.5	Supply and erection of Safety Equipment	Supply: <ul style="list-style-type: none"> • All safety equipment as per specification • Fire extinguishers as per the statutory norms • Insulation mats for all the equipment • Lockable keyboard • Sand Bucket with stand • Insulated gloves • Body lifting pole stretcher • First Aid Kit • Sign Boards and Danger Board • Protecting glasses • Insulated cable cutting pliers • Danger/Hazard notices • Eye wash equipment's for battery room • Locks, and other components as per applicable safety norms. Erection/ Installation: <ul style="list-style-type: none"> • Erection of all above equipment Testing & Commissioning <ul style="list-style-type: none"> • Testing & commissioning of all above equipment

10.3 33 kV RECEIVING SUBSTATIONS- Civil Works

10.3.1 The Bill for Civil Works of RSSs is presented in BOQ Bill Nos. 3.1 to 3.3. For detailed specifications, the Chapter 12 of TS and tender drawing shall be referred to. Civil and Building Works for Vasantkunj RSS shall be carried out by the Civil contractor.

10.3.2 Following are explanation of the items under these Bill Nos.:

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 3.2 to 3.3–33 kV RSS-Civil Works)
A.1	Land Preparation	
A.1.1	Tree Cutting, Land levelling and compacting, Back filling	<ul style="list-style-type: none"> • Clearing the site of all encumbrances • Cutting/transporting trees, as absolutely necessary, with the approval of and in consultation with the Employer, strictly in accordance with local laws. • Backfilling & Levelling the site to a finished ground level, as approved by the Employer • Compacting the ground, in accordance with standard engineering practices, setting up of site facilities as per specifications

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 3.2 to 3.3–33 kV RSS-Civil Works)
		<ul style="list-style-type: none"> • All other associated land preparation works • The bidder is specifically advised to inspect the site of RSS-cum-AMS, before bidding, to be fully aware of the works involved
A.1.2	Boundary wall	<ul style="list-style-type: none"> • The price shall include the cost of constructing a boundary wall along the periphery of the RSS-cum-AMS complex, together with appropriate gates: <ul style="list-style-type: none"> ○ one for heavy trucks (24 feet): ○ one (18 feet) gate for general purpose vehicle with motorized movement: as per the standard design of boundary wall of UPMRC. • The boundary wall shall be at least 3.0m high from finished level of RSS and provided with concertina wire etc. on the top over a height of approximately 0.5m, above 3.0m. • The price shall include the cost of testing and commissioning, as per Employer's Requirement of the related civil work and relevant installations.
A.2	Drainage	
A.2.1	Land drainage	<ul style="list-style-type: none"> • The price shall include the cost of preparation of designs for land drainage including drains, sump and, after their being approved by the Employer's representative, of executing the work in accordance with the best engineering practices, to ensure proper drainage arrangements for rain-water, waste water etc. • The price shall also include cost of supply and erection of suitable electrically operated pumps in the sump to evacuate water when it rises above a predetermined level. • The price shall include the cost of testing and commissioning, as per employer's requirement of the related civil work and relevant installations.
A.3	Access Road	<ul style="list-style-type: none"> • The price under this item shall include the cost of strengthening/widening of an existing approach road and/or construction of an access road, to the Substation area, from the nearest existing road which has the necessary width and strength to permit movement of trucks/trailers, carrying power transformers and power supply equipment. The approach/access roads shall have a minimum width of 4.5m and length up to 500m* and a load carrying capacity to support 100 tonne trailers. The radii of bends must be suitable for multiple-axle vehicles. • The price shall also include the cost of preparation of necessary designs and calculations, submitting them to the Employer's Representative, for approval. On approval of designs and calculation, the approach/access roads shall be constructed as per approved designs.

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 3.2 to 3.3–33 kV RSS-Civil Works)
		<ul style="list-style-type: none"> The price shall include the cost of testing and commissioning, as per Employer's Requirement of the related civil work and relevant installations. *In case of increase of length beyond 500m of access road payment shall be made as per actual
A.4	Earthing	<ul style="list-style-type: none"> The prices shall cover the cost of carrying out the site survey at site for measuring electrical parameters like earth resistivity etc. and being approved by the Employer's Representative, of executing the work of laying the earth-mesh and earth risers, according to approved drawings and specifications and in accordance with standard engineering practices. This will include the cost of soil treatment, providing of alternate layers of soil required for providing safe and acceptable earthing as per relevant practices codes and standards.
A.5	AMS and Control Room Building	
A.5.1	Deleted	<ul style="list-style-type: none"> Deleted
A.5.2	Building construction	<ul style="list-style-type: none"> The price shall include the cost of construction of the building, all inclusive of supply of all materials as per the designs and drawings approved by the Employer's Representative, including electrical wiring, plumbing, thermal and moisture protection, doors and windows, finishing of wall, floors, ceiling etc. The price shall include the cost of testing and commissioning, as per employer's requirement of the related civil work and relevant installations.
A.5.3	Facilities installations	<ul style="list-style-type: none"> The price shall include the cost of providing the various facilities in the RSS-cum-AMS & Control Room Building, such as but not limited to light fittings & sockets, fans, air-conditioners, sufficient furnitures fire detection and alarm system, yard lighting, earth-mesh under the building and earth-risers, earthing inside the room, all facilities as described in specifications etc. This shall include cranes and lifting equipments wherever required for installation, testing and commissioning
A.6	Guard Room	<ul style="list-style-type: none"> The prices shall cover the cost of preparing the design for the Guard room, and after their being approved by the Employer, the price of executing the works, including civil and structural works, lighting, ventilation with air coolers, plumbing and essential internal furnishings. The price shall include the cost of testing and commissioning, as per Employers Requirement of the related civil work and relevant installations.
A.7	Signages	<ul style="list-style-type: none"> The prices shall cover the cost of providing suitable Signage's, including Signboards at main gate visible

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 3.2 to 3.3–33 kV RSS-Civil Works)
		from a distance of 1.6 km (in Hindi and English) and other relevant indicators, in accordance with drawings and details to be submitted by the Contractor and subject to approval by the Employer.
A.8	Foundations	<ul style="list-style-type: none"> The price shall cover: <ul style="list-style-type: none"> Installation of foundations, including materials, plain as well as reinforced concrete, for equipment structures towers, gantries etc. Foundations along with materials of the entire 33 kV system of Receiving Substation & Auxiliary Main Substation (including Control Room) The price shall include the cost of testing and commissioning, as per Employer's Requirement of the related civil work and relevant installations.
A.9	Storage Space	<ul style="list-style-type: none"> The price shall include the construction and provision of covered storage space of approx. 150 sq.m for each Indoor & Outdoor in RSS/AMS inside Depot with suitable rolling shutters, doors and other ancillaries and facilities as per the specifications as in Chapter 12 of PS The price shall include the cost of testing and commissioning, as per Employer's Requirement of the related civil work and relevant installations.
A.10	Landscaping and Plantation	<ul style="list-style-type: none"> The price shall include provision of landscaping and plantation in RSS as per the specifications as in Chapter 12 of PS

10.4 33 kV HT Cables

10.4.1 The Bill 33kV HT Cables is presented in BOQ Bill No. 4.1. For detailed specifications, the Chapter 13 of TS and tender drawing shall be referred too.

10.4.2 Following are explanation of the items under these bill Nos.:

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 4.1 – 33 kV HT Cables)
A.1	33 kV Cables – ASS/TSS Ring	

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 4.1 – 33 kV HT Cables)
A.1.1	Supply, laying, testing and commissioning of 33 kV FRLS/ FRLSOH Cables and connections between ASSs/TSSs ring for elevated / UG / At Grade section along with Cable support infrastructure, Joints and terminations, Fittings, terminals, intertripping cable & other components, for completion of job as per specifications and tender drawings.	<ul style="list-style-type: none"> • 33kV cable as per specification from feeder CB in RSS/AMS to incoming CB in ASS/TSS (including Depot) • ASS/TSS to ASS/TSS • 33 kV CB to Aux Transformer & Traction Transformer in RSS/AMS, ASS/TSS. • Control cables for protection, interlocking, inter tripping & pilot wires. • HDPE conduit pipe for control and protection cable where cables are buried as per specification. • Straight Through Joint kit for all phases • Termination kit for all phases (GIS/AIS Type) • Barricades, bridges over drain • HDPE Pipe, Sand, RCC slabs for top and side protection, warning tape as and where required. • Route markers, warning boards as and where required. • Mounting arrangement on CB/ Transformer on either end. • Cable support arrangements including brackets, hangers, trays, support insulators etc. including anchoring and fixing arrangement, GI Structures, Trefoil clamps • Other components for completion of Job as per specifications and drawings • For Underground Section all cables/ wiring shall be FRLSOH type only • For Elevated/at grade Section all cables/ wiring shall be FRLS type only. • The Cable shall be considered from ASS/TSS to ASS/TSS for Milestone completion. <p>Laying/Erection:</p> <ul style="list-style-type: none"> • Construction of open trenches, bridges over drain, laying of HDPE pipes and other activities required for laying of cables • HDD and drilling at critical locations to complete the job, where open trench construction is difficult • Appropriate sealing of cut-outs as per specification • Laying of cable, erection of accessories and all components as indicated above <p>Testing & commissioning</p> <ul style="list-style-type: none"> • Testing & Commissioning of cable & accessories
A.2	Sealing of Cable Cut outs/openings	
A.2.1	Supply and erection of EPDM modules for sealing of cable cut-outs/openings at station area,	Supply:

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 4.1 – 33 kV HT Cables)
	ASS/TSS and wherever required ((for Auxiliary Supply cables Under the scope of LKE(02)-01 Contractor))	<ul style="list-style-type: none"> • Cable Cut-outs/openings sealing arrangements as per specifications. • Any other opening for cable entry/exits shall be considered. Erection & Commissioning: <ul style="list-style-type: none"> • Erection and completion of job as per specifications

10.5 Auxiliaries Sub-station (ASS)

10.5.1 The Bill for 33kV/415V ASS equipment is presented in BOQ Bill Nos. 5.1 For detailed specifications, the Chapter 14 of TS and tender drawing shall be referred to.

Note: - 1. The Traction contractor shall design, supply and install all the cable trays/hangars support etc. (pertaining to traction) inside ASS and ASS cum TSS Room for elevated, depot and Underground Station. Cable paths required for management of HT/LT (from ACDB to the 33 kV and DC switchgear and the other accessories e.g., battery, battery charger etc.) and Control & Monitoring cables, inside the ASS and ASS cum TSS Rooms, shall be in the scope of LKE (02)-01 contractor.

2. Heavy equipment, such as transformers and 33 kV panels shall be brought by road by the LKE(02)-01 Contractor. Wherever required, suitable loading / unloading platforms shall be constructed and the equipment shall be lifted to these loading / unloading platforms for elevated stations and Hatch cut-outs /as per site availability for underground stations with the help of cranes etc. by the LKE(02)-01 Contractor. The equipment shall be moved to respective positions/ foundations, with the help of trolley / rollers/ Lifting hooks by the Traction Contractor.. In elevated stations, rolling shutters & in underground stations knock out wall shall be used for placing heavy equipment like transformers, 33kV panels etc. inside ASS/TSS room (Preferably all the equipments will be placed before the finishing of the knockout wall). The LKE(02)-01 Contractor will interface with civil contractor in respect of capacity of hooks and their appropriate location. No mono-rails or rails on the floor shall be provided in the ASS / TSS room.

10.5.2 Following are explanation of the items under these Bill Nos.:

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
A	AUXILIARY/TRACTION SUBSTATION	
A.1.1, A.2.1, ... A.13.1	33 kV Switchgear	
	GIS Type for Underground Station ASS	
	Supply and erection including testing and commissioning of 1250A Protection GIS Circuit Breaker Panel with CT & accessories, complete	Supply: <ul style="list-style-type: none"> • 3 pole 33 kV switchboard consisting of 01 No. circuit breaker as per specifications & drawings • Protection relays as per specification • CTs, PTs as per specifications • Mounting channels if required

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
		<ul style="list-style-type: none"> • Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection/ Installation of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of 1250A Transformer Protection GIS Circuit Breaker Panel with CT & accessories, complete	<p>Supply:</p> <ul style="list-style-type: none"> • 3 pole 33 kV switchboard consisting of 01 No. circuit breaker outgoing feeder to Auxiliary/Traction Transformer in ASS/TSS as per specifications & drawings • Protection relays as per specification • CTs, PTs as per specifications • Mounting channels if required • Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection/Installation of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of 1250A Bus Coupling Protection Vacuum Circuit Breaker Panel, complete	<p>Supply: -</p> <ul style="list-style-type: none"> • 3 pole 33 kV switchboard consisting of 01 No. circuit breaker bus coupler & bus riser in ASS/TSS as per specifications & drawings • Protection relays as per specification • CTs, PTs as per specifications • Mounting channels if required • Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings <p>Erection/Installation:</p> <ul style="list-style-type: none"> • Erection/Installation of all above equipment <p>Testing & Commissioning:</p>

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
		<ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of Bus PT Panel	<p>Supply: -</p> <ul style="list-style-type: none"> • 3 pole 33 kV switchboard consisting of 01 No. feeder as Bus PT as per specifications & drawings • Protection relays as per specification • Mounting channels if required • Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings <p>Erection/Installation:</p> <ul style="list-style-type: none"> • Erection of all above equipment <p>Testing & Commissioning</p> <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	AIS Type for Elevated Station /Depot ASS	
	Supply and erection including testing and commissioning of 1250A Protection Vacuum Circuit Breaker Panel with CT & accessories, complete	<p>Supply: -</p> <ul style="list-style-type: none"> • 3 pole 33 kV switchboard consisting of 01 No. circuit breaker as per specifications & drawings • Protection relays as per specification • CTs, PTs as per specifications • Mounting channels if required • Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of 1250A Transformer Protection Vacuum Circuit Breaker Panel with CT & accessories, complete	<p>Supply:</p> <ul style="list-style-type: none"> • 3 pole 33 kV switchboard consisting of 01 No. circuit breaker outgoing feeder to Auxiliary/Traction Transformer in ASS/TSS as per specifications & drawings • Protection relays as per specification • CTs, PTs as per specifications • Mounting channels if required

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
		<ul style="list-style-type: none"> • Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings <p>Erection/Installation:</p> <ul style="list-style-type: none"> • Erection of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of 1250A Bus Coupling Protection Vacuum Circuit Breaker Panel, complete	<p>Supply:</p> <ul style="list-style-type: none"> • 3 pole 33 kV switchboard consisting of 01 No. circuit breaker bus coupler & riser in ASS/TSS as per specifications & drawings • Protection relays as per specification • CTs, PTs as per specifications • Mounting channels if required • Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection/ Installation of all above equipment <p>Testing & Commissioning</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of Bus PT Panel	<p>Supply:</p> <ul style="list-style-type: none"> • 3 pole 33 kV switchboard consisting of 01 No. feeder as Bus PT as per specifications & drawings • Protection relays as per specification • Mounting channels if required • Castle Lock, Fittings, Padlocks/Interlocks & other components for completion of Job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection/ Installation of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
A.1.2, A.2.2, ... A.13.2	33 kV / 415 V Transformer	
	Supply and erection including testing and commissioning of 33kV/415V, 500 kVA Dry Type Transformers	Supply: <ul style="list-style-type: none"> • Auxiliary transformer along with enclosure • Temperature sensor, alarm and trip modules • Fire protection system as per specifications • Fittings & other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/ Installation of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of 33kV/415V, 2000kVA Dry Type Transformers	Supply: <ul style="list-style-type: none"> • Auxiliary transformer along with enclosure • Neutral CT • Temperature sensor, alarm and trip modules • Fire protection system as per specifications • Fittings & other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/ Installation of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
A.1.3, A.2.3, ... A.13.3	Supply and erection including testing and commissioning other equipment of Auxiliary Sub Station	
	Supply and erection including testing and commissioning of Battery & Battery Chargers for elevated/at grade ASS	Supply: <ul style="list-style-type: none"> • Battery and battery chargers for elevated / at-grade substation with ASS only • One set of 110 V battery banks (min 180 AH) as per specification • One set of battery chargers, comprising of 2 Battery Chargers as per specification

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
		<ul style="list-style-type: none"> • Mounting rack for battery, protection and connections. • Other components for completion of Job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection/ Installation of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of Battery & Battery Chargers for elevated/at grade ASS & TSS	<p>Supply:</p> <ul style="list-style-type: none"> • Battery and battery chargers for at grade/elevated substation with ASS cum TSS • One set of 110 V battery bank (min 300 AH) as per specification • One set of battery charger, comprising 2 Battery Chargers as per specification • Mounting rack for battery, protection and connections. • Other components for completion of Job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection/ Installation of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of Battery & Battery Chargers for underground ASS	<p>Supply: -</p> <ul style="list-style-type: none"> • Battery and battery chargers for underground ASS only • One set of 110 V battery banks (min 180 AH) as per specification • One set of battery chargers, comprising of 2 Battery Chargers as per specification • Mounting rack for battery, protection and connections. • FRLSOH cable connection (Power & Control) shall be considered for UG section. • Other components for completion of Job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection/ Installation of all above equipment <p>Testing & Commissioning: -</p>

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
		<ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of Battery & Battery Chargers for underground ASS & TSS	<p>Supply: -</p> <ul style="list-style-type: none"> • Battery and battery chargers for underground substation with TSS cum ASS • One set of 110 V battery banks (min 300 AH) as per specification • One set of battery chargers, comprising of 2 Battery Chargers as per specification • Mounting rack for battery, protection and connections. • FRLSOH cable connection (Power & Control) shall be considered for UG section. • Other components for completion of Job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection/ Installation of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	ACDB	
	Supply and erection including testing and commissioning of ACDB (Type 1) – at-grade / elevated ASS only	<p>Supply:</p> <ul style="list-style-type: none"> • ACDB for at grade/elevated corridor substation, with ASS only • Single cabinet containing incoming MCB, outgoing MCB, fuses, copper bus bars with UV & OV protection. • Auxiliary contactors, indication lamps • Mounting arrangement and other components for completion of job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection/ Installation of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of ACDB (Type 2) – at-grade / elevated ASS cum TSS	<p>Supply :-</p> <ul style="list-style-type: none"> • ACDB at grade/elevated corridor TSS cum ASS • Single cabinet containing incoming MCB, outgoing MCB, fuses, copper bus bars with UV & OV protection. • Auxiliary contactors, indication lamps

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
		<ul style="list-style-type: none"> • Mounting arrangement and other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/ Installation of all above equipment Testing & Commissioning:- <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of ACDB (Type 3) – underground ASS only	Supply :- <ul style="list-style-type: none"> • ACDB at underground station with ASS only • Single cabinet containing incoming MCB (two incomers), outgoing MCB, fuses, copper bus bars with UV & OV protection & auto change over • Auxiliary contactors, indication lamps • FRLSOH cable connections (power & control) shall be considered. • Mounting arrangement and other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/ Installation of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of ACDB (Type 4) – underground ASS cum TSS	Supply :- <ul style="list-style-type: none"> • ACDB at underground station with TSS cum ASS • Single cabinet containing incoming MCB (two incomers), outgoing MCB, fuses, copper bus bars with UV & OV protection & auto change over • Auxiliary contactors, indication lamps • FRLSOH cable connections (power & control) shall be considered. • Mounting arrangement and other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/ Installation of all above equipment Testing & Commissioning:- <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	DCDB	

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
	Supply and erection including testing and commissioning of DCDB (Type 1) – at-grade / elevated ASS only	Supply :- <ul style="list-style-type: none"> • DCDB for at grade/elevated corridor substation with ASS only • Single cabinet containing incoming MCB, outgoing MCB, fuses, copper bus bars with UV protection • Auxiliary contactors, indication lamps • Mounting arrangement and other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/ Installation of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of DCDB (Type 2) – at-grade / elevated ASS cum TSS	Supply: <ul style="list-style-type: none"> • DCDB for at grade/elevated corridor TSS cum ASS • Single cabinet containing incoming MCB, outgoing MCB, fuses, copper bus bars UV protection • Auxiliary contactors, indication lamps • Mounting arrangement and other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/ Installation of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of DCDB (Type 3) – underground ASS only	Supply: <ul style="list-style-type: none"> • DCDB for underground corridor substation with ASS only • Single cabinet containing incoming MCB, outgoing MCB, fuses, copper bus bars UV protection • Auxiliary contactors, indication lamps • FRLSOH cable connections (power & control) shall be considered. • Mounting arrangement and other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/ Installation of all above equipment Testing & Commissioning:

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
		<ul style="list-style-type: none"> Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of DCDB (Type 4) – underground ASS cum TSS	<p>Supply:</p> <ul style="list-style-type: none"> DCDB for underground corridor substation with TSS cum ASS Single cabinet containing incoming MCB, outgoing MCB, fuses, copper bus bars UV protection Auxiliary contactors, indication lamps FRLSOH cable connections (power & control) shall be considered. Mounting arrangement and other components for completion of job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> Erection/ Installation of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> Testing & commissioning of all above equipment
	LV Cables	
	Supply, laying, testing and commissioning of LV Cables for Type 1 Sub-Station – at-grade / elevated ASS only	<p>Supply:</p> <ul style="list-style-type: none"> LV Cables for at grade/elevated corridor station with ASS LV control and power cables of suitable cross-section for inter-panel wiring, LT power connections, 110 V DC control supply cable connections, 415 V LT power supply connection cables, control cables to RTU, RTU to Telecom Equipment Room etc as per specifications and drawings. Termination lugs, glands, ferrules, cable ties, markers etc <p>Erection/ Installation:</p> <ul style="list-style-type: none"> Erection/ laying of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> Testing & commissioning of all above equipment
	Supply, laying, testing and commissioning of LV Cables for Type 2 Sub-Station – at-grade / elevated ASS cum TSS	<p>Supply:</p> <ul style="list-style-type: none"> LV Cables for at grade/elevated corridor station within TSS cum ASS LV control and power cables of suitable cross-section for inter-panel wiring, LT power connections, 110 V DC control supply cable connections, 415 V LT power supply connection cables, control cables

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
		<p>to RTU, RTU to Telecom Equipment Room etc as per specifications and drawings.</p> <ul style="list-style-type: none"> Termination lugs, glands, ferrules, cable ties, markers etc <p>Erection/ Installation:</p> <ul style="list-style-type: none"> Erection/ laying of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> Testing & commissioning of all above equipment
	Supply, laying, testing and commissioning of LV Cables for Type 3 Sub-Station – underground ASS only	<p>Supply:</p> <ul style="list-style-type: none"> LV Cables for underground corridor station with ASS LV control and power cables of suitable cross-section for inter-panel wiring, LT power connections, 110 V DC control supply cable connections, 415 V LT power supply connection cables, control cables to RTU, RTU to Telecom Equipment Room etc as per specifications and drawings. FRLSOH cable (Power & Control) shall be considered. Termination lugs, glands, ferrules, cable ties, markers etc <p>Erection/ Installation:</p> <ul style="list-style-type: none"> Erection/ laying of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> Testing & commissioning of all above equipment
	Supply, laying, testing and commissioning of LV Cables for Type 4 Sub-Station – underground ASS cum TSS	<p>Supply:</p> <ul style="list-style-type: none"> LV Cables for underground corridor station with TSS cum ASS LV control and power cables of suitable cross-section for inter-panel wiring, LT power connections, 110 V DC control supply cable connections, 415 V LT power supply connection cables, control cables to RTU, RTU to Telecom Equipment Room etc as per specifications and drawings. FRLSOH cable (Power & Control) shall be considered. Termination lugs, glands, ferrules, cable ties, markers etc <p>Erection/ Installation:</p> <ul style="list-style-type: none"> Erection/ laying of all above equipment <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> Testing & commissioning of all above equipment

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
	Supply, laying, testing and commissioning of LV Cables for Depot	Supply : <ul style="list-style-type: none"> • LV Cables for at grade Depot. • LV control and power cables of suitable cross-section for inter-panel wiring, LT power connections, 110 V DC control supply cable connections, 415 V LT power supply connection cables, control cables to RTU, RTU to Telecom Equipment Room etc as per specifications and drawings. • Termination lugs, glands, ferrules, cable ties, markers etc Erection/ Installation: <ul style="list-style-type: none"> • Erection/ laying of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
A.1.4, A.2.4 ... A13.4	Any other item(s) considered necessary to comply with the scope of work	Supply <ul style="list-style-type: none"> • Price under this covers any other item(s) considered necessary to comply with the scope of work and supply of OVPD for the ASS only station Erection / Installation <ul style="list-style-type: none"> • Erection / Installation of all above equipment Testing & commissioning <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
B	Supply and erection of Safety Equipment	Supply: <ul style="list-style-type: none"> • All safety equipment as per specification • Floor insulation mats of appropriate voltage rating • First Aid Kit used for treatment in case of electrical shock. • Hand Gloves • Lockable keyboard • Stainless Steel Almirah of Godrej make, or equivalent make 1 no. • Locks, and other components for completion of job as per specifications Erection/ Installation: <ul style="list-style-type: none"> • Erection/ laying of all above equipment Testing & Commissioning:- <ul style="list-style-type: none"> • Testing & commissioning of all above equipment

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 5.1 –ASS)
C	Supply and erection including testing and commissioning of ETS	
C.1	Supply and erection including testing and commissioning of ETS at Stations	Supply: <ul style="list-style-type: none"> • ETS Box as per specification • Mounting bracket at stations • Cable as per specification and/or as required (7C x 2.5 mm², 1.1 kV, XLPE insulated fire survival cable) • Other components for completion of job as per specifications and drawings • Other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/ Installation of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
C.2	Supply and erection including testing and commissioning of ETS at Depot	Supply: <ul style="list-style-type: none"> • ETS Box as per specification • Mounting bracket with pedestal/wall mounting arrangement in Depot • Cable as per specification and/or as required (7C x 2.5 mm², 1.1 kV, XLPE insulated fire survival cable). • Other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/ Installation of all above equipment Testing & Commissioning:- <ul style="list-style-type: none"> • Testing & commissioning of all above equipment

10.6 Traction Sub-station (TSS)

10.6.1 The Bill for 33kV/415V TSS equipment is presented in BOQ Bill Nos. 6.1 . For detailed specifications, the Chapter 15 of TS and tender drawing shall be referred to.

Note: - The Traction contractor shall design, supply and install all the cable trays/hangers support etc. (pertaining to traction) inside ASS and ASS cum TSS Room for elevated, Underground and depot ASS/TSS. Cable paths required for management of HT/LT (from ACDB to the 33 kV and DC switchgear and the other accessories e.g., battery, battery charger etc.) and Control & Monitoring cables, inside the ASS and ASS cum TSS Rooms, shall be in the scope of LKE(02)-01 contractor.

10.6.2 Following are explanation of the items under these bill Nos.:

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
A	Traction Sub-station (TSS)	
A.1.1, A.2.1, ... A.6.1	Supply, erection, testing and commissioning of 33kV/585-585V, 2850 kVA Dry Type Transformers as per Tender Drawings & Specifications	Supply: <ul style="list-style-type: none"> • Traction transformer along with enclosure • Mounting rails • Temperature sensor, alarm and trip modules • Fire protection system in accordance with NBC • Fittings & other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/Installation of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
A.1.2, A.2.2, ... A.6.2	Supply, erection, testing and commissioning of Rectifier, 2.5 MW	Supply: <ul style="list-style-type: none"> • Rectifier along with enclosure and insulation mat • Mounting rails • Fittings & other components for completion of job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/Installation of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
A.1.3, A.2.3, ..., A.6.3	Supply and erection including testing and commissioning of HSCB panel boards as per tender drawings & specifications.	

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
	Supply and erection including testing and commissioning of incoming HSCB panel boards.	Supply: <ul style="list-style-type: none"> • 1 board, 1 pole 750 V dc switchboard as per tender drawing and specifications • Protection relays as per specification • Current and voltage sensors device for measurement and protection • Fire protection system in accordance with NBC • Castle Locks, Fittings & other components for completion of Job as per specifications and drawings • Floor insulation mats of appropriate voltage rating for placement of DC equipments. • Main Bus Bar of 10 kA (Continuous) Erection/ Installation: <ul style="list-style-type: none"> • Erection/Installation of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of Outgoing HSCB panel boards.	Supply: <ul style="list-style-type: none"> • 1 panel board, 1 pole 750 V dc switchboard consisting of one feeder HSCB without isolator on the downstream feeding to third rail and stinger. • Protection relays as per specification • Current and voltage sensors device for measurement and protection • Fire protection system in accordance with NBC • Castle Locks, Fittings & other components for completion of Job as per specifications and drawings • Floor insulation mats of appropriate voltage rating for placement of DC equipments. Erection/ Installation: <ul style="list-style-type: none"> • Erection/Installation of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
A1.4, A2.4.....,toA 6.4	Supply-Erection, testing and Commissioning of Line Feeder Motorised Disconnecter, Coupling	

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
	Disconnectors, Earthing and Short-circuiting Devices	
	Supply and erection including testing and commissioning of Bypass Coupling Panel with dis-connector switches.	Supply: - <ul style="list-style-type: none"> • Motorized single pole Disconnecting Switch suitable for 750 V dc supply along with mounting insulator with bottom cable entry • Enclosure panel along with canopy for outdoor usage. • Fittings & other components for completion of Job as per specifications • Protections and Interlockings • Floor insulation mats of appropriate voltage rating for placement of DC equipments. • Pedestal for Installation and access to panel by operator Erection/ Installation: <ul style="list-style-type: none"> • Erection/Installation of all above equipment Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply and erection including testing and commissioning of dis-connector switch for Outgoing HSCB panel.	Supply: <ul style="list-style-type: none"> • Motorized single pole Disconnecting Switch suitable for 750 V dc supply along with mounting insulator with bottom cable entry. • Enclosure panel along with canopy for outdoor usage. • Fittings & other components for completion of Job as per specifications • Protections and Interlockings • Floor insulation mats of appropriate voltage rating for placement of DC equipments. • Pedestal for Installation Erection/ Installation: <ul style="list-style-type: none"> • Erection/Installation of all above equipment Testing & Commissioning <p>Testing & commissioning of all above equipment</p>
	Supply, erection, testing and commissioning of set of two Pole (2X2P) Motorized Short Circuit &	Supply:

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
	Earthing Panel along with all necessary accessories as per specifications	<ul style="list-style-type: none"> • Set of two Pole (2X2P) Motorized Short Circuit & Earthing Panel along with all necessary accessories as per specifications • All necessary cables along with terminations (Power & Control) shall be considered (FRLS for elevated/at grade & FRLSOH for underground stations). • Fittings & other components for completion of Job as per specifications • Cable Connections to the track & third rail shall be considered under Bill No. 6.1, Item No. A.1.9/A.2.9/.../A.6.9 • Floor insulation mats of appropriate voltage rating for placement of DC equipments. • Necessary Protections and Interlocks. <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection/Installation of all above equipment <p>Testing& Commissioning:</p> <p>Testing & commissioning of all above equipment</p>
	Supply, erection, testing and commissioning of Two Pole (2P) Motorized Short Circuit & Earthing Panel along with all necessary accessories as per specifications	<p>Supply:</p> <ul style="list-style-type: none"> • Two Pole (2P) Motorized Short Circuit & Earthing Panel along with all necessary accessories as per specifications • All necessary cables along with terminations (Power & Control) shall be considered (FRLS for elevated/at grade & FRLSOH for underground stations). • Fittings & other components for completion of Job as per specifications • Cable Connections to the track & third rail shall be considered under Bill No. 6.1 & 6.2, Item No. A.1.9/A.2.9/... • Power feed assembly as required shall be considered under Bill No. 7.1, Item No. A.1.9. <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection/Installation of all above equipment <p>Testing& Commissioning:</p> <p>Testing & commissioning of all above equipment of all above equipment</p>

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
	Supply and erection including testing and commissioning of motorized Disconnection Switch for Depot	Supply: <ul style="list-style-type: none"> • Motorized single pole isolator suitable for 750 V dc supply along with mounting insulator • Enclosure panel along with canopy and pedestal mountings for outdoor usage. • Fittings & other components for completion of Job as per specifications • Necessary protections and interlocks • Floor insulation mats of appropriate voltage rating for placement of DC equipments. • Pedestal for Installation Erection/ Installation: <ul style="list-style-type: none"> • Erection/Installation of all above equipment Testing& Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply, erection, testing and commissioning of double pole motorised LBS switch at Depot	Supply: <ul style="list-style-type: none"> • Motorized double pole Load Break Switch suitable for 750 V dc supply along with mounting insulator • Enclosure panel along with canopy and pedestal mountings for outdoor usage. • Fittings & other components for completion of Job as per specifications • Protections and Interlockings • Floor insulation mats of appropriate voltage rating for placement of DC equipments. • Pedestal for Installation Erection/ Installation: <ul style="list-style-type: none"> • Erection/Installation of all above equipment Testing& Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
	Supply, erection, testing and commissioning of 4 pole motorised LBS switch at Depot	Supply: <ul style="list-style-type: none"> • Motorized 04 pole load break switch suitable for 750 V dc supply along with mounting insulator • Enclosure panel along with canopy and pedestal mountings for outdoor usage. • Fittings & other components for completion of Job as per specifications • Protections and Interlockings

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
		<ul style="list-style-type: none"> • Floor insulation mats of appropriate voltage rating for placement of DC equipments. • Pedestal for Installation Erection/ Installation: <ul style="list-style-type: none"> • Erection/Installation of all above equipment Testing& Commissioning <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
A.1.5, A.2.5, ...A.6.5	Over Voltage Protection Device	
	Supply and erection including testing and commissioning of Over Voltage Protection Device in every station.	Supply: <ul style="list-style-type: none"> • Motorized isolator suitable for 750 V dc supply along with mounting insulator • Voltage and current sensing equipment • MMI Equipment and protection PLC • Communication Interface with Stray Current Monitoring System • Auxiliary contactor • Enclosure panel • Fittings, body earth connection & other components for completion of Job as per specifications and drawings Erection/ Installation: <ul style="list-style-type: none"> • Erection/Installation of all above equipment Testing& Commissioning: <p>Testing & commissioning of all above equipment</p>
A.1.6	Deleted	Deleted

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
A.1.7, A.2.7, ... , A.6.7	Supply and erection including testing and commissioning of Negative Return Panel for Two rectifier set	Supply: <ul style="list-style-type: none"> • Manual isolator along with mounting insulator as per specifications • Connectors for cables • Enclosure panel • Earth leakage relay • Castle Locks, Fittings & other components for completion of Job as per specifications and drawings • Floor insulation mats of appropriate voltage rating for placement of DC equipments. • Communication switches for relay communication to RTU Erection/ Installation& Commissioning: <ul style="list-style-type: none"> • Erection/Installation of all above equipment Testing& Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above equipment of all above equipment

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
A.1.8, A.2.8, ... , A.6.8	Supply, installing, testing and commissioning of a set of LV, 3 phase, 600 V, 1600A Aluminium sand-witched Bus ducts (Transformer – Rectifier Connection)	<p>Supply:</p> <ul style="list-style-type: none"> • LV 3-phase, 600 Volts, 1600 A sandwiched Aluminium Bus duct as per specifications • Earth bus connection strip as per specification • All hardware, connection pieces, horizontal/vertical bends, termination box, elbow etc. as required • Aluminium laminated flexible joint as required • Flexible termination at both ends with aluminium lamination as per TP set • Support arrangements on 2850kVA Traction Transformer and Rectifier • Adapter boxes with necessary accessories as required • Mounting channels if required. • Hanging rods, brackets and other components for completion of job as per specifications and drawings <p>Erection/ Installation:</p> <ul style="list-style-type: none"> • Erection of sandwiched Aluminium Bus duct along with its accessories and all components as indicated above including the termination at both ends <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above equipment
A.1.9, A.2.9, ..., A.6.9	Supply and erection including testing and commissioning of DC Positive/Negative Cables, control cables, Interconnection cable, Frame Connection cables etc as per tender drawings & specifications	
	Supply, laying, and erection including testing and commissioning of 19C x 2.5 mm ² , 1.1 kV, XLPE insulated FRLS/FRLSOH cable	<p>Supply:</p> <ul style="list-style-type: none"> • Cable as per specification • Cable support infrastructure • Other components for completion of job as per specifications and drawings <p>Erection/ laying:</p> <ul style="list-style-type: none"> • Erection/laying of cables along with all other accessories <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing & commissioning of all above cables & accessories

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
	Supply, laying, and erection including testing and commissioning of 3C x 2.5 mm ² , 1.1 kV, XLPE insulated FRLS/FRLSOH cable	Supply: <ul style="list-style-type: none"> • Cable as per specification • Cable support infrastructure • Other components for completion of job as per specifications and drawings Erection/ laying: <ul style="list-style-type: none"> • Erection/laying of cables along with all other accessories Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above cables& accessories
	Supply, laying, and erection including testing and commissioning of 3C x 6 mm ² , 1.1 kV, XLPE insulated cable FRLS/FRLSOH cable	Supply: <ul style="list-style-type: none"> • Cable as per specification • Cable support infrastructure • Other components for completion of job as per specifications and drawings Erection/ laying: <ul style="list-style-type: none"> • Erection/laying of cables along with all other accessories Testing & Commissioning: <ul style="list-style-type: none"> • Testing & commissioning of all above cables
	DC Positive Cables	
	Supply, laying, testing and commissioning of 1Cx300 mm ² DC Positive Cables and connection for 750 V dc feeder circuit in the elevated / at-grade sections and Depots	Supply: <ul style="list-style-type: none"> • 3.3 kV insulation class, 300 mm², copper, armoured, XLPE, FRLS for mainline and depots as per specifications from Rectifier to HSCB, HSCB to Load Bypass Switch (LBS), LBS to Third Rail, connection of disconnecting switches, coupling across air gaps, cross bonds, connection to OVPD etc., • 3.3 kV termination kits • Mounting arrangement at HSCB, rectifier, bypass panel. • Cable support infrastructure like brackets, hangers, trays etc., with fixing hardware arrangements as required • Other components for completion of Job as per specifications and drawings Erection/laying: <ul style="list-style-type: none"> • Installation of cable support infrastructure • Laying, termination of cables, erection of accessories and all components as indicated above

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
		<ul style="list-style-type: none"> • Appropriate sealing of cut-out as per specifications and drawings <p>Testing & Commissioning</p> <ul style="list-style-type: none"> • Testing & commissioning of cable & accessories
	Supply, laying, testing and commissioning of 1Cx300 sqmm DC positive Cables (FRLSOH) and connection for 750 V dc feeder circuit in the underground sections	<p>Supply:</p> <ul style="list-style-type: none"> • 3.3 kV insulation class, 300 mm², copper, armoured, XLPE, FRLSOH for mainline as per specifications from Rectifier to HSCB, HSCB to Load Bypass Switch (LBS), LBS to Third Rail, connection of disconnecting switches, coupling across air gaps, cross bonds, connection to OVPD etc., • 3.3 kV termination kits • Mounting arrangement at HSCB, rectifier, bypass panel. • Cable support infrastructure like brackets, hangers, trays etc., with fixing hardware arrangements as required . • Other components for completion of Job as per specifications and drawings <p>Erection/Laying:</p> <ul style="list-style-type: none"> • Installation of cable support infrastructure • Laying, termination of cables, erection of accessories and all components as indicated above • Appropriate sealing of cut-out as per specifications and drawings <p>Testing & Commissioning</p> <ul style="list-style-type: none"> • Testing & commissioning of cable & accessories
	DC Negative Cables	
	Supply, laying, testing and commissioning of 1Cx300 mm ² DC negative cable and connection for DC return circuit in the elevated / at-grade sections and Depot	<p>Supply:</p> <ul style="list-style-type: none"> • 1.1 kV insulation class, 300 mm², copper, armoured, XLPE, FRLS for mainline and depots as per specifications from Rectifier to NR Panel, NR Panel to running rail (connection of sectioning switches on return circuit side, connection of OVPD) etc. • 1.1 kV termination kit

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
		<ul style="list-style-type: none"> • Mounting and fixing arrangement at Running rail, Sectioning switches, NRP and OVPD • Cable support infrastructure like brackets, hangers, trays etc., with fixing hardware arrangements as required. • Mounting arrangement NR panel • Other components for completion of Job as per specifications and drawings <p>Erection/Laying:</p> <ul style="list-style-type: none"> • Installation of cable support infrastructure • Laying, termination of cables (including CAD weldings), erection of accessories and all components as indicated above • Appropriate sealing of cut-out as per specifications and drawings <p>Testing & Commissioning</p> <ul style="list-style-type: none"> • Testing & commissioning of cable & accessories
	Supply, laying, testing and commissioning of 1Cx300 mm ² DC negative cable (FRLSOH) and connection for DC return circuit in the underground sections	<p>Supply:</p> <ul style="list-style-type: none"> • 1.1 kV insulation class, 300 mm², copper, armoured, XLPE, FRLSOH for mainline as per specifications from Rectifier to NR Panel, NR Panel to running rail (connection of sectioning switches on return circuit side, connection of OVPD) etc. • 1.1 kV termination kit • Mounting and fixing arrangement at Running rail, Sectioning switches, NRP and OVPD • Cable support infrastructure like brackets, hangers, trays etc., with fixing hardware arrangements as required . • Mounting arrangement NR panel • Other components for completion of Job as per specifications and drawings <p>Erection/ laying:</p> <ul style="list-style-type: none"> • Installation of cable support infrastructure • Laying, termination of cables (including CAD weldings), erection of accessories and all components as indicated above • Appropriate sealing of cut-out as per specifications and drawings

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
		Testing & Commissioning <ul style="list-style-type: none"> • Testing & commissioning of cable & accessories
	Frame Connections	
	Supply, laying, testing and commissioning of 1C x 300 mm ² Cables for interconnection of casings / frame etc. of HSCB panel, NR panel, bypass panel, frame leakage relay etc. for elevated / at-grade and Depot TSSs	Supply: <ul style="list-style-type: none"> • 1.1 kV insulation class, 300 mm², copper, armoured, XLPE, FRLS for mainline and depots as per specifications • 1.1 kV Termination kit • Mounting arrangement • Cable support infrastructure like brackets, hangers, trays etc., with fixing hardware arrangements as required . • Other components for completion of Job as per specifications and drawings Erection/ Laying: <ul style="list-style-type: none"> • Installation of cable support infrastructure • Laying, termination of cables, erection of accessories and all components as indicated above • Appropriate sealing of cut-out as per specifications and drawings Testing & Commissioning <ul style="list-style-type: none"> • Testing & commissioning of cable & accessories
	Supply, laying, testing and commissioning of 1C x 300 mm ² Cables (FRLSOH) for interconnection of casings / frame etc. of HSCB panel, NR panel, bypass panel, frame leakage relay etc. for underground TSSs	Supply: <ul style="list-style-type: none"> • 1.1 kV insulation class, 300 mm², copper, armoured, XLPE, FRLSOH for mainline as per specifications • 1.1 kV Termination kit • Mounting arrangement • Cable support infrastructure like brackets, hangers, trays etc., with fixing hardware arrangements as required. • Other components for completion of Job as per specifications and drawings Erection/laying: <ul style="list-style-type: none"> • Installation of cable support infrastructure • Laying, termination of cables, erection of accessories and all components as indicated above • Appropriate sealing of cut-out as per specifications and drawings

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
		Testing & Commissioning <ul style="list-style-type: none"> • Testing & commissioning of cable & accessories
A.1.10, A.2.10, ..., A.6.10	HDPE pipe for cable crossings	
	Supply, erection of HDPE Pipes of following sizes <ul style="list-style-type: none"> a) 100mm inner dia b) Flexible conduit for DC cable connections as per specifications 	Supply: <ul style="list-style-type: none"> • Supply of HDPE Double Walled Corrugated pipes built to protect the underground and cables embedded in concrete. Produced from a state – of – art extrusion process. • HDPE pipes shall comply to IS – 14930 – 1 and 2, BS EN 50086-1, BS EN – 50086 – 2-4 and IEC 61386. • Colour shall be Black with superior corrosion resistance, anti-rodent, flame retardant, chemically inert, better impact strength, good abrasion resistance and easy jointing process • Flexible Conduits Erection & Commissioning: <ul style="list-style-type: none"> • Laying of HDPE pipes & flexible conduits in Track plinths, Track crossings in main line and depot and wherever required
	Supply, erection, supervision of 100NB GI Pipes	Supply: <ul style="list-style-type: none"> • Supply of 100 NB GI pipes built to protect the cables crossing Track plinths and cables embedded in concrete. • GI pipes shall comply to IS 1239 • Plastic end caps and other hardware required to protect concrete entering during concrete pour • Transportation to site Erection & Commissioning: <ul style="list-style-type: none"> • Erection supervision for laying of GI pipes in Track plinths, Track crossings in main line and depot and wherever required.
A.1.11, A.2.11, ..., A.6.11	Supply and erection of EPDM modules for sealing of cable cut-outs/openings at station area,	Supply: <ul style="list-style-type: none"> • Cable Cut-outs/openings sealing arrangements as per specifications.

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 6.1 – Traction Substation)
	ASS/TSS and wherever required (for DC cables)	<ul style="list-style-type: none"> For DC cables, 1 module shall comprise for 01 DC feeder. Cable entry/exits for DC cables shall be included under this item. <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Erection and completion of job as per specifications.
A.1.12, A.2.12,....., A.6.12	Any other item required to complete the work as per tender drawings & specifications	
A.7	Main Line Disconnectors and Cabling including the Jumpers for in Third rail Air gaps	
	Supply and erection including testing and commissioning of motorized Disconnection Switch for Mainline	<p>Supply:</p> <ul style="list-style-type: none"> Motorized single pole Disconnector Switch suitable for 750 V dc supply along with mounting insulator Enclosure panel along with canopy for outdoor usage. Fittings & other components for completion of Job as per specifications Protections and Interlockings Floor insulation mats of appropriate voltage rating for placement of DC equipments. Pedestal for Installation Disconnector Cable Connections to the third rail shall be considered under Bill No. 6.1 , Item No. A.7/A.8- A1.2 <p>Erection/ Installation:</p> <ul style="list-style-type: none"> Erection/Installation of all above equipment <p>Testing& Commissioning:</p> <p>Testing & commissioning of all above equipment</p>

10.7 Third Rail and Stinger System

- 10.7.1 The Bill for Third Rail is presented in BOQ Bill Nos. 7.1. For detailed specifications, the Chapter 16 of TS and tender drawing shall be referred to.
The length of third rail in depots for pricing purpose (Bill no. 7.1, Item no. A.1 to A.14) is as following:
Vasantkunj depots: 6.3 tkm (including Entry / Exit Line)

*In case of change in quantities of third rail system for depots, payment shall be made as per actual on pro-rate basis.

10.7.2 Following are explanation of the items under these bill Nos.:

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 7.1 – Third Rail)
A	THIRD RAIL	
A.1.1, A.2.1, ..., A.14.1	Supply, installation, interfacing, testing & commissioning of conductor rails as per the Technical Specifications	Supply <ul style="list-style-type: none"> • Conductor rails • All hardware and accessories • Zinc-loaded contact grease • Other components for completion of Job including Numbering/Labelling. Installation/Erection <ul style="list-style-type: none"> • Installation of Conductor Rails Testing & Commissioning <ul style="list-style-type: none"> • Acceptance tests, system tests and commissioning including all necessary tools & plants required for this purpose.
A.1.2, A.2.2, ... , A.14.2	Supply, installation, interfacing, testing & commissioning of splice joint assemblies as per the Technical Specifications	Supply <ul style="list-style-type: none"> • Splice joint assembly • Appropriate labelling • All hardware and accessories • Zinc-loaded contact grease • Other components for completion of Job Installation/Erection <ul style="list-style-type: none"> • Installation of Splice Joints Assemblies Testing & Commissioning <ul style="list-style-type: none"> • Acceptance tests, system tests and commissioning including all necessary tools & plants required for this purpose.
A.1.3, A.2.3, ... , A.14.3	Supply, installation, interfacing, testing & commissioning of UPVC insulated cover for Conductor Rails as per the Technical Specifications	Supply <ul style="list-style-type: none"> • Protective UPVC cover with all required hardware • Zinc-loaded contact grease • Caution and warning signages on the cover at appropriate distance • Other components for completion of Job including Numbering/Labelling. Installation/Erection <ul style="list-style-type: none"> • Installation of UPVC insulated cover for Conductor Rails Testing & Commissioning <ul style="list-style-type: none"> • Acceptance tests, system tests and commissioning including all necessary tools & plants required for this purpose.

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 7.1 – Third Rail)
A.1.4, A.2.4, ... , A.14.4	Supply, installation, interfacing, testing & commissioning of GRP insulated cover for Conductor Rails as per the Technical Specifications	Supply <ul style="list-style-type: none"> • Protective GRP cover with all required hardware • Zinc-loaded contact grease • Caution and warning signage's on the cover at appropriate distance • Other components for completion of Job including Numbering/Labelling. Installation/Erection Installation of GRP insulated cover for Conductor Rails Testing & Commissioning <ul style="list-style-type: none"> • Acceptance tests, system tests and commissioning including all necessary tools & plants required for this purpose.
A.1.5, A.2.5, ... , A.14.5	Supply, installation, interfacing, testing & commissioning of Expansion Joint Assemblies as per the Technical Specifications	Supply <ul style="list-style-type: none"> • Expansion joint assembly with all hardware and accessories required to make it a complete functional unit • Splice joint assembly with all hardware • Special Protective GRP cover with all required hardware • Zinc-loaded contact grease • Type test, batch test and routine test certificates as per the specifications • Other components for completion of Job including Numbering/Labelling. Installation/Erection Installation of Expansion Joint Assemblies Testing & Commissioning Acceptance tests, system tests and commissioning including all necessary tools & plants required for this purpose.
A.1.6, A.2.6, ... , A.14.6	Supply, installation, interfacing, testing & commissioning of High Speed Ramp Assemblies as per the Technical Specifications.	Supply <ul style="list-style-type: none"> • Ramp assembly with all hardware and accessories required to make it a complete functional unit • Splice joint assembly with all hardware • Special Protective UPVC/GRP cover with all required hardware • Zinc-loaded contact grease • Other components for completion of Job including Numbering/Labelling. Installation

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 7.1 – Third Rail)
		<ul style="list-style-type: none"> • Installation of High Speed Ramp Assemblies Testing & Commissioning <ul style="list-style-type: none"> • Acceptance tests, system tests and commissioning including all necessary tools & plants required for this purpose.
A.1.7, A.2.7, ... , A.14.7	Supply, installation, interfacing, testing & commissioning of Low Speed Ramp Assemblies as per the Technical Specifications	Supply <ul style="list-style-type: none"> • Ramp assembly with all hardware and accessories required to make it a complete functional unit • Splice joint assembly with all hardware • Special Protective UPVC/GRP cover with all required hardware • Zinc-loaded contact grease • Other components for completion of Job including Numbering/Labelling. Installation <ul style="list-style-type: none"> • Installation of Low Speed Ramp Assemblies Testing & Commissioning <ul style="list-style-type: none"> • Acceptance tests, system tests and commissioning including all necessary tools & plants required for this purpose.
A.1.8, A.2.8, ... , A.14.8	Supply, installation, interfacing, testing & commissioning of Insulated Support Assemblies as per the Technical Specifications	Supply <ul style="list-style-type: none"> • Design of site-specific support assemblies • Galvanized MS brackets • Insulated support assembly with insulator, all hardware and accessories required to make it a complete functional unit • Special Protective UPVC / GRP cover with all required hardware • Zinc-loaded contact grease • Other components for completion of Job including Numbering/Labelling. Installation <ul style="list-style-type: none"> • Installation of Insulated Support Assemblies Testing & Commissioning <ul style="list-style-type: none"> • Acceptance tests, system tests and commissioning including all necessary tools & plants required for this purpose.
A.1.9, A.2.9, ... , A.14.9	Supply, installation, interfacing, testing & commissioning of Mid Point Anchor Assemblies as per the Technical Specifications	Supply <ul style="list-style-type: none"> • Rail Anchors with all hardware and accessories required to make it a complete functional unit • Special Protective UPVC/GRP cover with all required hardware • Zinc-loaded contact grease

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 7.1 – Third Rail)
		<ul style="list-style-type: none"> Other components for completion of Job including Numbering/Labelling. Installation <ul style="list-style-type: none"> Installation of Mid-Point Anchor Assemblies Testing & Commissioning <ul style="list-style-type: none"> Acceptance tests, system tests and commissioning including all necessary tools & plants required for this purpose.
A.1.10, A.2.10, ... , A.14.10	Supply, installation, interfacing, testing & commissioning of Power Feed Assemblies as per the Technical Specifications	Supply <ul style="list-style-type: none"> Power Feed assembly with all hardware and accessories required to make it a complete functional unit Bimetallic copper / aluminium interface as required Special Protective UPVC / GRP cover with all required hardware Zinc-loaded contact grease Other components for completion of Job including Numbering/Labelling Installation <ul style="list-style-type: none"> Installation of Power Feed Assemblies Testing & Commissioning <ul style="list-style-type: none"> Acceptance tests, system tests and commissioning including all necessary tools & plants required for this purpose.
B	STINGER SYSTEM	
B.1.1	Supply, installation, testing and commissioning of enclosed conductor rail as per TS complete with all fixing / support brackets, all accessories, hardware etc. for stinger system in workshop/depot and as per the specifications	Supply: <ul style="list-style-type: none"> Conductor rails Fixing brackets Support accessories All hardware Zinc-loaded contact grease Other components for completion of Job including Numbering/Labelling Installation: <ul style="list-style-type: none"> Assembling, installing, testing and commissioning of the conductor rails All the manpower, small materials, tools, plants, testing equipment etc. required for installation and testing of the conductor rails are included in this item Interface with the designated contractor Testing & Commissioning: Testing & Commissioning of all equipments
B.1.2	Supply, installation of commissioning of end cover for above enclosed	Supply <ul style="list-style-type: none"> Cover for Conductor rails Fixing brackets Support accessories

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 7.1 – Third Rail)
	conductor rail including all hardware as required	<ul style="list-style-type: none"> • All hardware • Other components for completion of Job including Numbering/Labelling <p>Installation/Erection:</p> <ul style="list-style-type: none"> • Assembling, installing, testing and commissioning of the covers for conductor rails • All the manpower, small materials, tools, plants, testing equipment etc. required for installation and testing of the conductor rails are included in this item • Interface with the designated contractor <p>Testing & Commissioning: Testing & Commissioning of all equipment</p>
B.1.3	Supply, installation, testing and commissioning of splice assembly for above enclosed conductor rail complete with all hardware and accessories as required	<p>Supply</p> <ul style="list-style-type: none"> • Splice assembly • Support accessories • All hardware • Zinc-loaded contact grease • Other components for completion of Job including Numbering/Labelling <p>Installation:</p> <ul style="list-style-type: none"> • Assembling, installing, testing and commissioning of the splice assembly • All the manpower, small materials, tools, plants, testing equipment etc. required for installation and testing of the conductor rails are included in this item • Interface with the designated contractor <p>Testing & Commissioning: Testing & Commissioning of all equipment</p>
B.1.4	Supply, installation, testing and commissioning of suspension clamp for stinger system complete with all hardware and accessories as required	<p>Supply</p> <ul style="list-style-type: none"> • Suspension clamps • Fixing brackets • Support accessories • All hardware • Other components for completion of Job including Numbering/Labelling <p>Installation:</p> <ul style="list-style-type: none"> • Assembling, installing, testing and commissioning of the suspension clamp • All the manpower, small materials, tools, plants, testing equipment etc. required for installation and testing of the conductor rails are included in this item • Interface with the designated contractor <p>Testing & Commissioning: Testing & Commissioning of all equipments</p>

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 7.1 – Third Rail)
B.1.5	Supply, installation, testing and commissioning of power feed assembly for above enclosed conductor rail complete with all hardware and accessories as required	Supply <ul style="list-style-type: none"> • Power feed assembly • Support accessories • All hardware • Zinc-loaded contact grease • Other components for completion of Job including Numbering/Labelling Installation, testing & Commissioning: <ul style="list-style-type: none"> • Assembling, installing, testing and commissioning of the power feed assembly • All the manpower, small materials, tools, plants, testing equipment etc. required for installation and testing of the conductor rails are included in this item • Interface with the designated contractor Testing & Commissioning: Testing & Commissioning of all equipments
B.1.6	Supply, installation, testing and commissioning of collection trolley for above enclosed conductor rail complete with all hardware and accessories as required	Supply: <ul style="list-style-type: none"> • Collection trolley • Support accessories • All hardware • Other components for completion of Job including Numbering/Labelling Installation: <ul style="list-style-type: none"> • Assembling, installing, testing and commissioning of the collection trolley • All the manpower, small materials, tools, plants, testing equipment etc. required for installation and testing of the conductor rails are included in this item • Interface with the designated contractor Testing & Commissioning: Testing & Commissioning of all equipments
B.1.7	Supply, installation, testing and commissioning of isolator switch complete with support tray, cable, cover, enclosure, distribution cubicle and other all accessories as required and as per the specifications	Supply <ul style="list-style-type: none"> • Isolator switch • Fixing brackets • Operating arrangement • Support trays, • Cable, cover • Enclosure • Distribution cubicle • Support accessories • All hardware • Other components for completion of Job including Numbering/Labelling Installation: <ul style="list-style-type: none"> • Assembling, installing, testing and commissioning of the isolator switch

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 7.1 – Third Rail)
		<ul style="list-style-type: none"> • All the manpower, small materials, tools, plants, testing equipment etc. required for installation and testing of the isolator switch are included in this item • Interface with the designated contractor Testing & Commissioning: Testing & Commissioning of all equipments
C	Static 750v DC shore Supply	Supply: 750 V DC Shore Supply to facilitate connection at the Workshop Bay in Depot. Adequate Length of the cable to be considered and necessary arrangement to be ensured Installation: <ul style="list-style-type: none"> • Assembling, installing, testing and commissioning of the shore supply • All the manpower, small materials, tools, plants, testing equipment etc. required for installation and testing of the shore supply are included in this item • Interface with the designated contractor Testing & Commissioning: Testing & Commissioning of all equipments

10.8 Earthing & Bonding

10.8.1 The Bill for Earthing & Bonding is presented in BOQ Bill Nos. 8.1. For detailed specifications, the Chapter 17 of TS and Tender Drawing shall be referred to.

10.8.2 Following are explanation of the items under these Bill Nos.:

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 8.1 Earthing & Bonding)
A	EARTHING AND BONDING	
A.1	Earthing in ASS, ASS/TSS	
	Supply, laying and connections of Earthing from equipment to METs inside the ASS/TSS using 50 x 10 mm GI Flat	Supply: <ul style="list-style-type: none"> • GI flats of 50x10 mm² as per specifications • Welding/brazing and connections • Other components for completion of Job Erection/Installation:

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 8.1 Earthing & Bonding)
		<ul style="list-style-type: none"> Laying & connection of material as per approved design Testing & Commissioning <ul style="list-style-type: none"> Testing & commissioning
	Supply, laying and Connections of Earthing from equipment to METs inside the ASS/TSS using 50 x 6 mm GI Flat	Supply: <ul style="list-style-type: none"> GI flats of 50x6 mm² as per specifications Welding/brazing and connections Other components for completion of Job Erection/Installation: <ul style="list-style-type: none"> Laying & connection of material as per approved design Testing & Commissioning <ul style="list-style-type: none"> Testing & commissioning
	Supply, laying and Connections of Earthing from equipment's to METs inside the ASS/TSS using 25 x 3 mm GI Flat	Supply: <ul style="list-style-type: none"> GI flats of 25x3 mm² as per specifications Welding/brazing and connections Other components for completion of Job Erection/Installation: <ul style="list-style-type: none"> Laying & connection of material as per approved design Testing & Commissioning <ul style="list-style-type: none"> Testing & commissioning
	Supply, laying and Connections of Earthing from equipment's to METs inside the ASS/TSS using 75 x 6 mm GI Flat	Supply: <ul style="list-style-type: none"> GI flats of 75x6 mm² as per specifications Welding/brazing and connections Other components for completion of Job Erection/Installation: <ul style="list-style-type: none"> Laying & connection of material as per approved design Testing & Commissioning <ul style="list-style-type: none"> Testing & commissioning
	Supply, laying and Connections of Earthing from equipment's to METs	Supply :-

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 8.1 Earthing & Bonding)
	inside the ASS/TSS using 75 x 8 mm GI Flat	<ul style="list-style-type: none"> • GI flats of 75x8 mm² as per specifications • Welding/brazing and connections • Other components for completion of Job Erection/Installation: <ul style="list-style-type: none"> • Laying & connection of material as per approved design Testing & Commissioning <ul style="list-style-type: none"> • Testing & commissioning
A.2	Earthing in Stations, Viaduct and other places as per the requirement	
	Supply, laying of 185 mm ² AAAC (Bare Earth Conductor) with connections in Viaduct / tunnels & Station sections	Supply: <ul style="list-style-type: none"> • 185 mm² Al (AAAC) conductor all along the viaduct • Appropriate support structure and clamps • Connectors, clamps, lugs etc., and other components for completion of job Erection/Installation: <ul style="list-style-type: none"> • Erection of all above items, laying and connection of various conductors • Connection to MET at Stations Testing & Commissioning <ul style="list-style-type: none"> • Testing & commissioning
	Supply, laying of 70 mm ² unarmoured copper cable with all hardware for connections for hand rail, pier head bonding, plinth continuity, track-bed continuity, walkway bonding, station structure bonding etc.,	Supply: <ul style="list-style-type: none"> • 70 mm² insulated copper cable • Connectors, clamps, lugs etc., and other components for completion of job Erection/Installation: <ul style="list-style-type: none"> • Erection of all above items, laying and connection of various conductors • Connection to 185 mm² AAAC Testing & Commissioning <ul style="list-style-type: none"> • Testing & commissioning
A.3	Electrical Insulation Membrane for Platform	
	Supply, laying, testing and commissioning of platform Electrical Insulation Membrane (EIM) & Solvent	The Price shall include Supply, Installation/Erection, Testing & Commissioning of:

Item No.	BOQ Item Description	Explanation (BOQ Bill Nos. 8.1 Earthing & Bonding)
	based Primer & its Application at Station Platforms	Supply: <ul style="list-style-type: none"> EIM shall be laid up to not less than 2.0m from the edge of the platform and the platform side opening shall be finished with suitable and aesthetic insulation material. EIM shall be laid with suitable solvent based primer and overlap of 10 % i.e., 100 mm. In future, there may be a requirement for installing the platform screen doors or gates, same to considering in the detailed engineering stage. Installation/Erection: <ul style="list-style-type: none"> Installation/Erection of Platform Insulation Membrane Testing & Commissioning: <ul style="list-style-type: none"> Testing & Commissioning of Platform Insulation Membrane

10.9 SCADA

10.9.1 The Bill of Quantity for SCADA system at OCC & BCC and RTU for North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj) of Lucknow Metro Rail is presented in BOQ Bill Nos. 9.1. For detailed specifications, the Chapter 18 of TS and tender drawing shall be referred to.

10.9.2 Following are explanation of the items under these bill Nos.:

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
A	Supply, Erection, Testing & Commissioning of SCADA System at OCC For North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj) of Lucknow Metro Rail Project	
A.1	Servers	
A.1.1	Dual Redundant SCADA Communication Servers (Main and Standby) For North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj) (including MS Office Professional & Antivirus Software)	Supply: One Set of Server includes two SCADA servers (one main and one standby SCADA server system) in redundant configuration needed for the control & monitoring of electrical installations included in the scope of work, from the OCC. One Set of this item shall essentially include but not limited to the following: <ul style="list-style-type: none"> Two SCADA Communication Servers (one main & one standby) Basic Softwares (OS, All Drivers, MS office etc.) Antivirus software with 5 years of license subscription from the date of commissioning 1 No. 24" LED Monitor with Keyboard and Mouse for each set of servers

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> • 1 No. KVM switch with cables & connectors for Monitor, Mouse & Keyboard interface for each set of servers • Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of Servers and Powering-up • Installation of all Softwares, updates & patches • Network Connectivity & Network configuration/setup • Communication interface of Servers over OFC backbone with RTUs • Testing & commissioning of above equipments
A.1.2	Dual Redundant SCADA Database cum Application Servers (Main and Standby) For North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj) (including MS Office Professional, Antivirus Software & External Bulk Storage for Data and Software Back-up System)	<p>Supply: One Set of Server includes two SCADA servers (one main and one standby SCADA server system) in redundant configuration needed for storage & handling the complete database & for the control & monitoring of electrical installations included in the scope of work, from the OCC.</p> <p>One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> • Two SCADA Database cum Application Servers (one main & one standby) • Basic Softwares (OS, All Drivers, MS office etc.) • RDBMS Software • Antivirus software with 5 years of license subscription from the date of commissioning. • 1 No. 24" LED Monitor with Keyboard and Mouse for each set of servers • 1 No. KVM switch with cables & connectors for Monitor, Mouse & Keyboard interface for each set of servers • External bulk Storage Media facility (Network attached storage device) • Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of Servers and Powering-up • Installation of all Softwares, updates & patches • Network Connectivity & Network configuration/setup • Testing & commissioning of above equipments
A.1.3	Engineering Server for North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj)	<p>Supply: SCADA Engineering server shall be provided for SCADA HMI engineering, RTU Configuration,</p>

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
	(including MS Office Professional & Antivirus Software)	<p>Testing and other development and maintenance purpose.</p> <p>One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> ○ One SCADA Engineering Server ○ Basic Softwares (OS, All Drivers, MS office etc.) ○ Antivirus software with 5 years of license subscription from the date of commissioning ○ 1 No. 24" LED Monitor with wireless Keyboard and Mouse ○ Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> ○ Installation of Server and Powering-up ○ Installation of all Softwares, updates & patches ○ Network Connectivity & Network configuration/setup ○ Testing & commissioning of above equipments
		○
A.2	Workstations	
A.2.1	Operator Workstation with dual Monitor (For North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj)) (including MS Office Professional & Antivirus Software)	<p>Supply:</p> <p>This item shall include the supply of workstations needed as man machine interface for control, monitoring and supervision of electrical installations included in the scope of work, from the OCC.</p> <p>One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> ○ One Workstation Computer ○ Basic Softwares (OS, All Drivers, MS office etc.) ○ Antivirus software with 5 years of license subscription from the date of commissioning ○ Dual 24" LED Monitors with wireless Keyboard and Mouse ○ Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p>

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> ○ Installation of Workstation & Monitors and Powering-up ○ Installation of all Softwares, updates & patches ○ Network Connectivity & Network configuration/setup ○ Testing & commissioning of above equipments
A.3	Communication Equipment	
A.3.1	Redundant SCADA LAN including managed switches, FO & LAN cables and all accessories for communication over Telecom Network for North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj)	<p>Supply: This item includes the supply of redundant SCADA LAN in OCC for data exchange between various SCADA equipments (Servers, Workstations, Printers, Video Control Panel etc.) and integration with field RTUs with SCADA system over Telecom OFC backbone.</p> <p>One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> • Layer-2, 24-Port Managed Ethernet Switch (Core Switch in Server Room) – 2 Nos. • Layer-2, 8-Port Managed Ethernet Switch (Access Switch in OCC Theatre Room) - 2 Nos. • Redundant Fiber optic cable (Armoured, FRLS-OH) for SCADA system communication at OCC and communication link from TER to SCADA server room and from SCADA server room to OCC Theatre room. • CAT 6 or latest communication cable (STP, Armoured, in case of cable laying outside the panel in a trench or cable tray) for connecting all concerned SCADA equipments in dual LAN network. • CAT 6 or latest communication cable (STP, Unarmoured, in case of cable laying inside a panel) for connecting all concerned SCADA equipments in dual LAN network. • If required communication cables shall be laid inside flexible metallic conduit. • LIU (Light Interfacing Unit) Box • Patch Cables RJ 45 / FO • Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p>

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> • Installation of all networking devices and Powering-up • Laying and connection of communication cables • Network Connectivity & network configuration. • FO cable testing for connectivity of SCADA communications equipments with OFC backbone • Testing & commissioning of above equipment
A.3.2	Firewall For North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj)	<p>Supply: This item includes the supply of Network Firewall/L3 Router for Web Server and Master clock interface and shall essentially include, but not limited to the following:</p> <ul style="list-style-type: none"> • Hardware Firewall/L-3 Router • Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of all networking devices and Powering-up • Network Connectivity & configuration of Firewall • Testing & commissioning of above equipment
A.3.3	Network Management System with LED Monitor for North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj) (including server, MS Office Professional/Equivalent, Antivirus Software & NMS Software) Lin Server mom	<p>Supply: One Set of Network Management System of electrical installations included in the scope of work, from the OCC.</p> <p>One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> • Set of Server • Basic Softwares (OS, All Drivers, MS office etc.) • NMS Software • Antivirus software with 5 years of license subscription from the date of commissioning. • 1 No. 24" LED Monitor with Keyboard and Mouse for set of servers • Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of Servers and Powering-up • Installation of all Softwares, updates & patches

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> • Network Connectivity & Network configuration/setup Testing & commissioning of above equipments
A.4	Server Rack for North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj)	Supply: This item shall include, but not limited to the following: <ul style="list-style-type: none"> • 19" Server Rack • Any other components/accessories required for completion of the works Erection & Commissioning: <ul style="list-style-type: none"> • Installation of server rack • Earthing of all SCADA equipments and rack
A.5	Equipment Room Furniture for North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj)	Supply: The item includes suitable and aesthetically designed furniture at SCADA server room. It shall essentially include but not limited to the following: <ul style="list-style-type: none"> • The Desk and set of drawers • Roller chairs • Any other components/accessories required for completion of the works Erection & Commissioning: <ul style="list-style-type: none"> • Installation of furniture Note: The contractor shall interface for the design and material to be used
A.6	Printers	
A.6.1	LaserJet B/W A4/A3 (For North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj))	Supply: This item shall include, but not limited to the following: <ul style="list-style-type: none"> • A4/A3 LaserJet printer – 1 No. • Any other components/accessories required for completion of the works Erection & Commissioning: <ul style="list-style-type: none"> • Installation of printer and powering up
A.6.2	LaserJet Colour A4/A3 (For North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj))	Supply: This item shall include, but not limited to the following: <ul style="list-style-type: none"> • A4/A3 LaserJet printer – 1 No. • Any other components/accessories required for completion of the works Erection & Commissioning: <ul style="list-style-type: none"> • Installation of printer and powering up
A.7	Auxiliary Power Feeding Distribution including cables, ACDBs and all	Supply:

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
	other accessories (For North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj))	<p>This item includes supply & wiring the input power supply to UPS and power distribution from UPS to all SCADA equipments and shall essentially include and but not limited to the following:</p> <ul style="list-style-type: none"> • Supply of power cables • Distribution board and sub distribution boards for power supply to various SCADA equipments and power outlets. • cable containment and any other accessories • Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of all distribution boards • Laying of input power cables to UPS and power distribution from UPS to all SCADA equipments in various rooms and in furniture. • Earthing of all SCADA equipment and Distribution boards
A.8	Stray Current Monitoring System for East West Corridor (Charbagh to Vasantkunj) (incl. central evaluation unit and stray current monitoring station and software)	<p>Supply:</p> <p>This includes supply of Stray current monitoring system complete with hardware and necessary software.</p> <p>The item shall include and but not limited to the following:</p> <ul style="list-style-type: none"> • 1 No. Central Evaluation System • Basic Softwares (OS, All Drivers, MS office etc.) • Antivirus software with 5 years of license subscription from the date of commissioning • 1 No. 24" LED Monitor with Keyboard and Mouse • Stray Current Monitoring Software • Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of Central Evaluation System and Powering-up • Installation of all Softwares, updates & patches • Network Connectivity & configuration/setup

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> SCMS Software configuration, Engineering and development Testing and commissioning of the system
A.9	SCADA Software and Portable Programming Devices for North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj)	<p>Supply: It shall include the supply of complete set of software with licenses for the concerned Line Main OCC.</p> <ul style="list-style-type: none"> Any other components/accessories required for completion of the works Portable Programming Devices <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of software in all servers, workstations and video wall controllers SCADA software configuration, Engineering and Development I/O signals testing and commissioning with field equipments
Supply, Erection, Testing & Commissioning of SCADA System at BCC for East West Corridor (Charbagh to Vasantkunj) of Lucknow Metro Rail Project		
B.1	Servers	
B.1.1	SCADA Communication Server (Standalone server) for East West Corridor (Charbagh to Vasantkunj) (including MS Office Professional & Antivirus Software)	<p>Supply: One Set of Server includes one standalone SCADA server needed for the control & monitoring of electrical installations included in the scope of work, from the BCC.</p> <p>One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> One SCADA Communication Server Basic Softwares (OS, All Drivers, MS office etc.) Antivirus software with 5 years of license subscription from the date of commissioning 1 No. 24" LED Monitor with Keyboard and Mouse Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of Server and Powering-up Installation of all Softwares, updates & patches Network Connectivity & Network configuration/setup Communication interface of Server over OFC backbone with RTUs

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> Testing & commissioning of above equipments
B.1.2	SCADA Database cum Application Server (Standalone server) for East West Corridor (Charbagh to Vasantkunj) (including MS Office Professional, Antivirus Software & External Bulk Storage for Data and Software Back-up System)	<p>Supply: One Set of Server includes one standalone SCADA server needed for storage & handling the complete database & for the control & monitoring of electrical installations included in the scope of work, from the BCC.</p> <p>One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> One SCADA Database cum Application Server Basic Softwares (OS, All Drivers, MS office etc.) RDBMS Software Antivirus software with 5 years of license subscription from the date of commissioning. 1 No. 24" LED Monitor with Keyboard and Mouse External bulk Storage Media facility (Network attached storage device) Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of Server and Powering-up Installation of all Softwares, updates & patches Network Connectivity & Network configuration/setup Testing & commissioning of above equipments
B.2	Communication Equipment	
B.2.1	Redundant SCADA LAN including managed switches, FO & LAN cables and all accessories for communication over Telecom Network for East West Corridor (Charbagh to Vasantkunj).	<p>Supply: This item includes the supply of redundant SCADA LAN in BCC for data exchange between various SCADA equipments (Servers, Workstations, Printers etc.) and integration with field RTUs with SCADA system over Telecom OFC backbone.</p> <p>One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> Layer-2, 16-Port Managed Ethernet Switch (Core Switch in Server Room) – 2 Nos. Redundant Fiber optic cable (Armoured, FRLS-0H) for SCADA system

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<p>communication at BCC and communication link from TER to SCADA control room.</p> <ul style="list-style-type: none"> • CAT 6 or latest communication cable (STP, Armoured, in case of cable laying outside the panel in a trench or cable tray) for connecting all concerned SCADA equipments in dual LAN network. • CAT 6 or latest communication cable (STP, Unarmoured, in case of cable laying inside a panel) for connecting all concerned SCADA equipments in dual LAN network. • If required communication cables shall be laid inside flexible metallic conduit. • LIU (Light Interfacing Unit) Box • Patch Cables RJ 45 / FO • Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of all networking devices and Powering-up • Laying and connection of communication cables • Network Connectivity & network configuration. • FO cable testing for connectivity of SCADA communications equipments with OFC backbone • Testing & commissioning of above equipment
B.2.2	Firewall for East West Corridor (Charbagh to Vasantkunj)	<p>Supply: This item includes the supply of Network Firewall/L3 Router for external interface and Master clock interface and shall essentially include, but not limited to the following:</p> <ul style="list-style-type: none"> • Hardware Firewall/L-3 Router • Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of all networking devices and Powering-up • Network Connectivity & configuration of Firewall

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> Testing & commissioning of above equipment
B.3	Server Rack East West Corridor (Charbagh to Vasantkunj)	<p>Supply: This item shall include, but not limited to the following:</p> <ul style="list-style-type: none"> 19" Server Rack Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of server rack Earthing of all SCADA equipments and rack
B.4	Equipment Room Furniture East West Corridor (Charbagh to Vasantkunj)	<p>Supply: The item includes suitable and aesthetically designed furniture at RSS Control room. It shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> The Desk and set of drawers Roller chairs Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of furniture <p>Note: The contractor shall interface for the design and material to be used</p>
B.5	Printers	
B.5.1	LaserJet Colour A4/A3 (for East West Corridor (Charbagh to Vasantkunj))	<p>Supply: This item shall include, but not limited to the following:</p> <ul style="list-style-type: none"> A4/A3 LaserJet printer – 1 No. Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of printer and powering up
B.6	Auxiliary Power Feeding Distribution including cables, ACDBs and all other accessories (for East West Corridor (Charbagh to Vasantkunj))	<p>Supply: This item includes supply & wiring the input power supply to UPS and power distribution from UPS to all SCADA equipments and shall essentially include and but not limited to the following:</p> <ul style="list-style-type: none"> Supply of power cables Distribution board and sub distribution boards for power supply to various SCADA equipments and power outlets. cable containment and any other accessories

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of all distribution boards Laying of input power cables to UPS and power distribution from UPS to all SCADA equipments in various rooms and in furniture. Earthing of all SCADA equipment and Distribution boards
B.7	SCADA Software for East West Corridor (Charbagh to Vasantkunj) & Portable Programmable devices	<p>Supply: It shall include the supply of complete set of software with licenses for the concerned Line BCC.</p> <ul style="list-style-type: none"> Any other components/accessories required for completion of the works Portable Programmable Devices <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of software in all servers and workstations SCADA software configuration, Engineering and Development I/O signals testing and commissioning with field equipments
Supply, Erection, Testing & Commissioning of RTUs For North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj) of Lucknow Metro Rail Project		
C.1	Supply and erection including testing and commissioning of RTU in Elevated ASS (Type 1)	<p>Supply: The Supply of RTU shall essentially include, but not limited to the following:</p> <ul style="list-style-type: none"> RTU Panel complete with internal wiring as per specifications and drawing Processor/CPU Card, Power Supply Card, Communication cards etc. all in redundant Hot-Standby configuration All applicable Input-Output modules & Transducers etc. Power Supply Converter & subsequent distribution inside panel Redundant OFC communication cables and accessories (LIU, FO Patch chords etc.) for linking RTU to TER Communication cables for interconnection with Relays (at designated port in switchgear panel), Energy meters

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> • 20% spare I/O signals capacity or min. 1 spare card shall be provided for each type of module ○ Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of RTU • Earthing connection of RTU with MET • Laying of redundant OFC communication cables from RTU to TER • Laying of communication cables for interconnection with relays, Energy meters • RTU Programming, Development of database, HMI, logics, events, alarms, interlockings and any other functional requirement under the technical specification etc. for the power installation & integration with OCC/BCC • I/O signals testing and commissioning with power supply equipments and integrated testing with OCC/BCC
C.2	Supply and erection including testing and commissioning of RTU in Elevated ASS cum TSS (Type 2)	<p>Supply: The Supply of RTU shall essentially include, but not limited to the following:</p> <ul style="list-style-type: none"> • RTU Panel complete with internal wiring as per specifications and drawing • Processor/CPU Card, Power Supply Card, Communication cards etc. all in redundant Hot-Standby configuration • All applicable Input-Output modules & Transducers etc. • Power Supply Converter & subsequent distribution inside panel • Redundant OFC communication cables and accessories (LIU, FO Patch chords etc.) for linking RTU to TER • Communication cables for interconnection with Relays (at designated port in switchgear panel), Energy meters • 20% spare I/O signals capacity or min. 1 spare card shall be provided for each type of module ○ Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p>

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> • Installation of RTU • Earthing connection of RTU with MET • Laying of redundant OFC communication cables from RTU to TER • Laying of communication cables for interconnection with relays, Energy meters • RTU Programming, Development of database, HMI, logics, events, alarms, interlockings and any other functional requirement under the technical specification etc. for the power installation & integration with OCC/BCC • I/O signals testing and commissioning with power supply equipments and integrated testing with OCC/BCC
C.3	Supply and erection including testing and commissioning of RTU in Underground ASS (Type 3)	<p>Supply: The Supply of RTU shall essentially include, but not limited to the following:</p> <ul style="list-style-type: none"> • RTU Panel complete with internal wiring as per specifications and drawing • Processor/CPU Card, Power Supply Card, Communication cards etc. all in redundant Hot-Standby configuration • All applicable Input-Output modules & Transducers etc. • Power Supply Converter & subsequent distribution inside panel • Redundant OFC communication cables and accessories (LIU, FO Patch chords etc.) for linking RTU to TER • Communication cables for interconnection with Relays (at designated port in switchgear panel), Energy meters • 20% spare I/O signals capacity or min. 1 spare card shall be provided for each type of module ○ Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of RTU • Earthing connection of RTU with MET • Laying of redundant OFC communication cables from RTU to TER • Laying of communication cables for interconnection with relays, Energy meters

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> RTU Programming, Development of database, HMI, logics, events, alarms, interlockings and any other functional requirement under the technical specification etc. for the power installation & integration with OCC/BCC I/O signals testing and commissioning with power supply equipments and integrated testing with OCC/BCC
C.4	Supply and erection including testing and commissioning of RTU in Underground ASS cum TSS (Type 4)	<p>Supply: The Supply of RTU shall essentially include, but not limited to the following:</p> <ul style="list-style-type: none"> RTU Panel complete with internal wiring as per specifications and drawing Processor/CPU Card, Power Supply Card, Communication cards etc. all in redundant Hot-Standby configuration All applicable Input-Output modules & Transducers etc. Power Supply Converter & subsequent distribution inside panel Redundant OFC communication cables and accessories (LIU, FO Patch chords etc.) for linking RTU to TER Communication cables for interconnection with Relays (at designated port in switchgear panel), Energy meters 20% spare I/O signals capacity or min. 1 spare card shall be provided for each type of module Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of RTU Earthing connection of RTU with MET Laying of redundant OFC communication cables from RTU to TER Laying of communication cables for interconnection with relays, Energy meters RTU Programming, Development of database, HMI, logics, events, alarms, interlockings and any other functional requirement under the technical specification etc. for the power installation & integration with OCC/BCC

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> I/O signals testing and commissioning with power supply equipments and integrated testing with OCC/BCC
C.5	Supply and erection including testing and commissioning of RTU in Depot (Type 5)	<p>Supply: The Supply of RTU shall essentially include, but not limited to the following:</p> <ul style="list-style-type: none"> RTU Panel complete with internal wiring as per specifications and drawing Processor/CPU Card, Power Supply Card, Communication cards etc. all in redundant Hot-Standby configuration All applicable Input-Output modules & Transducers etc. Power Supply Converter & subsequent distribution inside panel Redundant OFC communication cables and accessories (LIU, FO Patch chords etc.) for linking RTU to TER Communication cables for interconnection with Relays (at designated port in switchgear panel), Energy meters 20% spare I/O signals capacity or min. 1 spare card shall be provided for each type of module Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of RTU Earthing connection of RTU with MET Laying of redundant OFC communication cables from RTU to TER Laying of communication cables for interconnection with relays, Energy meters RTU Programming, Development of database, HMI, logics, events, alarms, interlockings and any other functional requirement under the technical specification etc. for the power installation & integration with OCC/BCC I/O signals testing and commissioning with power supply equipments and integrated testing with OCC/BCC
C.6	Supply and erection including testing and commissioning of RTU in RSS (Type 6)	<p>Supply: The Supply of RTU shall essentially include, but not limited to the following:</p>

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> • RTU Panel complete with internal wiring as per specifications and drawing • Processor/CPU Card, Power Supply Card, Communication cards etc. all in redundant Hot-Standby configuration • All applicable Input-Output modules & Transducers etc. • Power Supply Converter & subsequent distribution inside panel • Redundant OFC communication cables and accessories (LIU, FO Patch chords etc.) for linking RTU to TER • Communication cables for interconnection with Relays (at designated port in switchgear panel), Energy meters • 20% spare I/O signals capacity or min. 1 spare card shall be provided for each type of module <ul style="list-style-type: none"> ○ Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of RTU • Earthing connection of RTU with MET • Laying of redundant OFC communication cables from RTU to TER • Laying of communication cables for interconnection with relays, Energy meters • RTU Programming, Development of database, HMI, logics, events, alarms, interlockings and any other functional requirement under the technical specification etc. for the power installation & integration with OCC/BCC • I/O signals testing and commissioning with power supply equipments and integrated testing with OCC/BCC
D) SCADA Equipment at Vasantkunj RSS/AMS		

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
D.1	Local Workstation with LED Monitor (including MS Office Professional & Antivirus Software)	<p>Supply: This item shall include the supply of workstation needed for control and monitoring of sub-station equipment.</p> <p>One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> ○ One Workstation Computer ○ Basic Softwares (OS, All Drivers, MS office etc.) ○ Antivirus software with 5 years of license subscription from the date of commissioning ○ 1 no. 24" LED Monitor with wireless Keyboard and Mouse ○ Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> ○ Installation of local workstation and Powering-up ○ Installation of all Softwares, updates & patches ○ Network Connectivity & configuration/setup ○ Testing & commissioning of above equipments
D.2	Disturbance Recorder Workstation with LED Monitor	<p>Supply: This item shall include the supply of workstations needed for control, monitoring and protection functions specified, self-monitoring, signaling and testing facilities, measuring as well as memory functions, event recording and evaluation of disturbance records.</p> <p>One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> ○ One Workstation Computer ○ Basic Softwares (OS, All Drivers, MS office etc.) with DR functionality and relay configuration software ○ Antivirus software with 5 years of license subscription from the date of commissioning ○ 1 no. 24" LED Monitors with wireless Keyboard and Mouse ○ Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p>

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> Installation of DR workstation and Powering-up Installation of all Softwares, updates & patches Network Connectivity & configuration/setup <p>Testing & commissioning of above equipments</p>
D.3	LAN Switch	<p>Supply: This item shall include the supply of redundant Managed Ethernet switches and accessories for communication of bay level IEDs over IEC 61850 protocol. One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> Two nos. of managed LAN switches with IEC 61850 compliant Ethernet and FO ports Sufficient no. of Ports with minimum 50% of spare ports of each type Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of switches and Powering-up Network Connectivity and Network configuration/setup Testing & commissioning of above equipments
D.4	Furniture (including tables, chairs, almirahs, storewell racks, etc.)	<p>Supply: The item includes suitable and aesthetically designed furniture at Meeting Room, Incharge Room, Indoor & Outdoor Store Room and Maintenance room. It shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> The Desk and set of drawers Roller chairs Storage racks Almirahs Any other components/accessories required for completion of the works. <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of furniture Note: The contractor shall interface for the design and material to be used
D.5	Auxiliary Power Feeding Distribution including cables, ACDBs and all other accessories	<p>Supply: This item includes supply & wiring the input power supply to UPS and power distribution from UPS</p>

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<p>to all SCADA equipments and shall essentially include and but not limited to the following:</p> <ul style="list-style-type: none"> • Supply of power cables • Distribution board and sub distribution boards for power supply to various SCADA equipments and power outlets. • cable containment and any other accessories • Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of all distribution boards • Laying of input power cables to UPS and power distribution from UPS to all SCADA equipments in various rooms and in furniture. ○ Earthing of all SCADA equipment and Distribution boards
D.6	Local HMI Software	<p>Supply: It shall include the supply of Local HMI software with licenses for the local workstation at RSS.</p> <ul style="list-style-type: none"> ○ Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> • Installation of software in local workstation etc. • Software configuration, Engineering and Development <p>I/O signals testing and commissioning with field equipments at RSS level</p>
D.7	O&M Workstation with LED Monitor (including MS Office Professional & Antivirus Software)	<p>Supply: This item shall include the supply of workstation needed for UPMRC O&M and shall be connected on a separate office LAN.</p> <p>One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> ○ One Workstation Computer ○ Basic Softwares (OS, All Drivers, MS office etc.) ○ Antivirus software with 5 years of license subscription from the date of commissioning ○ 1 no. 24" LED Monitor with wireless Keyboard and Mouse

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.1)
		<ul style="list-style-type: none"> Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of O&M workstation and Powering-up Installation of all windows softwares, updates & patches
D.8	LaserJet B/W A4/A3 Printer	<p>Supply: This item shall include, but not limited to the following:</p> <ul style="list-style-type: none"> A4/A3 LaserJet printer – 1 No. Any other components/accessories required for completion of the works <p>Erection & Commissioning: Installation of printer and powering up</p>
D.9	Firewall/L3 Router	<p>Supply: This item includes the supply of Network Firewall/L3 Router for external interface and Master clock interface and shall essentially include, but not limited to the following:</p> <ul style="list-style-type: none"> Hardware Firewall/L-3 Router Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> Installation of all networking devices and Powering-up Network Connectivity & configuration of Firewall <p>Testing & commissioning of above equipment</p>

10.10 SCADA Annual Maintenance Contract

10.10.1 The Bill for SCADA AMC is presented in BoQ Bill No. 9.2.

10.10.2 Following notes are explanation of items under the Bill No. 9.2.

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.2)
Supply, Erection, Testing & Commissioning of SCADA System for North South (CCAP to MSPA) & East West Corridor (Charbagh to Vasantkunj) of Lucknow Metro Rail Project		
SCADA C-AMC		
A	SCADA AMC	Under this schedule the maintenance shall be performed according to the contract for 3 years after 2 years of DLP.

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.2)
A.1	Comprehensive AMC for 1-3 Years	The price shall include the comprehensive AMC cost of 3 years for all SCADA Hardware and software equipments supplied under this contract including OCC/BCC/RSS equipments i.e., servers, workstations, SCMS etc. and all the RTUs and associated components etc. installed at RSS/ASS/TSS/Depot.

10.11 Upgradation of SCADA at UPMRCL TRANSPORT NAGAR - RSS 1 and Munshi Pulia RSS 2 & BCC

10.11.1 The Bill for SCADA AMC is presented in BoQ Bill No. 9.3.

10.11.2 Following notes are explanation of items under the Bill No. 9.3.

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.3)
Up-gradation of SCADA System (Make-ABB) installed at BCC server room, TPNR RSS & MSPA RSS of Lucknow Metro		
1	Upgradation of SCADA at UPMRCL BCC Upgrade	<p>Supply: One Set of this item shall essentially include but not limited to the following:</p> <ul style="list-style-type: none"> ○ 19" Rack Mountable Server for SAS ○ 19" Rack Mountable DR Server ○ FE & BASE Server Software Up-gradation ○ NMS License ○ Tower type PC for Engineering Work station ○ Tower type PC for TPC Workstation ○ KVM Extender ○ Server Software Up-gradation for SAS system ○ One SCADA Communication Server ○ Ethernet switch ○ Backup recovery server/Auto tape loader ○ Backup recovery server license ○ Basic Softwares (OS, All Drivers, MS office etc.) ○ Antivirus software with 5 years of license subscription from the date of commissioning ○ 1 No. 24" LED Monitor with Keyboard and Mouse ○ Firewall ○ Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> ○ Installation of Server and Powering-up

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 9.3)
		<ul style="list-style-type: none"> ○ Installation of all Softwares, updates & patches ○ Network Connectivity & Network configuration/setup ○ Communication interface of Server over OFC backbone with RTUs ○ Testing & commissioning of above equipments
2	Upgradation of SCADA at UPMRCL TRANSPORT NAGAR - RSS 1 and Munshi Pulia RSS 2	<p>Supply: One Set of these items shall be essentially included for both RSSg but not limited to the following:</p> <ul style="list-style-type: none"> ○ 19" Rack Mountable Server for SAS ○ 19" Rack Mountable DR Server ○ NMS License ○ Tower type PC for O&M Work station ○ KVM Extender ○ Server Software Up-gradation for SAS system ○ One SCADA Communication Server ○ Ethernet switch ○ GPS Unit ○ Standalone Gateway and it's software ○ Basic Softwares (OS, All Drivers, MS office etc.) ○ Antivirus software with 5 years of license subscription from the date of commissioning ○ 1 No. 24" LED Monitor with Keyboard and Mouse ○ Firewall ○ Any other components/accessories required for completion of the works <p>Erection & Commissioning:</p> <ul style="list-style-type: none"> ○ Installation of Server and Powering-up ○ Installation of all Softwares, updates & patches ○ Network Connectivity & Network configuration/setup ○ Communication interface of Server over OFC backbone with RTUs <p>Testing & commissioning of above equipments</p>

10.12 General

10.12.1 The Bill for General requirement is presented in BOQ Bill Nos. 10.1. For detailed specifications, the Chapter 17 of TS and Tender Drawing shall be referred to.

10.12.2 Following are explanation of the items under these Bill Nos.:

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 10.1 – GENERAL)
A) Training of Employer's Staff		
A.1	Off Shore Training	<ul style="list-style-type: none"> • This item shall cover the Training of Employer's Staff as specified in GS and Chapter 10 of TS • It shall essentially include, but not limited to <ul style="list-style-type: none"> • Training plan • Training tools and staff wages • Training documentation • The price shall also include the cost of imparting training as well as advices thereafter • The price shall not include the travelling and accommodation cost of trainees
A.2	Training in India	<ul style="list-style-type: none"> • This item shall cover the Training of Employer's Staff as specified in GS and Chapter 10 of TS • It shall essentially include, but not limited to <ul style="list-style-type: none"> • Training plan • Training tools and staff wages • Training documentation • The price shall also include the cost of imparting training as well as advices thereafter • The price shall not include the travelling and accommodation cost of trainees • The Practical training on system products shall be organized at OEM or supplier's premises • Any theoretical training on system products shall be organized at Training room in UPMRC premises
B	Manuals	
B.1	Operation & Maintenance Manuals for East West Corridor Lines including RSS's	<ul style="list-style-type: none"> • This item shall cover the Maintenance & Operation Manuals as specified in GS & Chapter 8 of TS • One set of manuals shall include all Operations and Maintenance manuals pertaining to all equipment/systems which have been used / installed in the various Corridors along with the depot and RSS. • The documents shall be supplied in Five hard copies along with soft copy . • All the Operation and Maintenance manuals shall be submitted to the Engineer in charge for approval.
C	Maintenance Supervision	<ul style="list-style-type: none"> • This item shall cover the Maintenance supervision for defect liability period (which is for 2 years after successful commissioning) as specified in GS and Chapter 8 of TS of Employer's requirement. • The role of the relevant and experienced Employers will be to ensure that the maintenance during this period is carried out by the employer's staff properly and that the

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 10.1 – GENERAL)
		<p>warranty/guaranty obligations of the Contractor remains undiluted.</p> <ul style="list-style-type: none"> For this purpose, the Contractor shall provide a Competent Supervision Organisation, as mutually agreed between the Employer/Engineer and Contractor and as specified in GS/TS.
D	Integrated testing & commissioning	
D.1	RSS/AMS	<ul style="list-style-type: none"> This item shall cover the Integrated Testing & Commissioning as specified in GS and Chapter 7 of TS of Employer's requirement. The integrated testing and commissioning shall be done in phases as per the commissioning schedules of different section as prescribed in TS. The Integrated Testing & Commissioning shall essentially include, but not limited to: <ul style="list-style-type: none"> ➤ Integrated testing & commissioning plan ➤ Tools, instruments, tackles, and documents required; ➤ Providing attendance to the Employer, including during inspection by statutory Authorities, Ministry of Railways and Commissioner of Railway safety. ➤ Carrying out the appropriate integrated testing & commissioning functions.
D.2	Corridor including Depot	<ul style="list-style-type: none"> This item shall cover the Integrated Testing & Commissioning as specified in GS and Chapter 7 of TS of Employer's requirement. The integrated testing and commissioning shall be done in phases as per the commissioning schedules of different section as prescribed in TS. The Integrated Testing & Commissioning shall essentially include, but not limited to: <ul style="list-style-type: none"> ➤ Integrated testing & commissioning plan ➤ Tools, instruments, tackles, and documents required; ➤ Providing attendance to the Employer, including during inspection by statutory Authorities, Ministry of Railways and Commissioner of Railway safety. ➤ Carrying out the appropriate integrated testing & commissioning functions.

Item No.	BOQ Item Description	Explanation (BOQ Bill No. 10.1 – GENERAL)
E.1	Tools and plants	<ul style="list-style-type: none"> The price, under this item, shall include the cost of supplying special tools, plant and equipment for maintenance and/or routine repairs as listed in Chapter 9 of TS of Employer's Requirements with detailed price breakup for each item.
F.1	Spares	<ul style="list-style-type: none"> The price under this item shall include the cost of supplying spare parts, as listed in Chapter 9 of TS of Employer's Requirements with detailed price breakup for each item.
G.1	Deleted	Deleted
H.1	Deleted	Deleted

10.13 Miscellaneous Items

10.13.1 The Bill of Quantity for Miscellaneous Items is presented in BOQ Bill Nos. 11.1 For detailed specifications, the Chapter 14 of TS and tender drawing shall be referred to.

10.13.2 Following are explanation of the items under these Bill Nos.:

Item No.	Work Description	Explanation (BOQ Bill Nos. 11.1– Misc Items)
A.1	Cable Support Bracket	
	Cable Support brackets for other System contractor for elevated section as per specification and drawings	<p>Supply:</p> <p>The price shall cover the cost of supply of the following but not limited to:</p> <ul style="list-style-type: none"> Cable support bracket along the viaduct both UP & DN track, side line, ramp area (up to the scope of viaduct contractor) in the elevated section as per the specifications and drawings for laying the 33kV HT cables, signalling, telecom and other systems cables as per the specifications and drawings provided <p>Erection Testing& Commissioning:</p> <ul style="list-style-type: none"> Laying, erection, testing & commission of Cable support bracket along the viaduct and fittings in complete Other components for completion of job as per specifications and drawings
A.2	Viaduct Lighting for elevated section	

Item No.	Work Description	Explanation (BOQ Bill Nos. 11.1– Misc Items)
	Viaduct Light fittings & associated accessories including cable for feeding viaduct lights.	<p>Supply:</p> <p>The Price shall cover the cost of Supply of light fittings including all accessories in the elevated section along the side line, ramp (upto the scope of viaduct contractor) area viaduct both UP and DN tracks.</p> <ul style="list-style-type: none"> • e.g., lamps, holders, surface/recess mounting arrangement etc. • including necessary supports, Cabling, accessories and hardware as per specifications & as required at site • The price shall also include the cost of supplying Cables and cable connection/termination kit from the appropriate station panel, suitable for carrying the current required by the Lighting arrangement. The cable should be designed for carrying a continuous rated current of lighting load, after considering the de-rating factors, as applicable. • Other components for completion of job as per specifications and drawings <p>Erection:</p> <ul style="list-style-type: none"> • Laying, erection, testing & commission of light fittings with accessories as above in complete <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing and Commissioning
A.3	Viaduct Socket for elevated Section	
	Viaduct Sockets & associated Fittings including cable for feeding viaduct sockets.	<p>Supply:</p> <p>Power Sockets, cables and associated fittings. The price shall cover the cost of supply of the following but not limited to:</p> <ul style="list-style-type: none"> • 16A sockets in a lockable enclosure IP65 and suitable fixing arrangement, placed along on • one side of the viaduct, side line, ramp area (upto the scope of viaduct contractor). <p>The price shall cover the cost of design, supply erection, testing & commissioning of providing the following but not limited to:</p>

Item No.	Work Description	Explanation (BOQ Bill Nos. 11.1– Misc Items)
		<ul style="list-style-type: none"> • Cables and cable connection/termination from the appropriate station panel, suitable for • carrying the current required by the 16A sockets, 3-phase. The cable should be designed for carrying a continuous rated current of 32A, after considering the de-rating factors, as applicable. • Other components for completion of job as per specifications and drawings <p>Erection/Installation:</p> <ul style="list-style-type: none"> • Laying, erection, testing & commission of viaduct sockets & associated cables and fittings in complete <p>Testing & Commissioning:</p> <ul style="list-style-type: none"> • Testing and commission.
A.4	<p>Inverter Supply and erection including testing and commissioning of 1 MW inverter set in TSS, complete</p>	<p>Supply:-</p> <ul style="list-style-type: none"> • 01No. Inverter set with all necessary accessories • Protection relays as per specification • Current and voltage sensors device for measurement and protection • Castle Locks, Fittings & other components for completion of Job as per specifications and drawings • Floor insulation mats of appropriate voltage rating for placement of DC equipments. • Protections & Interlocks. <p>Erection/Installation:</p> <ul style="list-style-type: none"> • Erection of all above equipment <p>Testing & Commissioning Testing & commissioning of all above equipment</p>
A.5	<p>Portable SCD: 20nos. Light weight Portable Short circuiting device along with detectors for short circuiting third rail in complete with rating of 100Ka in 35msec</p>	<p>Supply:</p> <ul style="list-style-type: none"> • Portable SCD and VD for short circuiting third rail along with all necessary accessories as per specifications <p>Erection/Installation:</p> <ul style="list-style-type: none"> • Erection of all above equipment

Item No.	Work Description	Explanation (BOQ Bill Nos. 11.1– Misc Items)
		Testing & Commissioning <ul style="list-style-type: none"> Testing & commissioning of all above equipment
A.6	RSS/TSS/ASS manning	
A.6.1	Skilled supervisor	Provision of skilled supervisor as per specification.
A.6.2	Skilled worker	Provision of skilled worker as per specification.
A.6.3	Unskilled worker	Provision of unskilled worker as per specification.
		Note: Manning will be provided for monitoring the Substations, switching operations, application of SCDs, issue of power blocks as per requirement during train testing, ITC.

10.14 Design

10.14.1 The Bill of Quantity for Design Items is presented in BOQ Bill Nos. 12.1.

10.14.2 Following are explanation of the items under these Bill Nos.:

Item No.	Work Description	Explanation (BOQ Bill Nos. 12.1)
A	Design	
A.1	Verification of Preliminary design of Traction & Power Supply System for East West Corridor	Verification of preliminary design of Power supply & Distribution system, 750 V DC Traction Electrification and SCADA system including 33kV Receiving Sub Station/Auxiliary Main Substation and Depot for East West corridors for Lucknow Metro Rail Project of UPMRCL as specified in ERTS and tender drawings such that the tentative capacities, ratings and quantities of equipment. Design Submittals as per Chapter-2
A.2	Final Design of Traction & Power Supply System for East West Corridor	Final design of Power supply & Distribution system, 750 V DC Traction Electrification and SCADA system including 33kV Receiving Sub Station /Auxiliary Main Substation and Depot for East West corridors for Lucknow Metro Rail Project of UPMRCL. Design Submittals as per Chapter-2
A.3	Detailed Design of all equipment of 33kV Receiving Cum Auxiliary Main Substation including associated Cabling for East West Corridor	Detailed design of Electrical and Civil Works of Receiving / Auxiliary Main Substation including associated cabling, 33kV Switchgear, control Panel, Power

Item No.	Work Description	Explanation (BOQ Bill Nos. 12.1)
		<p>Transformer, 33kV Switchgear, Auxiliary Transformer, Earthing, battery and battery charger, ACDB, DCDB, UPS such that it meets the operational, functional, performance requirement as defined in Chapter-2 of ERTS. Design Submittals shall include but not limited to:</p> <ul style="list-style-type: none"> • Design calculations • Cable route plan, cable trench cover drawings, Design calculation of sheath voltages and finalization of cross-bonding requirement. • Measurement of Soil Resistivity • Design of Earth mat • Detailed substation layout drawing along with the equipment drawing • RSS/AMS civil design: Detailed design for the AMS & Control Room Building, including Architectural Services, Civil and Structural Designs, Lighting, Ventilation and Air-conditioning. Detailed design shall include layout drawings, design calculations etc. • RSS/AMS civil drawings inclusive of but not limited to General arrangement (layout and elevation); Structures and sub-structures, Foundations, Drainage (Covered type), Networks (Water, sewage, etc.), Baffle walls, Boundary walls. • Earthing arrangement • Interlocking requirements • Protection philosophy including proper relay coordination • Wiring diagrams & cable termination details • Schematic diagrams • Elevation drawings • Temperature rise data
A.4	Detailed Design of all equipment of 33/0.415kVAuxiliary Substation including associated Cabling for East West Corridor-	Detailed design Auxiliary Substation including associated cabling, GIS Switchgear, AIS Switchgear, Auxiliary Transformer, Battery and battery charger, ACDB, DCDB, ETS such that it meets the operational, functional, performance requirement as defined in Chapter-2 of ERTS. Design Submittals shall include but not limited to:

Item No.	Work Description	Explanation (BOQ Bill Nos. 12.1)
		<ul style="list-style-type: none"> • Design calculations • Earthing arrangement • Layout drawing • Interlocking requirements • Protection philosophy • Wiring diagrams & cable termination details • Schematic diagrams • Elevation drawings • Temperature rise data
A.5	Detailed Design of all equipment of 750V DC Traction Substation including associated Cabling and Inverter Configuration as and where applicable for East West Corridor	<p>Detailed design of Traction Substation including associated AC/DC cabling, Rectifier Transformer, Rectifier, LV Bus Duct, HSCB, track side disconnect Switches, NRP, Motorised Short circuit and earthing panel, OVPD, frame connections, HDPE pipe, portable SCD and inverter configuration (inverter, inverter T/F and associated switchgear) as and where applicable, such that it meets the operational, functional, performance requirement as defined in Chapter-2 of ERTS. Design Submittals shall include but not limited to:</p> <ul style="list-style-type: none"> • Design calculations • Earthing arrangement • Layout drawing • Interlocking requirements • Protection philosophy • Wiring diagrams & cable termination details • Schematic diagrams • Elevation drawings • Temperature rise data
A.6	Detailed Design of all equipment of 750 V DC Third Rail System including sectioning arrangements and DC disconnect switch locations for Main Line & Depot including Stinger System for East West Corridor	<p>Detailed design of Third rail System including associated assemblies, conductor rail, splice joint assembly, UPVC/GRP Cover, expansion joint assembly, High Speed Ramp, Low Speed Ramp, insulated support assembly, Mid-Point Anchor assembly, Power feed Assembly DC disconnect switch location for mainline and depot including stinger system such that it meets the operational, functional, performance requirement as defined in Chapter-2 of ERTS. Design submittals shall include but not limited to:</p> <ul style="list-style-type: none"> • Sectioning plan • Design Calculations

Item No.	Work Description	Explanation (BOQ Bill Nos. 12.1)
		<ul style="list-style-type: none"> • Drawings / specifications / manuals to describe the component, to explain the installation and maintenance and to calculate the maximum section lengths • Gap study for gap types to be used based on train configuration but also placement of current collector shoes at individual cars. • Minimum / maximum gap length in tangent tracks and at turnouts of different types • Ramp types • Clearance gauge of a support with respect to the vehicle outline and its movements during operation
A.7	Detailed Design of all equipment of SCADA system including Stray Current Monitoring System for East West & North South Corridor	<p>Detailed design of SCADA System and Stray current control monitoring system such that it meets the operational, functional, performance requirement as defined in Chapter-2 of ERTS. Design Submittals shall include but not limited to:</p> <ul style="list-style-type: none"> • Overall SCADA architecture of corridor-1&2 including RSS-1&2 and both Depot • Detailed SCADA architecture of OCC, BCC, RSS and SCMS • SCADA layout of all SCADA equipment as and where applicable • Logics and interlocking • Control Transfer Philosophy • Power Supply arrangements of all SCADA equipment • Firewall settings • RTU GA drawings and wiring schemes • ETS logics and drawing.
A.8	Detailed Design of Earthing & Bonding Arrangement, Stray Current Control, Platform Insulation Membrane and EMC Requirement for East West Corridor	<p>Detailed design of earthing, bonding, stray current management system and EMC requirements such that it meets the operational, functional, performance requirement as defined in Chapter-2 of ERTS . Design submittals shall include but not limited to:</p> <ul style="list-style-type: none"> • Detailed report and the integrated earthing and bonding drawing • Stray current survey and the engineering drawings for stray current control and longitudinal connectivity

Item No.	Work Description	Explanation (BOQ Bill Nos. 12.1)
		<ul style="list-style-type: none"> Detailed drawing of Platform insulation membrane detailed engineering drawings for installation of track cross bonds EMC studies
A.9	As built drawings for East West Corridor Lines including Vasantkunj RSS	<ul style="list-style-type: none"> This item shall cover the cost of supplying As-Built drawings, as specified in GS and Chapter 6 of TS, for each of the corridors included in this bill It shall essentially include, but not limited to <ul style="list-style-type: none"> ➤ As built drawings depicting the completed works that have been certified as complete ➤ Shop drawings containing information related to the permanent works ➤ Working drawings containing the information related to the temporary works depicting the construction of permanent works <p>Any other as built drawing (if required) shall also be provided.</p>
B	General Requirements	
B.1 to B.9	Various submissions	Submission of these documents / plan / program as per the details provided in GS & TS (as relevant). Updating these documents in line with progress of the project, and as per the requirements elaborated in specifications and as required.