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Tender No.: HORC/HRIDC/C-2/2022 **Date: 29.07 .2022**

Reference: Specific Procurement Notice dated 18.06.2022.

CORRIGENDUM NO. 5

Name of Work: C-2: Composite Contract Package in connection with laying of New BG Double Railway Line of HORC project for:

(i)Design and Construction of Civil Works (Earthwork, Bridges, Station Buildings, Retaining Walls and other miscellaneous Works) from Km 55.60 to Km 61.50 and its connectivities to IR network from New Patli to Patli & New Patli to Sultanpur including modifications in Sultanpur station yard,

(ii) Design, Supply, Installation, Testing & Commissioning of OHE (1x25 kV) and General Electrical services from Km 49.70 to Km 61.50 and its connectivities to IR network from New Patli to Patli & New Patli to Sultanpur including modifications in Sultanpur station yard and

(iii) Design, Supply, Installation, Testing & Commissioning of Signalling & Telecommunication from Km 49.70 to Km 61.50 and its connectivities to IR network from Manesar to Patli and New Patli to Patli & New Patli to Sultanpur including modifications in Patli and Sultanpur station yards.

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
1.	Part 1, Section II, TDS, Sub-Clause ITT 4.1	**Add the following after the last sentence of Clause 4.1** If JV/Consortium is permitted to participate in the Tender, Lead Member must have majority share participation in the JV. No change in constitution or percentage share shall be permitted at any stage after the Tender submission, failing which the Tenderer shall be treated as non-responsive. Authorized Representative of JV/Consortium shall be from Lead Member of JV/Consortium.	Deleted
2.	Part 1, Section II, TDS, Sub-Clause ITT 4.4	**Add the following after the last sentence of Clause 4.4** In the event that the Contract is awarded to a foreign Tenderer or to a JV/Consortium having foreign lead Member, such foreign	**Add the following after the last sentence of Clause 4.4** In the event that the Contract is awarded to a foreign Tenderer, such foreign Tenderer shall be required to set up a project

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
		Tenderer/foreign lead Member shall be required to set up a project office in India in accordance with Applicable Laws in India, and shall be required to submit a proof of having opened a project office in India along with statutory approvals, if any, prior to submitting any interim payment certificate in accordance with the Contract, failing which no payment shall be made to the Contractor by the Employer (in accordance with the Contract) until such requirement has been complied with by the foreign Contractor. The aforesaid condition of establishing a project office in India shall not be applicable in case the selected Tenderer is a joint venture between an Indian entity and a foreign entity where Indian Member is lead Member.	office in India in accordance with Applicable Laws in India, and shall be required to submit a proof of having opened a project office in India along with statutory approvals, if any, prior to submitting any interim payment certificate in accordance with the Contract, failing which no payment shall be made to the Contractor by the Employer (in accordance with the Contract) until such requirement has been complied with by the foreign Contractor.
3.	Part 1, Section III, Evaluation and Qualification Criteria, Checklist	**Checklist-CL**	The existing Checklist-CL in Section III: Evaluation and Qualification Criteria is replaced with Checklist-CL/R1 and is annexed as **Attachment 1** of this Corrigendum No. 5
4.	Corrigendum No. 3, Attachment No.1, Appendix B to Financial Part: Price Schedules/R1: Clause No.1 1 to Clause No. 4	1- Preamble 2- Measurement and Payment 3-Procedure for Payment 4- Methodology for Claiming Payment	Clause 1- Preamble *Clause 2- Variations in Schedule 'A', Schedule 'B' and Schedule 'C'* Clause 3- Measurement and Payment Clause 4- Methodology for Claiming Payment Detailed description of revised Clauses is annexed as **Attachment 2** of this Corrigendum No. 5
5.	Part 2, Employer's Requirements, Section VII 2: Functional	Section VII 2: Functional (Civil)	The existing Section VII 2: Functional (Civil) is replaced with Section VII 2: Functional (Civil) /R1 and is annexed as **Attachment 3** of this Corrigendum No. 5

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
6.	Part 2, Employer's Requirements, Section VII 4: Construction (Civil), Sub-Clause 2.1 a)	**UTILITIES** a) Refer Employer's Requirements - Functional and Appendix-12 of Employer Requirements.	**UTILITIES** a) Refer Employer's Requirements – Functional *(Civil)* and *Appendix-10* of Section VII-12: Appendices, Employer's Requirements.
7.	Part 2, Employer's Requirements, Section VII 4: Construction (Civil), Sub-Clause 2.3 a)	**SITE LABORATORIES** a) The Contractor shall provide, erect and maintain in a clean, stable and secure condition a laboratory, equipped for the routine testing of cement, aggregate, concrete and soil samples and for the storage and curing of concrete cubes or cylinders only. This laboratory shall be located at the Contractor's principal work site or at a location agreed to by the Engineer. Detailed requirements for this laboratory are set out in Appendix 14 to these Employer's Requirements.	**SITE LABORATORIES** a) The Contractor shall provide, erect and maintain in a clean, stable and secure condition a laboratory, equipped for the routine testing of cement, aggregate, concrete and soil samples and for the storage and curing of concrete cubes or cylinders only. This laboratory shall be located at the Contractor's principal work site or at a location agreed to by the Engineer. Detailed requirements for this laboratory are set out in *Appendix 12* to these Employer's Requirements.
8.	Part 2, Employer's Requirements, Section VII 4: Construction (Civil), Sub-Clause 4.2 a)	**PROGRESS PHOTOGRAPHS** **a)** The Contractor shall provide monthly progress photographs which have been properly recorded to show the progress of the works to the Engineer. The photographs shall be taken on locations agreed with the Engineer to record the exact progress of the Works.	**PROGRESS PHOTOGRAPHS *AND VIDEOGRAPHY*** **a)** The Contractor shall provide monthly progress photographs *and Videography by drone* which have been properly recorded to show the progress of the works to the Engineer. The photographs shall be taken on locations agreed with the Engineer to record the exact progress of the Works. *Videography by drone for the Works shall be carried out every month and submitted to the Engineer.*
9.	Part 2, Employer's Requirements,	**a)** Materials and goods for inclusion in the Permanent Works shall be new unless the Engineer has consented otherwise. Preference	**a)** Materials and goods for inclusion in the Permanent Works

<table>
<tr><th>S. No.</th><th>Tender Document Part / Section/ Clause No.</th><th>Description of Existing Clause</th><th>Modified Description of Existing Clause / New Clause</th></tr>
<tr><td></td><td>Section VII 4: Construction (Civil), Sub-Clause 5 a)</td><td>shall be given to local materials where available. Approved Manufacturers/Suppliers of few important items have been given in Appendix 10 of this document. These materials shall be procured only for these manufacturers/Suppliers.</td><td>shall be new unless the Engineer has consented otherwise. Preference shall be given to local materials where available. Approved Manufacturers/Suppliers of few important items have been given in Section VII-11: Tender Drawings and Documents. These materials shall be procured only for these manufacturers/Suppliers.</td></tr>
<tr><td>10.</td><td>Part 2, Employer’s Requirements, Section VII 4: Construction (Civil), Sub-Clause 8.1(b)</td><td>8.1(b), Static Inspection</td><td>The existing Sub-Clause 8.1(b), Static Inspection is replaced and is annexed as Attachment 4 of this Corrigendum No. 5</td></tr>
<tr><td>11.</td><td>Part 2, Employer’s Requirements, Section VII 4: Construction (Civil), Attachment C-2, S. No. 6</td><td><table><tr><th>DESIGNATION</th><th>QUALIFICATION</th><th>EXPERIENCE LEVEL</th></tr><tr><td>Civil Engineer (Station)</td><td>Graduate or Diploma in Civil Engineering</td><td>Minimum total experience of years for out of which a 2 year experience in relevant field in Infrastructure projects.</td></tr></table></td><td><table><tr><th>DESIGNATION</th><th>QUALIFICATION</th><th>EXPERIENCE LEVEL</th></tr><tr><td>Civil Engineer (Station)</td><td>Graduate or Diploma in Civil Engineering</td><td>Minimum total experience of 5 years for Degree & 8 years for Diploma out of which 2 year experience in relevant field in Infrastructure projects.</td></tr></table></td></tr>
<tr><td>12.</td><td>Part 2, Employer’s Requirements,</td><td>q) The embankment on approaches of bridges shall be protected by stone pitching/CC blocks of suitable sizes, over 15cm thick</td><td>q) The embankment on approaches of bridges shall be protected by stone pitching/CC blocks of suitable sizes,</td></tr>
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S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
	Section VII 5: Outline Design Specifications (ODS), Sub-Clause 2.8 q)	consolidated gravel bed, encased in cast in-situ RCC grid frames of suitable cross section having opening size of 3mX3m, for a length of 30m for major bridges & 15m for RCC boxes. Toe wall shall be provided at the end of the embankment slope. Adequate drainage arrangement shall also be provided.	over 15cm thick consolidated gravel bed, encased in cast in-situ RCC grid frames of suitable cross section having opening size of *approximately 1.75m x 1.75m*, for a length of 30m for major bridges & 15m for RCC boxes. Toe wall shall be provided at the end of the embankment slope. Adequate drainage arrangement shall also be provided.
13.	Part 2, Employer's Requirements, Section VII 5: Outline Design Specifications (ODS), Sub-Clause 3.3 a)	a) A minimum side slope of 2H:1V for embankment shall be adopted up to 6m height. For higher embankments (more than 6m height.), the slopes shall be designed, however side slope shall not be steeper than 2H:1V.	a) A minimum side slope of 2H:1V for embankment shall be adopted up to *4m* height. For higher embankments (more than *4m* height.), the slopes shall be designed, however side slope shall not be steeper than 2H:1V.
14.	Part 2, Employer's Requirements, Section VII 5: Outline Design Specifications (ODS), Sub-Clause 4.3 a) xi.		**Add new Sub-Clause 4.3 a) xi at the end of Sub-Clause 4.3 a) x** *xi) Pile foundation shall be provided in abutment of Bridge No. 136 (1x18.3 +1x76.2 +1x18.3) at Ch.55.719.*
15.	Part 2, Employer's Requirements, Section VII 5: Outline Design Specifications (ODS), Sub-Clause	v. Amenities for persons with disability (PwD) shall be provided as per as per extant Railway Board instructions/guidelines. All platforms shall be accessible for disabled passenger on wheelchair.	v. Amenities for persons with disability (PwD) shall be provided as per as per extant Railway Board instructions/guidelines. All platforms shall be accessible for disabled passenger on wheelchair. *Tactile tiles shall be provided on platforms, subway, entry & exit and other places to guide the visually impaired person as per the Railway Board guidelines.*

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
	5.3 c) v, Other requirements		
16.	Part 2, Employer's Requirements, Section VII 5: Outline Design Specifications (ODS), Sub-Clause 5.3 c) viii, Other requirements	viii. Connecting road from entrance of each station to the existing public road for providing road access to the station. All the internal roads within the station area and connecting road to nearest existing public road shall be at least single double lane bituminous road with 1.5m wide footpath and side drain.	viii. Connecting road from entrance of each station to the existing public road for providing road access to the station. All the internal roads within the station area and connecting road to nearest existing public road shall be *of cement concrete double/single lane with 1.0 m wide foot path and side/cross drains as shown in tender drawings. The roads shall be designed for 450 commercial vehicle /day & for a design period of 30 years or more as per IRC:58-2015.*
17.	Part 2, Employer's Requirements, Section VII 5: Outline Design Specifications (ODS), Sub-Clause 5.3 c) xii, 2nd bullet point, Other requirements	• Platform surface shall be smooth and provided with Vacuum de watered concrete (VCD) flooring.	• Platform surface shall be smooth and provided with *fiber reinforced* Vacuum de watered concrete *(VDC)* flooring.
18.	Part 2, Employer's Requirements, Section VII 5: Outline Design Specifications (ODS), Sub-Clause 5.3 c) xiii	-	**Add new Sub-Clause 5.3 c) xiii at the end of Sub-Clause 5.3 c) xii** *xiii Subway for inter-platform transfer including stairs and lift*

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19.	Part 2, Employer's Requirements, Section VII 5: Outline Design Specifications (ODS), Sub-Clause 5.4 u)	-	**Add new Sub-Clause 5.4 u) at the end of Sub-Clause 5.4 t)** *u) SUBWAY FOR INTER-PLATFORM TRANSFER* *Subway shall be designed to cater DFC loading (32.5T) from the tracks along with the other loads from the platform. It shall be placed on firm bed (strata)/pile foundation to avoid the settlement/differential settlement. The requirements/criteria laid down in clause 4.1 & 4.2 for the design of Box bridges shall be followed for the design of Subway. Lift well in the subway shall be founded on firm strata.*
20.	Part 2, Employer's Requirements, Section VII 5: Outline Design Specifications (ODS), Sub-Clause 6.2	**6.2 Details of Structures to be designed** The Contractor shall design the retaining walls of various heights that are required in C2 Package. Retaining wall is required to be provided at some of the locations along the alignment due to limited availability of ROW. On LHS (i.e. on KMP side) of main line, no retaining wall shall be provided. Further, some additional land is proposed to be acquired along the alignment. In case additional land is made available before undertaking the construction, provision of retaining wall shall be deleted and earthen slope shall be provided at that location. Cost of additional earthwork due to provision of slope shall be paid under the Schedule B. Precast retaining walls shall be used up to 6m height (height above the ground level). Beyond 6m height, cast in situ retaining wall may be used. Reinforced Earth wall (RE wall) shall not be permitted.	**6.2 Details of Structures to be designed** The Contractor shall design the retaining walls of various heights that are required in C2 Package. Retaining wall is required to be provided at some of the locations along the alignment due to limited availability of ROW. *Retaining wall shall be located at the edge of ROW.* On LHS (i.e. on KMP side) of main line, no retaining wall shall be provided *except at locations where private land falls between HORC ROW and KMP ROW*. Further, some additional land is proposed to be acquired along the alignment. In case additional land is made available before undertaking the construction, provision of retaining wall shall be deleted and earthen slope shall be provided at that location. Cost of additional earthwork due to provision of slope shall be paid under the Schedule B. Precast retaining walls shall be used up to *2m* height (height above the ground level). Beyond 2m height, cast in situ retaining wall may be used.

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			Reinforced Earth wall (RE wall) shall not be permitted.
21.	Part 2, Employer's Requirements, Section VII 6: Outline Construction Specifications (OCS) – Civil, Sub-Clause 2.1		**Add the following at the end of Sub-Clause 2.1** *Boulder backing and backfill behind retaining wall shall be provided after completing the earthwork upto the height of retaining wall with mechanical compaction in layers and thereafter cutting the earthwork in required profile.*
22.	Part 2, Employer's Requirements, Section VII 6: Outline Construction Specifications (OCS) – Civil		*New Chapter -6: Roadwork has been added at the end of Chapter -5 in Section VII 6: Outline Construction Specifications (OCS) – Civil and is annexed as **Attachment 5** of this Corrigendum No. 5.*
23.	Part 2, Employer's Requirements, Section VII -7: Particular Specifications (PS)-OHE and General Electrical Services	Section VII-7, Particular Specifications (PS)-OHE and General Electrical Services	The existing Section VII-7, Particular Specifications (PS)-OHE and General Electrical Services is replaced with Section VII-7, Particular Specifications (PS)-OHE and General Electrical Services/R1 and annexed as **Attachment 6** of this Corrigendum No. 5.
24.	Part 2, Employer's Requirements,		New List of Charted utilities for Signalling works at existing Patli station of IR has been added to Section VII -11: Tender

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
	Section VII -11: Tender Drawings and Documents		Drawings and Documents and annexed as **Attachment 7** of this Corrigendum No. 5.
25.	Part 2, Employer's Requirements, Section VII -12: Appendices, Appendix 15B and Appendix 15C	-	New Appendix 15 B- Jurisdictional Sketch for Civil, S&T and Electrification Works of C-2 Package, Appendix 15C- General Power Supply Cum Sectioning Diagram for New Patli to Manesar Section and Appendix 15D- Layout Plan (LOP) for Sultanpur (incl.) to FarukhNagar (excl.) of existing OHE have been added to Section VII-12 Appendices and are annexed as **Attachment 8** of this Corrigendum No. 5.
26.	Part 2, Employer's Requirements, Section VII -12: Appendices, Appendix 2, Note 4	Electrical Part 2 work includes Electrification work of New Patli Station/ Yard, Sultanpur Station/yard, New Patli to Sultanpur block section, New Patli to Manesar block section, New Patli & Sultanpur switching Posts (2 Nos SSP & 01 No SP respectively), General Services work for New Patli, Sultanpur Station Building /Yard area and SCADA work at Sultanpur SP.	Electrical Part 2 work includes Electrification work of New Patli Station/Yard, *New Patli to Sultanpur connectivity*, Sultanpur Station/yard *(OHE Modification and Electrification)*, New Patli to *Badsa (Excl.) Double Main line Section*, New Patli & Sultanpur switching Posts (2 Nos. SSP & 01 No. SP respectively), General Services work for New Patli, Sultanpur Station Building /Yard area and SCADA work at Sultanpur SP.
27.	Part 2, Employer's Requirements, Section VII-9: – Particular Specifications (PS)- Signalling, Sub-Clause 1.4	1.4 SCOPE OF WORKS The Signalling works shall meet all the requirements as defined in the Particular Specifications. However brief scope is given below: - (1) Design, Supply, Installation, Testing, and Commissioning of the Signalling works at the following two Junction stations of HORC: Manesar Jn. and New Patli Jn. The Signalling System shall include, but not be limited to, the Sub-systems namely Distributed	1.4 SCOPE OF WORKS *1.4.1* The Signalling works shall meet all the requirements as defined in the Particular Specifications. However brief scope *of work covered under Schedule A* is given below: - (1) Design, Supply, Installation, Testing, and Commissioning of the Signalling works at the following two Junction stations of HORC: Manesar Jn. and New Patli Jn. The Signalling System shall

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		architecture with object controllers of EI for Signalling interlocking System, MSDAC for track vacancy detection System, IPS for Power supply System, Absolute Block System of working with Block proving with Axle counter (BPAC) and Remote Diagnostic and Predictive Maintenance (RDPM) using Data logger system for remote monitoring management. (2) Design, Supply, Installation, Testing, and Commissioning of the Signalling works at two IR stations: Patli (NR) (Phase-1 & 2) and Sultanpur. The Signalling System at Patli shall include, but not be limited to, the Sub-systems namely alteration/modifications to existing EI for Signalling interlocking System, existing DC track circuit for track vacancy detection System, existing IPS for Power supply System and existing RDPM using Data logger system for remote monitoring management. And the Signalling System at Sultanpur shall include, but not be limited to, the Sub-systems namely Distributed architecture with object controllers of EI for Signalling interlocking System, MSDAC for track vacancy detection System, IPS for Power supply System, interlocking of LC gates and RDPM using Data logger system for remote monitoring management. (3) Design, Supply, Installation, Testing, and Commissioning of Absolute Block system of working with Block proving with Axle counter (BPAC) on Single line connecting Manesar (HORC) & Patli station (NR), New Patli (HORC) & Patli station (NR), New Patli	include, but not be limited to, the Sub-systems namely Distributed architecture with object controllers of EI for Signalling interlocking System, MSDAC for track vacancy detection System, IPS for Power supply System, Absolute Block System of working with Block proving with Axle counter (BPAC) and Remote Diagnostic and Predictive Maintenance (RDPM) using Data logger system for remote monitoring management. (2) Design, Supply, Installation, Testing, and Commissioning of the Signalling works at two IR stations: Patli (NR) (Phase-1 & 2) and Sultanpur. The Signalling System at Patli shall include, but not be limited to, the Sub-systems namely alteration/modifications to existing EI for Signalling interlocking System, existing DC track circuit for track vacancy detection System, existing IPS for Power supply System and existing RDPM using Data logger system for remote monitoring management. And the Signalling System at Sultanpur shall include, but not be limited to, the Sub-systems namely Distributed architecture with object controllers of EI for Signalling interlocking System, MSDAC for track vacancy detection System, IPS for Power supply System, interlocking of LC gates and RDPM using Data logger system for remote monitoring management. (3) Design, Supply, Installation, Testing, and Commissioning of Absolute Block system of working with Block proving with Axle counter (BPAC) on

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		(HORC) & Sultanpur (NR). This also includes alterations/modifications to existing Signalling/Telecom System at Faruqnagar (NR) and Garhi Harsuru (NR) stations to introduce Absolute Block system of working in Sultanpur (NR)- Faruqnagar (NR) and Sultanpur (NR)- Garhi Harsuru (NR) sections. (4) Shifting of utility for carrying out Signalling/Telecom/Electrical/Civil/Track works covered in this Package/different Packages for connection between proposed station of HORC and existing Patli & Sultanpur station of IR shall be in the scope of this contract. Such work of removal of any unchartered utility to be done by the Contractor, this shall be dealt under Schedule "C"-Provisional Sums. The Contractor shall be paid as per actual work done for removal of uncharted utilities based on the approval by the Engineer, on case-to-case basis. Interfacing with IR stations Signalling/Telecom system will be coordinated by the Engineer. (5) Maintenance of the aforesaid Signalling system for one year period after final taking over. (6) The scope of Signalling works shall also include, but not limited to, Project Management, Interface Management, Quality Management, System Assurance Management, Safety Management, EMC Management, Design, Procurement & Manufacturing Management, Construction & Installation Management, Overall Site Supervision & Management, Completion Management, Warranty and Defect Liability including Maintenance	Single line connecting Manesar (HORC) & Patli station (NR), New Patli (HORC) & Patli station (NR), New Patli (HORC) & Sultanpur (NR). This also includes alterations/modifications to existing Signalling System at Farukh Nagar (NR) and Garhi Harsuru (NR) stations to introduce Absolute Block system of working in Sultanpur (NR)- Farukh Nagar (NR) and Sultanpur (NR)- Garhi Harsuru (NR) sections. (4) Maintenance of the aforesaid Signalling system for one year period after taking over. (5) The scope of Signalling works shall also include, but not limited to, Project Management, Interface Management, Quality Management, System Assurance Management, Safety Management, EMC Management, Design, Procurement & Manufacturing Management, Construction & Installation Management, Overall Site Supervision & Management, Completion Management, Warranty and Defect Liability including Maintenance Management, etc. (6) Shifting of Chartered Signalling utilities at existing station Patli of IR as given in Part 2-Section VII-11-Tender Drawings and Documents in connection with work of single line connectivity being carried out by C1, T1 and other electrification contractor shall be undertaken as per requirement of C1, T1 and other electrification contractor.

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
		Management, etc.	*1.4.2 Brief scope of Signalling work covered under Schedule C is given below: -* *Shifting of unchartered Signalling utilities at existing station Patli of IR in connection with work of single line connectivity being carried out by C1, T1 and other electrification contractor shall be under taken as per requirement of C1, T1 and other electrification contractor prior to the Signalling work to be done by the C2 contractor under Schedule 'A'.* 1.4.3 *Jurisdictional sketch of S&T works is attached in Appendix 15B, Section VII-12, Appendices, Employer's Requirements.*
28.	Part 2, Employer's Requirements, Section VII-9:– Particular Specifications (PS)- Signalling Sub-Clause 2.2.2 (2) (e)	Foundations for Signals (i) The foundations of signals must be made of concrete not less than M-20 grade. (ii) The foundations must be dimensioned sufficiently for signals on posts, and shunt signals. (iii) The height of the foundations must be adjusted to the geographical situation (slope, etc.) and to the location of the signals. It should not be more than rail level. Depth of foundation from ground level shall not be less than 1.3m. (iv) The height of independent Position Light Shunt signal shall not exceed a maximum limit that may infringe the SOD of IR. Depth of foundation from ground level shall not be less than 600mm. (v) The foundation drawings of Main signal and Position Light Shunt Signals (Independent) shall be proposed by the Contractor and approved by the Engineer. (vi) Suitable pre-fabricated assembly units of reinforced concrete may be used with the approval of the Engineer. In this case, the foundation must have one or several eyebolts for transport purposes. These must be closed after final mounting. (vii) All signals foundations shall have SOD clearance from the track	Foundations for Signals*/Apparatus cases* (i) The foundations of signals*/apparatus cases* must be made of concrete not less than M-20 grade *of PP Cement of suitable grade.* (ii) The foundations must be dimensioned sufficiently for signals on posts, shunt signals and apparatus *cases.* (iii) The height of the foundations must be adjusted to the geographical situation (slope, etc.) and to the location of the signals. It should not be more than rail level. Depth of foundation from ground level shall not be less than 1.3m. (iv) The height of independent Position Light Shunt signal shall not exceed a maximum limit that may infringe the SOD of IR. Depth of foundation from

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
			ground level shall not be less than 600mm. (v) The foundation drawings of Main signal, Position Light Shunt Signals (Independent) *and Apparatus cases* shall be proposed by the Contractor and approved by the Engineer. (vi) Suitable pre-fabricated assembly units of reinforced concrete may be used with the approval of the Engineer. In this case, the foundation must have one or several eyebolts for transport purposes. These must be closed after final mounting. (vii) All signals*/apparatus cases* foundations shall have SOD clearance from the track.
29.	Part 2, Employer's Requirements, Section VII-9: – Particular Specifications (PS)-Signalling, Sub-Clause 5.3.1 (b)	The Cables for carrying Signalling power supplies outdoor shall be copper conductor, minimum conductor size 16 sq. mm, PVC insulated armoured, unscreened, underground power cable as per IRS specification IRS: S-63/2007 & IS: 1554 (Part-2). The size of conductor shall be so selected as to suit the electrical load.	The Cables for carrying Signalling power supplies outdoor shall be copper conductor, minimum conductor size 16 sq. mm, PVC insulated armoured, unscreened, underground power cable as per IRS specification IRS: S-63/2007 & IS: 1554 (Part-2). The size of conductor shall be so selected as to suit the electrical load. *This shall include power cable of suitable size for extending the electric power supply to Object controller rooms from the IPS Room at station building.*
30.	Part 2, Employer's Requirements, Section VII-9:– Particular Specifications (PS)-	On minor RCC box Bridges, 300mmx300mm concrete duct on the both side of Railway Tracks will be provided by Civil Structure Contractor of Package C 1 and of this Package for laying of cables. All Outdoor Signalling cables and Telecommunication Cables (OFC cable, Telecom Quad Cable & PIJF Telephone Cables etc.) on these Concrete Bridges &	On minor RCC box Bridges, 300mmx300mm concrete duct on the both side of Railway Tracks will be provided by Contractor for laying of cables. All Outdoor Signalling cables and Telecommunication Cables (OFC cable, Telecom Quad Cable & PIJF Telephone Cables etc.) on these Concrete Bridges & Culverts shall be laid inside DWC Pipes. OFC cable shall be

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
	Signalling Sub-Clause 5.3.16 (4)	Culverts shall be laid inside DWC Pipes. OFC cable shall be laid inside the HDPE duct. Entry/Exit of the Cables to/from Bridges & Culverts shall be suitably protected by concrete cover. The Contractor shall carry out necessary co-ordination with Civil, Structure (C 1 and this Package) & Track Contractor (T 1) in this matter. Cable shall be laid in Double Wall Corrugated Pipes in the slope to climb from ground to top level of bridges. It shall be so laid to maintain a continuous depth of 1 meter (top of DWC Pipe) from the nearest ground level. The slope of track formation shall be restored to its original condition after laying of cables. On Major OWG bridges, GI pipe shall be laid on the top level of the bridges.	laid inside the HDPE duct. Entry/Exit of the Cables to/from Bridges & Culverts shall be suitably protected by concrete cover. The Contractor shall carry out necessary co-ordination with Civil, Structure (C 1 and this Package) & Track Contractor (T 1) in this matter. Cable shall be laid in Double Wall Corrugated Pipes in the slope to climb from ground to top level of bridges. It shall be so laid to maintain a continuous depth of 1 meter (top of DWC Pipe) from the nearest ground level. The slope of track formation shall be restored to its original condition after laying of cables. On Major OWG bridges, GI pipe shall be laid on the top level of the bridges.
31.	Section-VII-10: Employer's Requirements – Particular Specifications (PS) Telecommunication Clause-1.3	1.3 Scope Of Work 1.3.1 General: 1) Design, Supply, Installation, Testing, and Commissioning, of the Telecom works. The Telecommunication System shall also include, but not be limited to, the Sub-systems namely, required alteration/modifications to existing Optical Fibre Communication System, Quad Cable Communication System, IP Ready EPABX System and Attendant console, Train control communication including emergency communication system, VHF communication system and required SMPS based Telecom Power Supply System, Room (if required) for housing telecom equipment & power supply system for NR station Patli (PH-1 & 2). 2) And Design, Supply, Installation, Testing, and Commissioning of the Telecom works. The Telecommunication System shall also include, but not be	1.3 Scope of Works *1.3.1 Scope of Works under Schedule A* *1.3.1.1* General: 1)Design, Supply, Installation, Testing, and Commissioning, of the Telecom works. The Telecommunication System shall also include, but not be limited to, the Sub-systems namely, required alteration/modifications to existing Optical Fibre Communication System, Quad Cable Communication System, IP Ready EPABX System and Attendant console, Train control communication including emergency communication system, VHF communication system and required SMPS based Telecom Power Supply System, Room (if required) for housing telecom equipment & power supply system for NR station Patli (PH-1 & 2). 2)And Design, Supply, Installation, Testing, and Commissioning of the Telecom works. The

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
		limited to, the Sub-systems namely, required IP-MPLS based Optical Fibre Communication System, Quad Cable Communication System, IP Ready EPABX System and Attendant Console, Train control communication including emergency communication system, VHF communication system, Public Announcement System, Clock System and required SMPS based Telecom Power Supply System for Sultanpur of IR.	Telecommunication System shall also include, but not be limited to, the Sub-systems namely, required IP-MPLS based Optical Fibre Communication System, Quad Cable Communication System, IP Ready EPABX System and Attendant Console, Train control communication including emergency communication system, VHF communication system, Public Announcement System, Clock System and required SMPS based Telecom Power Supply System for Sultanpur of IR.
		3) Design, Supply, Installation, Testing, and Commissioning of the Telecom works. The Telecommunication System shall also include, but not be limited to, the Sub-systems namely, required IP-MPLS based Optical Fibre Communication System, Quad Cable Communication System, IP Ready EPABX System and Attendant Console, Train control communication including emergency communication system, VHF communication system, Public Announcement System, Clock System and required SMPS based Telecom Power Supply System for HORC stations namely New Patli Jn.	3)Design, Supply, Installation, Testing, and Commissioning of the Telecom works. The Telecommunication System shall also include, but not be limited to, the Sub-systems namely, required IP-MPLS based Optical Fibre Communication System, Quad Cable Communication System, IP Ready EPABX System and Attendant Console, Train control communication including emergency communication system, VHF communication system, Public Announcement System, Clock System and required SMPS based Telecom Power Supply System for HORC stations namely New Patli Jn.
		4) Design, Supply, Installation, Testing, and Commissioning of the Telecom works. The Telecommunication System shall also include, but not be limited to, the Sub-systems namely, required IP-MPLS based Optical Fibre Communication System, Quad Cable Communication System, IP Ready EPABX System and Attendant Console, Train control communication including emergency communication system, VHF communication system, IP based integrated passenger information system, Clock System and required	4)Design, Supply, Installation, Testing, and Commissioning of the Telecom works. The Telecommunication System shall also include, but not be limited to, the Sub-systems namely, required IP-MPLS based Optical Fibre Communication System, Quad Cable Communication System, IP Ready EPABX System and Attendant Console, Train control communication including emergency communication system, VHF communication system, IP based integrated passenger information system, Clock System and required SMPS based

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
		SMPS based Telecom Power Supply System for HORC stations namely Manesar Jn. 5) Design, Supply, Installation, Testing, and Commissioning of the Telecom works. The Telecommunication works shall also include, but not be limited to the Sub-systems namely, required Optical Fibre Communication System, Quad Cable Communication System, IP Ready EPABX System and Attendant Console, Train control communication including emergency communication system, and required communication arrangement for TSS, SP, SSP between Manesar Jn. & New Patli, Jn.,between Manesar Jn. &IR Patli, between New Patli Jn. & IR Patli, and between New Patli Jn.& NR Sultanpur. This also includes alterations/modifications to existing signalling/telecom system at Farukhnagar (NR) and Garhi Harsuru (NR) stations telecom system of NR. 6) Maintenance of the aforesaid Telecommunication system for one year period after final taking over. 1.3.2 Scope of Supplies 1) The scope of supply shall include all necessary Hardware, Software, Firmware, Accessories, Materials and Documentation for Telecommunication System. The detailed requirements shall be as given in this Particular Specification. 2) The scope of supply shall also include supply of Spares and Tools & Test Equipment as stipulated in this Particular Specification.	Telecom Power Supply System for HORC stations namely Manesar Jn. 5)Design, Supply, Installation, Testing, and Commissioning of the Telecom works. The Telecommunication works shall also include, but not be limited to the Sub-systems namely, required Optical Fibre Communication System, Quad Cable Communication System, IP Ready EPABX System and Attendant Console, Train control communication including emergency communication system, and required communication arrangement for TSS, SP, SSP between Manesar Jn. & New Patli, Jn., between Manesar Jn. & IR Patli, between New Patli Jn. & IR Patli, and between New Patli Jn. & NR Sultanpur. This also includes alterations/modifications to existing Telecom system at Farukh Nagar (NR) and Garhi Harsuru (NR) stations telecom system of NR. 6)Maintenance of the aforesaid Telecommunication system for one year period after taking over. *1.3.1.2* Scope of Supplies 1)The scope of supply shall include all necessary Hardware, Software, Firmware, Accessories, Materials and Documentation for Telecommunication System. The detailed requirements shall be as given in this Particular Specification. 2)The scope of supply shall also include supply of Spares and Tools & Test Equipment as stipulated in this Particular Specification. *1.3.1.3* Scope of Services 1)The scope of services to be performed by the Contractor

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
		1.3.3 Scope of Services 1) The scope of services to be performed by the Contractor shall include Design, Manufacturing, Delivery, System Assurance, Storage, Installation, Testing and Commissioning of the Telecommunication System and Maintenance of the system for one year. The detailed requirements shall be asgiven in this Particular Specification and General Specification. 2) The scope of services shall also include, but not limited to, Project Management, Interface Management, Quality Management, System Assurance Management, Safety Management, EMC Management, Design, Procurement & Manufacturing Management, Construction & Installation Management, Overall Site Supervision & Management, ESHS Management, Completion Management, Warranty & Defect Liability period including Maintenance Management, etc. 3) The scope of services shall also include Maintenance Support Services including rectification & removal of defects during the Defect Notification Period including one year Maintenance and Training for Employer's Personnel.	shall include Design, Manufacturing, Delivery, System Assurance, Storage, Installation, Testing and Commissioning of the Telecommunication System and Maintenance of the system for one year. The detailed requirements shall be as given in this Particular Specification and General Specification. 2)The scope of services shall also include, but not limited to, Project Management, Interface Management, Quality Management, System Assurance Management, Safety Management, EMC Management, Design, Procurement & Manufacturing Management, Construction & Installation Management, Overall Site Supervision & Management, ESHS Management, Completion Management, Warranty & Defect Liability period including Maintenance Management, etc. 3)The scope of services shall also include Maintenance Support Services including rectification & removal of defects during the Defect Notification Period including one year Maintenance and Training for Employer's Personnel. *1.3.2Scope of Work under Schedule 'C'* *Brief scope of Telecom works covered under Schedule 'C' is given below: -* *Shifting of unchartered Telecom utilities at existing stations Patli and Sultanpur of IR in connection with work of single line connectivity being carried out by C1, T1 and other electrification contractor shall be undertaken as per requirement of C1, T1 and other electrification contractor prior to the Telecom work to be done by the C2 contractor under Schedule 'A'.*

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
			1.3.3 Jurisdictional sketch of S&T works is attached in Appendix 15B, Section VII-12, Appendices, Employer's Requirements .
32.	Part 2, Employer's Requirements, Section VII-10: Particular Specifications (PS) Telecommunication Sub Clause-13.3.2	Additional space if not available shall be provided through construction of Porta cabin/hut by contractor besides Telecommunication Equipment Room/Telecom Power Supply Equipment Room at Interfacing IR Stations, TSSs, SPs, SSPs and any other location as required. These rooms shallbe preferably be co- located with the existing Signalling Equipment Room/Signalling Power Supply Equipment Room.	Additional space if not available shall be provided through construction of *Room* by contractor besides Telecommunication Equipment Room/Telecom Power Supply Equipment Room at Interfacing IR Stations, TSSs, SPs, SSPs and any other location as required. These rooms shall preferably be co-located with the existing Signalling Equipment Room/Signalling Power Supply Equipment Room.
33.	Part 3, Section IX – Particular Conditions of Contract, Part B – Specific provisions, Sub-Clause 13.3.1	**Following is added to GC Clause 13.3.1** **Variation in the accepted Contract Amount & deriving rates of new items** **A.** The quantities of items and /or Provisional Sum, shown in Price Schedule "B" and Price Schedule "C" are approximate, and liable to vary during the actual execution of the work. Some items may have to be added or deleted. The Contractor shall be bound to carry out and complete the stipulated Work as instructed by the Engineer, irrespective of the magnitude of variations including additions or deletion in the Price Schedules. Variations in Price Schedule "B" and Price Schedule "C" shall be paid as follows: **(i) Price Schedule 'B' having items rates with quantities:** a) At the accepted rates of the Contract for Positive variation in quantities of items to the extent of 25%. In case of variation in quantities on minus side, Contract rates will be payable at the accepted rates of the Contract for the executed quantities.	**Following is added to GC Clause 13.3.1** **Variation in the accepted Contract Amount & deriving rates of new items** **A.** The quantities of items shown in Price Schedule "B" and estimated cost shown in Price Schedule "C" are approximate, and *are* liable to vary during the actual execution of the work. Some items may have to be added or deleted. The Contractor shall be bound to carry out and complete the stipulated Work as instructed by the Engineer, irrespective of the magnitude of variations including additions or deletion in the Price Schedule Variations in *Price Schedule "A*", Price Schedule "B" and Price Schedule "C" shall be paid as follows: ***(I)Price Schedule 'A'*** *a) For Bridges involving pile foundations, the quoted price of Schedule 'A' shall include providing piles, upto a pile depth of 20 m (below bottom of pile cap). Any increase or decrease in pile depth above/below the value of 20 m shall be*

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
		b) In case the Variation in individual items (except for items under Para c), d) & e) below) as stipulated above: is more than 25% on plus side, the rate for the varied quantity beyond 25% shall be negotiated between the Engineer and the Contractor and mutually agreed rates arrived at before execution of the extra quantity. c) In case of earth work, the aforesaid Variation limit of 25% shall apply to the gross quantity of earth work and Variation in the quantity of individual classifications of soil will not be subject to this limit where any Variation can take place. d) In case of foundation work, no Variation limit applies and Contractor shall carry out the Work, at the accepted rates of the Contract irrespective of any Variation. e) Variation in the quantity of items individually costing upto 1% of Accepted Contract Amount or Rs. 50 lakhs, whichever is less, shall be payable at the accepted rates of the Contract, till the value of such individual item on account of Variation reaches upto 2% of the Accepted Contract Amount or Rs. 1 crore, whichever is less. Negotiation of rates for such items shall be conducted only for the exceeded quantity beyond 2% of the Accepted Contract Amount or Rs. 1 crore, whichever is less. **(ii) Price Schedule "C" having Provisional Sum (containing only rates of items but without quantities) /:** a) At the accepted rates of the Contract for positive variation in Provisional Sum to the extent of 25%. In case of Variation in Provisional Sum on minus side, Contract rates will be payable at the accepted rates of the Contract for the executed quantities.	*payable/recoverable at the accepted rate of relevant item in Schedule 'C'.* ***b**) For any variation in the Scope of the Works in Schedule 'A', cost of additional quantities/items shall be worked out based on the accepted rates of items provided in Schedule 'B' or Schedule 'C'.* *In case, items involving variation are not covered in Schedule 'B' or Schedule 'C', rates of such items shall be taken from NWR USSOR-2019 (for Formation and Bridge works) duly adjusted for escalation @5% per annum from Nov' 2019 and DSR-2021 Vol I &II (for items other than Formation and Bridge works) duly adjusted for escalation @5% per annum from Apr' 2021. In cases where items involving variation are not covered in DSR or NWR USSOR, the rates of such items shall be worked out based on the rates available for similar items in DSR/NWR USSOR.* ***a) Deriving Rates for New Items / Negotiation*** *In case Engineer introduces an item for which the Contract does not contain any rates or prices applicable to the varied Works, the rate of such items shall be derived, wherever possible, from rate for similar items available in the Price Schedules of the Accepted Contract Amount. In case this is not possible, the rate shall be decided on the following basis:* *i) Cost of Materials at current market price, as actually utilized in the final finished Permanent Works, including a reasonable percentage for wastage and transportation.*

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
		b) In case the Variation in Provisional Sum as stipulated above is more than 25% on plus side, the rate for works under item A.(ii) beyond 25% Variation in Provisional Sum shall be negotiated between the Engineer and the Contractor and mutually agreed rates arrived at, before its execution. **B. Deriving Rates for New Items / Negotiation** This Sub-clause shall be applicable to all Price Schedules including Lump-Sum Schedule. (i) In case Engineer introduces an item for which the Contract does not contain any rates or prices applicable to the varied Works, the rate of such items shall be derived, wherever possible, from rate for similar items available in the Price Schedules of the Accepted Contract Amount. In case this is not possible, the rate may be decided on the following basis: a) Cost of Materials at current market price, as actually utilized in the final finished Permanent Works, including a reasonable percentage for wastage and transportation. b) Cost of enabling works if any (unless provided for separately) worked out on the above basis but with less stringent quality. Specifications minus salvage value of serviceable material released after completion of Work and cost of material released as scrap.	*ii) Cost of enabling works if any (unless provided for separately) worked out on the above basis but with less stringent quality. Specifications minus salvage value of serviceable material released after completion of Work and cost of material released as scrap.* *iii) Cost of labour actually used at the site of Work at rates under Payment of Minimum Wages Act for the area of Work for each category of worker, further enhanced by a percentage of 10% of the aforesaid rates to account for labour not directly utilized at Site and other ancillary and incidental expenses on labour.* *iv) Hire charges for Plant & Machinery, scaffolding, shuttering, forms, etc., required to be used at the site of the work. The tools used by the various trades shall not be counted as Plant & Machinery for this purpose.* *v) An amount of 15% of items c) (i), (ii), (iii) and (iv) above to allow for Contractor's overheads including water/electricity charges and labour cess etc., profits and corporate taxes etc. No such percentage shall be applicable to the estimated cost of Materials supplied free of cost to the Contractor.* **vi)** *In all cases where extra items of Work are involved, for which there are no rates in the Accepted Contract Amount, the Contractor shall give a notice to the Engineer, of at least 7 days before the need for its execution arises.*

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
			(II) Price Schedule 'B' having items rates with quantities: ***a)*** At the accepted rates of the Contract for Positive variation in quantities of items to the extent of *50%*. In case of variation in quantities on minus side, Contract rates will be payable at the accepted rates of the Contract for the executed quantities. *For the purpose of variation for quantity of items of all types of cement given in Schedule 'B' shall be considered as on item.* **b)** In case the Variation in individual items (except for items under *Para c)*, below as stipulated above: is more than 50% on plus side, the rate for the varied quantity beyond *50%* shall be negotiated between the Engineer and the Contractor and mutually agreed rates arrived at before execution of the extra quantity. ***c)*** *Variation in the quantity of items individually costing upto 1% of Accepted Contract Amount (i.e. total of Schedule 'A' and Schedule 'B' and Schedule 'C') or Rs. 1 crore, whichever is less, shall be payable at the accepted rates of the Contract, till the value of such individual item on account of Variation reaches upto 2% of the Accepted Contract Amount or Rs. 2 crore, whichever is less. Negotiation of rates for such items shall be conducted only for the exceeded quantity beyond 2% of the Accepted Contract Amount or Rs. 2 crore, whichever is less.* ***d) Deriving Rates for New Items / Negotiation***

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
			In case Engineer introduces an item for which the Contract does not contain any rates or prices applicable to the varied Works, the rate of such items shall be derived, wherever possible, from rate for similar items available in the Price Schedules of the Accepted Contract Amount. In case this is not possible, the rate shall be decided on the following basis: *i) Cost of Materials at current market price, as actually utilized in the final finished Permanent Works, including a reasonable percentage for wastage and transportation.* *ii) Cost of enabling works if any (unless provided for separately) worked out on the above basis but with less stringent quality. Specifications minus salvage value of serviceable material released after completion of Work and cost of material released as scrap.* *iii) Cost of labour actually used at the site of Work at rates under Payment of Minimum Wages Act for the area of Work for each category of worker, further enhanced by a percentage of 10% of the aforesaid rates to account for labour not directly utilized at Site and other ancillary and incidental expenses on labour.* *iv) Hire charges for Plant & Machinery, scaffolding, shuttering, forms, etc., required to be used at the site of the work. The tools used by the various*

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
			trades shall not be counted as Plant & Machinery for this purpose. *v) An amount of 15% of items d) (i), (ii), (iii) and (iv) above to allow for Contractor's overheads including water/electricity charges and labour cess etc., profits and corporate taxes etc. No such percentage shall be applicable to the estimated cost of Materials supplied free of cost to the Contractor.* *vi) In all cases where extra items of Work are involved, for which there are no rates in the Accepted Contract Amount, the Contractor shall give a notice to the Engineer, of at least 7 days before the need for its execution arises.* **(III) Price Schedule "C" (containing only rates of items but without quantities) /:** a) At the accepted rates of the Contract for *varied cost of Schedule 'C' upto INR 4 Cr.* In case of Variation on minus side, Contract rates will be payable at the accepted rates of the Contract for the executed quantities. **b)** In case the *varied cost of Schedule 'C' is more than INR 4 Cr., the rates of individual items* shall be negotiated between the Engineer and the Contractor and mutually agreed rates arrived at, before its execution.

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
			B. ***Disagreement in Rates for New Items*** In the event of disagreement *of rates of new items/negotiations* in respect of items *A (I) c) and A (II) d)* above, the Engineer shall fix such rates of price as are, in his opinion appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to the Contractor. Alternatively, in the event of disagreement, the Contractor shall have no claim to execute extra quantities/new items and the Engineer shall be free to get such additional quantities beyond 50% / new items executed through any other Agency. However, if the Engineer or the Employer so directs the Contractor shall be bound to carry out any such additional quantities beyond the limits stated above original quantities and/or new items and the disagreement or the difference regarding rates to be paid for the same shall be settled in the manner laid down under the conditions for the settlement of dispute.

Attachment 1
to
Corrigendum No. 5

Section III, Evaluation and Qualification Criteria
Checklist-CL /R1

Checklist-CL/R1

A. TECHNICAL PART

S. No.	Requirement of Tender Document	Ref. Clause of Tender documents	Tenderer's Name:	
			Whether information submitted (Yes/No/N.A.)	Ref. Pg No. in the Technical Submittal
1.	Letter of Tender-Technical Part	ITT 11.2 (a) and Section IV		
2.	Technical Part signed by authorized representative of Single Entity/Joint Venture/Consortium	ITT 20.3		
3.	Tender Security	ITT 19.1		
4.	Form ELI – 1.1: (a) Tenderer Information Form (Single Entity)	ITT 17.1 and Appendix D of Section IV		
5.	Form ELI-1.4: Power of Attorney (POA) for Submitting Tender	ITT 20.3 and Appendix D of Section IV		
6.	Board Resolution in case of a Public/Private limited company/LLP	TDS ITT 20.3		
7.	Incorporation Certificate and Memorandum and Articles of Association (MOA & AOA) (in case of Private/Public Limited Company)	Note (iii) (d) of Form ELI 1.4		
8.	Incorporation Certificate and Limited Liability Membership Agreement in case of Limited Liability Membership firms.	Note (iii) (e) of Form ELI 1.4		
9.	Proprietorship Affidavit (in case the Tenderer is Proprietorship Tenderer)	Note (iii) (a) of Form ELI 1.4		
10.	Partnership Deed (in case the Tenderer is Partnership Firm)	Note (iii) (b) of Form ELI 1.4		
11.	In case of foreign tenderer, the Notarised POA/MOU/JV Agreement is notarised in the country of origin and stamped by India Embassy/ High Commission or Member Countries of Hague convention submitted these documents with "Apostille" stamp	Note (i) of Form ELI 1.4		
12.	Form CON - 1: Historical Contract Non-Performance, Pending Litigation and Litigation History	ITT 17.2 and Appendix D of Section IV		
13.	Form CON - 2: Environmental, Social, Health, and Safety Performance Declaration	ITT 17.2 and Appendix D of Section IV		

S. No.	Requirement of Tender Document	Ref. Clause of Tender documents	Tenderer's Name:	
			Whether information submitted (Yes/No/N.A.)	Ref. Pg No. in the Technical Submittal
14.	Form FIN – 3.3.1: Financial Situation and Performance	ITT 17.2 and Appendix D of Section IV		
15.	Form FIN – 3.3.2: Average Annual Construction Turnover	ITT 17.2 and Appendix D of Section IV		
16.	Form FIN – 3.3.3: Financial Resources	ITT 17.2 and Appendix D of Section IV		
17.	Form FIN - 3.3.4: Current Contract Commitments / Works in Progress	ITT 17.2 and Appendix D of Section IV		
18.	Form EXP – 3.4.1: General Construction Experience	ITT 17.2 and Appendix D of Section IV		
19.	Form EXP – 3.4.2(a): Specific Construction and Contract Management Experience	ITT 17.2 and Appendix D of Section IV		
20.	Site Organization	ITT 16.1 and Appendix A of Section IV		
21.	Outline Method Statement	ITT 16.1 and Appendix A of Section IV		
22.	Work Execution Programme	ITT 16.1 and Appendix A of Section IV		
23.	*Undertaking For Specialised Activity [Fabrication, assembly & launching of Open Web Girders (OWG)]*	*FORM UT-1/1 of Section IV*		
24.	*Undertaking For Specialised Activity [Electrification Works(OHE)]*	*FORM UT-1/2 of Section IV*		
25.	*Undertaking For Specialised Activity [Signalling]*	*Form UT-1/3 of Section IV*		
26.	*Undertaking For Specialised Activity [Telecom OFC Works]*	*Form UT-1/4 of Section IV*		
27.	*Undertaking For Specialised Activity [Detailed Design]*	*Form UT-1/5 of Section IV*		
28.	Undertaking for compliance to Employer's Requirement & Specification by Tenderer	FORM UT-2 of Section IV		
29.	Undertaking for Downloaded Tender Document	Form UT-3 of Section IV		

S. No.	Requirement of Tender Document	Ref. Clause of Tender documents	Tenderer's Name:	
			Whether information submitted (Yes/No/N.A.)	Ref. Pg No. in the Technical Submittal

Note:

(i) **The check list is indicative and not exhaustive. The Tenderer must go through the complete tender documents and submit the required documents accordingly.**

(ii) **If any of the above form or criteria is not applicable to the Tenderer, then they can simply indicate N.A. against the relevant column**

(iii) **All Tender Forms contained in the Tender Documents must be fully and properly completed and all the forms must be returned signed by Authorized Representative of the Tenderer.**

B. FINANCIAL PART

The Financial Part is provided in the Tender Documents in the form of MS-EXCEL file and PDF file. The Contract Price for the Works shall be quoted in the MS-EXCEL file provided in the e-procurement portal. The Tenderer shall download the MS-EXCEL file and after quoting their Contract Price, upload the same along with other PDF documents of Financial Part mentioned in (a) below as a ZIP file on e-procurement portal. The quoted Contract Price shall not be offered/quoted elsewhere in the Technical Part submission/ Tender submission. These prices shall include all costs associated with the contract including GST. The Tenderer shall complete the Financial Part in accordance with the instructions given in the Financial Part.

Following information are required to be submitted by Tenderers in their Financial Part**:**

(a) In PDF File

1. Letter of Tender – Financial Part
2. Appendix A to Financial part
   Schedule of Adjustment Data
   Table A: *Deleted*
   Table B: Foreign Currency (FC)
   Table C: Summery of Payment Currencies
   Appendix B to Financial Part: Price Schedules
3. Price Schedule

3.1 Contract Price comprises of the following Price Schedules:

Schedule	Description
A	Lump Sum component of Works
B	Retaining Wall *& other civil Works*
C	*Item rate for miscellaneous woks*

(b) In MS-Excel File

Price Schedule for quoting Price for the Works against each Schedule.

I hereby confirm that:

(i) I have checked the above list with our submittal. I am also aware that if our tender is not containing the above documents, the Employer has the right to reject our tender.

a. All the pages of tender submission are properly indexed and numbered.

Seal:
Date:
(Signature of Authorized representative of Tenderer)

Attachment 2
to
Corrigendum No. 5

Section IV: Tender Forms

Appendix B to Financial Part: Price Schedules/R1
Clause No. 1 to Clause No. 4

Appendix B to Financial Part: Price Schedules/R1

1 Preamble

1.1. The Price Schedules shall be read in conjunction with the Instructions to Tenderers, the General Conditions, the Particular Conditions and the Employer's Requirements (General Specifications, Design Requirements Criteria, Technical Specifications, Drawings) and the Addenda (if any).

1.2. **Schedule 'A'** comprises scope of work to be executed under lump sum contract as detailed in Part 2- Employers' Requirements of Tender Document. The Tenderer has to quote a single lump sum amount against Schedule 'A'. Payment to the Contractor will be made in accordance with payment stages/Milestones defined for each Cost Centre detailed *in Clause 5.0* below unless otherwise specified in the Contract.

1.3. **Schedule 'B'** comprises of percentage rate for "Retaining Wall *and other civil works"***.** The work has to be carried out as per the description of items given in Schedule 'B' and directions of the Engineer. The Tenderer has to quote the percentage Excess (+) or Less (-) over the basic amount given in the Schedule 'B'. The payment against this *Schedule 'B'* will be made on the basis of quantities executed, measured and certified. Under this Schedule, the Contractor is required to carry out all works *of retaining walls and other civil works*, which are not covered in Schedule 'A', as per site requirements and as per the direction of the Engineer.

1.4. **Schedule 'C'** comprises *"Item rates for miscellaneous works".* Under this Schedule, the Contractor has to undertake items or works not covered in Schedules 'A' or *Schedule* 'B'. *Execution of items under this Schedule shall be carried out only after specific instructions of* the Engineer. *This Schedule consists of* items for Civil, Signalling & Telecommunications. The work has to be carried out as per Schedule of items given in this Schedule 'C'. This Schedule contains only Rate and Unit of items of the works. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer and valued at the rates and prices quoted in the Price Schedules. The *Tenderer* has to quote the percentage (%) Excess (+) or Less (-) over the basic amount given in Schedule 'C' for items to be executed against this head.

1.5. The Schedules may not generally give a full description of the works to be performed and the plant or equipment to be supplied under each item. Tenderers shall be deemed to have read the Employer's Requirements and the other sections of the Tender Documents and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling the rates and prices.

1.6. The price quoted in the Price Schedules for Schedule 'A'. Schedule 'B' and Schedule 'C' are for complete and finished items of the work in all respects. The Price quoted in the Price Schedules shall, except in so far as it is otherwise provided under the Contract, shall include all design, include all necessary survey work, plants , tools, machinery, Contractor's equipment, labour, compliance of labour laws, supervision, materials, transportation, handling, loading & unloading, storage, sampling, testing, fuel, oil, consumables, electric power, water, all leads & lifts, dewatering, all temporary works including temporary

accesses, staging, form works and false works, stacking, provision and maintenance of all temporary works area, construction of temporary store and buildings, fencing, barricading, lighting, drainage arrangements, erection & maintenance of inspection facilities above and below ground such as brick, concrete and steel etc., reinstatement, remedy of any defects during the Defects Notification Period, safety measures for workmen and road users, preparation of design and drawings pertaining to permanent and temporary works, & traffic diversion works, mobilisation and demobilisation, establishment and overhead charges, labour camps, insurance cost for labour and works, contractor's profit, all taxes including Goods and Service Tax (GST), insurance, royalties, duties, cess, octroi, other levies and other charges together with all general risks, liabilities and obligations set out or implied in the Contract.

The price and rates quoted by Tenderer shall be deemed to have included GST at the rate of 18% as notified by 47th GST Council on 29th June 2022.

1.7. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the Price Schedules, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related items of the Work.

1.8. To the extent acceptable to the Employer for the purpose of making payments or partial payments, valuing variations or evaluating claims, or for such other purposes as the Engineer may reasonably require, the Contractor may provide the Engineer with a breakdown of any composite or lump sum items included in the Schedules.

1.9. The Provisional Sums included and so designated in the Price Schedules shall be expended in whole or in part at the direction and discretion of the Engineer. The Provisional Sum shall be used to cover the Employer's share of the DAAB members' fees and expenses, in accordance with Clause 21. No prior instruction of the Engineer shall be required with respect to the work of the DAAB in accordance with Sub-Clause 13.4 of Part B-Specific Provisions - Particular Conditions of Contract. The Contractor shall submit the DAAB members' invoices and satisfactory evidence of having paid 100% of such invoices as part of the substantiation of those statements submitted under Sub-Clause 14.3. in accordance with Sub-Clauses 13.4 of the General Conditions.

1.10. The prices shall be quoted against Schedule 'A', Schedule 'B' and Schedule 'C' in the Price Schedule (Excel Workbook) uploaded on the e-Procurement portal.

1.11. The prices quoted shall be comprehensive and must include for complying in all respects with the Price Schedules, Instruction to Tenderers, the General Conditions, the Particular Conditions, Employer's Requirements, Specifications and Drawings and for all matters and things necessary for the proper construction, completion, and making good of any defect in part or of the whole of the Works.

1.12. No claims for additional payment shall be allowed for any error or misunderstanding by the Contractor of the work involved.

2 Variations in Schedule 'A', Schedule 'B' and Schedule 'C'

2.1 Variations in Price Schedules shall be dealt in accordance with Sub Clause 13.3.1 of Part B- Specific Provisions, Section IX- Particular Conditions of Contract.

2.2 The through Chainages mentioned in the Scope of the Works/Tender Drawings can undergo some minor corrections, without any impact on the overall length/Scope of the Works. The coordinates of the salient locations of C-2 Package with the corresponding chainages are given in Tender drawings.

2.3 It may be noted that coordinates are fixed and will generally not undergo any change.

3 Measurement and Payment

3.1 The measurement shall be made as per Price Schedules i.e. Schedule 'A'. Schedule 'B' and Schedule 'C' and other relevant provisions of the Contract such as Employer's Requirements and the Drawings.

3.2 If during execution of the Contract, it is decided by the Employer/Engineer that one or more items of Work/Milestone of a Cost Centre in a particular Price Schedule is not required to be executed, the proportionate amount against that particular Item of Work/Milestones shall not be paid. The Engineer's decision in this regard shall be final.

3.3 The Payment shall be made as per Clause 14 [Contract Price and Payment] of the General Conditions and Particular Conditions.

3.4 The Employer shall make interim payments to the Contractor in accordance with the provisions of Sub-Clause 14.6 [Issue of Interim Payment Certificates] of the General Conditions and Particular Conditions, as certified by the Engineer on the basis of the progress achieved for the items of works/stages/Milestones of the works.

3.5 The Contractor shall base its claim for interim payment in accordance with Sub-Clause 14.3 [Application for Interim Payment] of the General Conditions and Particular Conditions for each stage for various items of work on the basis of actual progress of work executed (i.e. Milestones achieved) till the end of the month for which the payment is claimed in relation to the Contractor's total executed quantity, supported with documents and updated programme in accordance with the Employer's Requirements.

3.6 The Employer may carry out necessary tests, either directly or through an independent agency, of the Works done by the Contractor for which payment has been accepted and certified by the Engineer. The payment shall depend upon the outcome of such tests.

3.7 Format for the Contractor's application for payment shall be agreed between the Engineer and the Contractor.

3.8 All necessary supplementary details to support progress claims, including all certified Request for Inspection in hard bound copy, shall be included with application for payment. Sketches, drawings, approvals, calculations, test reports etc. shall accompany an application for payment to be substantiated and certified by the Engineer and submitted to the Employer.

3.9 Even if no work is executed during the month, or the Contractor does not choose to issue an application for payment, a 'NIL' application shall be submitted.

3.10 For the purposes of payment, the Contractor shall submit to the Engineer a detailed Price Schedule indicating a further breakdown for each stage of payment contained in the Price Schedules within forty-two (42) days after the receipt of the Letter of Acceptance. Such cost breakdowns shall be subject to approval of the Engineer who shall review and evaluate with comments and/or issue approval within twenty-eight (28) days of receipt of same. The Contractor shall resubmit the cost breakdown structure corresponding to the Engineer's comments for review, if required.

3.11 The Engineer is not obliged to issue an Interim Payment Certificate until such breakdown structure of payment schedule has been submitted and accepted by the Engineer.

4 Methodology for Claiming Payment

4.1 The Contractor shall prepare his monthly application for payment in the agreed format in two hard copies and one soft copy. This shall be accompanied by supplementary details in accordance with Sub-Clause 14.3 [Application for Interim Payment Certificates] of the General Conditions. All hard copies shall bear the original signatures of the Contractor's Representative and be submitted to the Engineer.

4.2 If these are found in order, in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] of the General Conditions, then the Engineer shall forward two certified copies of the application along with certified supplementary details to the Employer, with his recommendation for payment; otherwise, all documents shall be returned to the Contractor for rectification and resubmission.

Attachment 3 to Corrigendum No. 5

Section VII: Employer's Requirements

Section VII-2: Functional (Civil)/R1

EMPLOYER'S REQUIREMENTS – FUNCTIONAL (CIVIL)/R1

Objective

The objective of the Contract is the design, construction, completion, testing and commissioning of the permanent works by the Contractor (including without limitation, the design, construction and removal of the Temporary Works) and the rectification of defects appearing in Permanent Works in the manner and to the standards and within the time obligations, liabilities and risks which may be involved, the Contractor shall undertake the execution of the Works.

1. GENERAL

1.1 The design and performance of the Permanent Works shall comply with the specific core requirements contained in these Employer's Requirements – Functional (Civil).

1.2 The design of the Permanent Works shall be developed in accordance with these Employer's Requirements – Functional (Civil), and the other requirements of the Contract.

1.3 The Permanent Works shall be designed and constructed to the highest standards available using proven up-to-date good Engineering practices. The Specification shall in any case not specify standards which, in the Engineer's opinion, are less than or inferior to those described in the Outline Design Specifications (ODS) and Outline Construction Specifications (OCS). Construction shall be carried out employing the procedures established by the Contractor as per approved quality assurance plan and Environmental, Social, Health and Safety (ESHS) Plan.

1.4 The Contractor shall be responsible for obtaining all necessary approvals from the relevant Public/Government/Local/Statutory or any agencies in the design and construction of the Works.

1.5 Employer's Requirements- Functional (Civil) shall be read in conjunction with Employer's Requirements-Design, Construction, Outline Design specification, Outline Construction Specifications and other requirements of the Contract.

1.6 Jurisdictional Sketch of Civil works under C-2 package is attached as Appendix 15B, Section VII-12, Appendices, Employer's Requirements.

2. SCOPE OF WORK

2.1 Scope under Lump Sum Price Schedule 'A'

The through Chainages mentioned in the Scope of the Works/Tender drawings can undergo some minor corrections, without any impact on the overall length/Scope of the Works. The coordinates of the salient locations of C-2 Package with the corresponding chainages are given in Tender drawings. It may be noted that coordinates are fixed and will generally not undergo any change. The Lumpsum scope of work in brief is given below but the scope also includes all other requirements stipulated in various parts/sections of the Contract Document including Appendices and Annexures.

2.1.1 Design and construction of railway formation

The Contractor shall design and construct railway formation *for 32.5 t axle load* as per RDSO Specifications "Comprehensive Guidelines and specifications for Railway Formation-Specification No. RDSO/2020/GE: IRS-0004, Sept 2020" from *Chainage 55600 m to Chainage 61500 m for double track of Main line; from Chainage 614 m to Chainage 2700 m for connecting line from New Patli to Patli; from Chainage 703 m to Chainage 4114 m for connecting line from New Patli to Sultanpur; and at Sultanpur station from Chainage*

+689.546 m on Farukhnagar side and from Chainage +530.00 m on Badsa side to Chainage -861.218 m on Garhi Harsaru side as shown in tender drawings and shall include earthwork in cutting/filling, subgrade, prepared subgrade and blanketing including compaction. *The Contractor shall arrange borrow areas for earthwork in embankment at its own cost.*

2.1.2 Design and construction of slope protection works

The Contractor shall design and construct protection work of embankment in the approaches of bridges by pitching as shown in tender drawings. The balance length of slope of embankment shall be protected by turfing in accordance with Section VII- 6 Outline Construction Specifications-Civil (OCS).

2.1.3 Design and construction of precast RCC drains on berms and cuttings

The Contractor shall design and construct precast RCC drains on berms and cuttings as shown in the Tender drawings. Chutes shall be provided for collecting water from berms at every 50 m approximately. Collecting chambers shall be provided at the junction of drains and chutes on berms. Chutes shall be extended 1 m beyond the toe of the slope. Wherever toe walls/retaining walls are provided, the outfall arrangement of chutes shall be properly designed at the junction of toe wall/retaining wall.

2.1.4 Design and construction of minor bridges

The Contractor shall design and construct minor bridges (RUBs and waterway bridges) as per list *given* in **Annexure-F-1.** Minor bridges shall include all components of bridges such as RCC box*/PSC slab, abutment, pier,* wing wall, return wall, curtain/drop wall, flooring, ground improvement if required, protection of approach embankment slopes *for a length of 15 m on each side,* boulder backing, granular backfill, inspection steps *on both sides of embankment* and other incidental works to complete the bridge in all respects *as shown in the Tender drawings*. *RUBs shall be provided with height gauges on each approach road as per RDSO drawing No. M-0001. Drainage arrangement shall be provided for RUBs wherever natural drainage is not available. Repairs to approach roads, wherever required, shall also be carried out by the Contractor.*

2.1.5 Design and construction of major bridges including bearings

The Contractor shall design and construct major bridges as per *list given in* **Annexure- F-2**. Superstructure including bearings of all major bridges shall be as per standard RDSO drawings *as detailed in Section VII-5, Outline Design Specifications-Civil*. However, Open Web Girders (OWG) and Composite Girders of 30.5m span shall be provided with spherical bearings. Major bridges shall include all components of bridges such as foundation, abutment/pier, bearings, girders, wing wall, return wall, ground improvement if required, protection of approach embankment slopes *for a length of 30 m on each side,* boulder backing & granular back fill behind abutment/wing/return wall, side pathway & man refuge as per RDSO drawing No. CBS 0045, access ladder & inspection platforms for abutments/piers, trolly refuge, inspection steps *on both sides of embankment*, inspection arrangements for connections of top chord of OWG *as per RDSO report No.BS-113,* height gauges on approach roads as per RDSO drawing *No. M-0001*, bridge boards, bridge plaques and other incidental works to complete the bridges in all respects.

2.1.6 Linking of track on Open Web Girders (OWG)

The Contractor shall supply H- beam sleepers including track fittings and link track on *03 Nos. of OWG bridges as per list in Annexure F2.* including providing and fixing guard rails and gang pathway. Rails for linking of track shall be supplied free of cost by the Employer.

2.1.7 Design and construction of stations

The Contractor shall design and construct two stations namely New Patli & Sultanpur as shown in Tender drawings. The work mainly includes station buildings, RCC underground water storage tank, RCC overhead water storage tank, water supply distribution system from overhead water storage tanks to station building and platforms, all types of retaining walls at station from Chainage: 57830 to Chainage 58440, barbed wire fencing with RCC posts at ROW, firefighting system in accordance with Section VII-5: Outline Design Specifications (ODS), Section VII-6 Outline Construction Specifications (OCS) and as shown in Tender drawings. Passenger Facilities to be provided at these stations are given in ***Annexure- F-3****.*

2.1.8 Design and construction of approach road of stations

The Contractor shall design and construct Vacuum Dewatered Concrete (VDC) station approach road including retaining walls, earthwork in filling and hume pipe for crossing road as shown in Tender drawings.

2.1.9 Rainwater harvesting

The Contractor shall design and construct rainwater harvesting system for surface runoff from platforms as per Section VII-5: Outline Design Specifications (ODS) and Section VII-6 Outline Construction Specifications (OCS).

2.1.10 Design and construction of yard drainage system

The Contractor shall design and construct yard drainage at New Patli and Sultanpur station consisting of covered/underground longitudinal *and cross drains* as shown in Tender drawings.

2.1.11 Design & construction of RCC precast fencing at end platforms at New Patli and Sultanpur stations.

2.1.12 Design and construction of S&T huts at New Patli and Sultanpur stations on both ends of station yard as shown in tender drawings.

2.1.13 Design and construction of RCC hume pipe (NP-4) of 450 mm dia/precast RCC box (500mm x 500mm, clear opening) in the embankment at approximately 500m interval for crossing utilities in future.

2.1.14 Design of precast and cast in-situ retaining wall along the alignment at locations given in Annexure F-4. These retaining walls shall be constructed and paid under Schedule 'B'.

2.1.15 Design of circulating area of New Patli station including land scaping, traffic movement plan, parking space and storm water drainage as shown in Tender drawings. Execution of these works shall be carried out by the Contractor and paid under Schedule 'B'.

2.1.16 Design of bridges including protection works as mentioned in Schedule 'B' in para *2.2* below. Construction of these bridges shall be carried out by the Contractor and paid under Schedule 'B'

2.1.17 Traffic management along the work site including construction works required in connection with traffic management like road works, footpaths, drains and other

services etc. and repair and maintenance of these construction works during construction period. Any road widening / diversion along with associated drainage system required to facilitate the movement of traffic and their repair & maintenance is also included in the lump sum scope *of Schedule 'A'*. It also includes reinstatement of land/structure/services etc. to original condition wherever road diversion has been made outside original road including reconstruction of structure demolished for traffic management. Materials and other specification related to traffic control devices shall conform to IRC standards.

2.1.18 Design and construction of one deep tube-well of 12,000-15,000 litre/hr yield with pump house and overhead gantry for lowering-taking out pumps for each station, providing & installing submersible pumps of required capacity with all accessories including panels, cables distribution boxes, electrical cable upto main control panel in stations, providing GI/Mild Steel pipeline from tube well to underground storage tank and from underground storage tank to overhead storage tank with all accessories and pump for pumping from underground tank to overhead tank including all accessories.

2.1.19 Design and application of water proofing system of subway and underground water storage tanks.

2.1.20 Design & construction of temporary structures including construction methodology and getting it approved from third party.

2.1.21 The Contractor shall provide and maintain during progress of works barricading around the work area *where vehicular or pedestrian traffic passes* with all safety measures as shown in Tender drawings. The excavations near habitations/public movement areas and all works along the roads shall be provided with proper caution signs and marked with red lights, reflectors at night to avoid accidents near public places to ensure safety of public

2.1.22 Reinstatement/Restoration of roads and services with new material of similar specification as per codal requirement after completion of work for the area disturbed by the contractor during construction activities. However, reinstatement of roads and its drainage system will be as per current standards being used by the roads/service owning agency for similar roads. Proper survey to be done before dismantling of any of the above services along with extensive Photographs, Videos & sample of these services by the contractor & get it verified by the representative of Engineer so as to ascertain the extent of these existing services and its specification.

2.1.23 There is possibility of some of the items not getting mentioned in the above list of works. Contractors are requested to go through the Tender drawings also in details as the works listed in Clause 2.1 above as well as indicated in the Tender drawings would be considered inclusive in the scope of work under lump sum quoted price except the items mentioned in Sub-Clause *2.2 and 2.3* below. Engineer's decision shall be final in this regard in case of dispute.

2.1.24 The work content against the lump sum component of the work shall also include, but not limited to, the following:

a) Site clearance and dismantling of obstructions etc., before commencement of work as specified or as directed by the Engineer;

b) True and proper setting out and layout of the Works, benchmarks and provision of all necessary labour, instruments and appliances in connection therewith as specified or as directed by the Engineer;

c) All aspects of quality assurance, including testing of materials as per the approved inspection and test plan and other components of the work, as specified or as directed by the Engineer;

d) Day to day cleaning of worksite throughout the execution period;

e) Maintenance of the completed Work during the period as specified or as directed by the Engineer;

f) Submission of completion (i.e., 'As-Built') drawings 06 (Six) sets in A-1 size and all other related documents as specified including scanned and AutoCAD copy with soft copies in both formats of all As-built drawings & documents.

g) Preparing detailed designs, general drawings and working drawings for various components of the works and obtaining approval in respect thereof from the Engineer, inclusive of incorporation of all modifications, alterations, changes, etc. that may be required to be carried as directed by the Engineer ;

h) Compliance of requirements of Environmental, Social, Health and Safety (ESHS) Manual.

i) Results of sub-surface investigations conducted at project site are enclosed with the Tender document. This information about the soil and sub-soil water conditions is being made available to the contractor in good faith and the contractor shall have to obtain the details of sub soil parameters independently. No claim whatsoever on account of any discrepancy about the soil parameters and sub soil water conditions that may be actually encountered at the time of execution of the work and those given in these tender documents shall be admissible to the contractor under any circumstances.

2.1.25 Other Works under Lump Sum

The Interface management Document as per Appendix- 5 of Employer's Requirements shall also be complied**.**

2.1.26 STRUCTURES

Alignment is passing adjacent to KMP Expressway/IR Tracks. The Contractor should ensure that the design and construction should be carried out with adequate measures for the safety & protection of KMP/IR structures. Any of the construction activity shall be planned without affecting the operations of the existing system. It should be ensured that no damage is caused to any such element/person/ property and Engineer/ Employer shall be indemnified against such damage at no extra cost.

2.1.27 ASSOCIATED WORKS

Works to be performed shall also include all general works, preparatory works for the construction and works of any kind necessary for the design and satisfactory construction, completion and maintenance of the works to the intent and meaning of the drawings adopted and Outline Construction Specifications , to best Engineering standards and orders that may be issued by the Engineer from time to time, compliance with all Conditions of Contract, supply of all materials, apparatus, plants, equipment, tools, fuel, water, strutting, timbering, transport, offices, stores, workshop, staff, labour and the provision of proper and sufficient protective works, diversion, temporary fencing, lighting and watching required for the safety of the public and protection of works on adjoining land; first-aid equipment, sanitary

accommodation for the staff and workmen, effecting and maintenance of all insurances, the payment of all wages, salaries, fees, royalties, duties or the other charges arising out of the erection of works and the regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion.

2.1.28 CONTRACTOR'S FACILITIES & SITE OFFICE

For batching plant, field quality control laboratory, site office and other activities (excluding labour camps) a plot of land of approx. 20,000 Sq. m (approx.) will be made available by the Employer on as is where is basis free of cost. This land shall be made good for such offsite activities as needed by the Contractor at no extra cost to the Employer. The land shall be cleared from debris, all structures made by the contractor including, RCC footings and rafts etc. and reinstated to the line, level and to the same conditions as existed before the work started before handing over back to the Employer within 91 days after Taking over Certificate. The final bill shall be released to the contractor after all structures from the *Contractor facility and site office are removed* & clearance of site. *The cost of setting up of all the above mentioned facilities & the office and reinstatement of site is included in lump sum price in Schedule 'A'.*

2.2 Scope under BOQ Schedule 'B'

Under this Schedule, the Contractor is required to carry out works which are not covered in Schedule 'A'. Broadly following works shall be carried out under this Schedule 'B':

a) Procurement, supply and installation (including joining and grouting) of precast retaining wall *along the embankment at locations as given in Annexure F-*4 for *heights upto 2 m* from ground level.

b) Construction of cast in-situ retaining wall generally for heights *more than 2m from ground level at locations as given in Annexure F-4.*

c) Construction of minor bridges other than those covered in Lump Sum Schedule 'A' given above. Tentative details of bridges covered under the Schedule 'B' is as under-

S. No.	**Chainage (m)*	*Type of crossing*	*Type of Bridge*	*Tentative Span (m)*
New Patli- Sultanpur connectivity				
1.	*585*	*Gail Pipe Line*	*Inverted U/ Slab*	*1 x 5m x 5m (110m long)*
2.	*1785*	*Gail Pipe Line*	*Inverted U/Slab*	*1 x 5m x 5m (100m long)*
3.	*3733*	*Gail Pipe Line*	*Inverted U/Slab*	*1 x 5m x 3.1m (20m long)*
**Chainages are from centre line of New Patli station*				

d) Development of circulating area of stations, parking space, storm water disposal of circulating area etc.

e) Plantation and any other horticulture work.

f) Construction of roads, footpath and structures other than those covered in Lump Sum Schedule 'A' of Employer's Requirements.

g) Any other item as directed by the Engineer related to the work.

2.3 ***Scope under Schedule 'C' (Item Rate for miscellaneous works)***

Under this Schedule, the Contractor is required to carry out works which are not covered in Schedule 'A' and Schedule 'B'.

a) Diversion of all uncharted utilities, if required, as per approved plan.

b) Any other activity as directed by the Engineer

2.4 REFERENCE TO THE STANDARD CODES OF PRACTICE

2.4.1 All Standards, Outline Construction Specifications, Technical Specifications and Codes of Practice referred to shall be latest editions including all applicable official amendments and revisions. The Contractor shall make available at site all relevant Indian Standard Codes of practice, IRS, IS, IRC, UIC, as applicable.

2.4.2 Wherever Indian Standards do not cover some particular aspects of design/ construction, relevant International Standards will be referred to. The Contractor shall make available at site such standard codes of practice.

2.4.3 In case of discrepancy among Standard codes of practice and *Section VII-6:* Outline Construction Specifications-Civil (OCS), the order of precedence shall be as *given* below:

a. Outline Design Specifications-Civil

b. Outline Construction Specifications-Civil.

c. Standard Codes of Practice. In case of discrepancy among Standard Codes of Practice, the order of precedence will be

i. IRS,

ii. IS,

iii. IRC,

iv. other International codes

d. Indian Railway Unified Standard Specifications,

e. CPWD specifications,

f. NBC 2016,

g. MORTH Specification for Road & Bridges,

2.5 DIMENSIONS

As regards errors, omissions and discrepancies in Specifications and Drawings, relevant clause of Particular Specification will apply. The levels, measurements and other information concerning the existing site as shown on the conceptual / layout drawings are believed to be correct, but the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever *shall* be entertained on account of any errors or omissions in the levels or strata turning out different from what is shown on the drawings.

2.6 INSPECTION

The Employer may appoint an independent agency to ensure the quality checking of design, supply, fabrication, erection and construction of all works under scope of work. The Contractor shall ensure the complete co-operation with the agency to perform their work satisfactorily. In addition, the Employer also reserves right to undertake quality check and inspection directly by itself.

2.7 **ALIGNMENT OF TRACKS**

a) The alignment shall be as shown in the tender drawings. The alignment has been developed by the Employer to meet operational and technical criteria. The Contractor is not required to evaluate the alignment for compliance with these criteria but shall review it with respect to his own design and construction proposals and shall satisfy himself that it suites to the available land width and there is no conflict with the clearances at proposed structures.

b) The Contractor is permitted to propose minor deviations in alignment to suit his construction proposals, but he must demonstrate that any such deviations shall comply with good design practice and the alignment requirement of the Design Criteria. Such deviations shall require prior approval of the Employer subject to following conditions:

i. There is no extra cost to the employer.

ii. Changes proposed are essentially required to suit the contractor's specific design.

iii. There is no change at the contract boundaries or if there is any, the same is agreed by the Contractor of the adjoining section without any extra cost to the employer**.**

2.8 **DURABILITY AND MAINTENANCE**

The Permanent Works shall be designed and constructed such that, if maintained reasonably, they shall endure in a serviceable condition throughout their minimum lives as described in Section VII-5, Outline Design Specifications-Civil. The Permanent Works shall be designed and constructed so as to minimise the cost of maintenance whilst not compromising the performance characteristics and ride quality of the railway.

2.9 **OPERATIONAL REQUIREMENTS**

a) The vertical and horizontal alignments for the main and connectivity line shall comply with the conditions laid in *para 2.7* (a) & (b) above.

b) During construction the Contractor shall be responsible for providing and maintaining adequate flood protection to ensure protection of the works.

2.10 **FUNCTIONAL REQUIREMENTS OF PUMPING ARRANGEMENTS**

Water pumps shall be designed for unmanned operation, controlled through liquid level controllers, capable of pumping the requisite amount of water to the utility or to the ground / overhead tanks. The pumping installation shall withstand the corrosive effects of normal water supply and serve for the anticipated life of the equipment. The pipe line size should be such that the velocity head does not exceed the normal static head except for the fire pump which is governed by separate criteria. The valve controls and regulating mechanisms shall be designed for automatic operation.

2.11 **ENVIRONMENTAL CONSIDERATIONS**

All provisions and conditions contained in the Environmental, Social, Health and Safety (ESHS) Manual as per Appendix 13 shall be strictly complied with.

2.12 TRAFFIC MANAGEMENT

The Contractor shall carry out the Works so as to minimise disruption to road and pedestrian traffic. The Contractor shall prepare his traffic management plan based on his proposed construction methodology in co-ordination with Engineer and in conjunction with the concerned road authority as per Appendix 10. He shall comply strictly with the approved plan during construction of his works.

2.13 CRS INSPECTION

The Contractor shall note that the Commissioner for Railway Safety (CRS) will inspect the Works from time to time for the purpose of determining whether the HORC Project complies in terms of operational and infrastructural safety in accordance with the Laws of India. The Contractor shall note that CRS approval is mandatory for commissioning the system. Notwithstanding other provisions of the Contract, the Contractor shall ensure that the Works comply with the requirements of CRS in terms of construction to the drawings and shall make all necessary arrangements and assist the representatives of the Employer and CRS in carrying out their inspection duties and also comply with their instructions regarding rectifying any defects and making good any deficiencies. Contractor shall prepare and make available all drawings, documents, sketches, photographs etc. as required for submission of application for inspection of CRS as instructed by the Engineer.

2.14 STANDARDS

Equipment, materials and systems shall be designed, manufactured and tested in accordance with the latest issue of National and/or International codes and standards. The Contractor shall submit hard copies in original to the Engineer of all codes and standards used for the work.

Reference to standards or to materials and equipment of a particular manufacturer shall be regarded as followed by the words "or equivalent". The Contractor may propose alternative standard materials, or equipment that shall be equal to or better than those specified. If the Contractor for any reason proposes alternatives to or deviations from the specified standards, or desires to use materials or equipment not covered by the specified standards, the Contractor shall apply for the consent of the Engineer. The Contractor shall state the exact nature of the change, the reason for making the change and relevant specifications of the materials and equipment in the English language. The decision of the Engineer in the matter of quality will be final.

ANNEXURE-F-1

LIST OF MINOR BRIDGES

MAIN LINE						
S.No.	**Br. No.**	***Chainage (m)**	**Type of Crossing**	**Type of Bridge**	**SPAN No. x L (in m) x H (in m)**	**No. of Tracks**
1.	137	56117.4	Balancing Culvert	RCC Box	1x5x4	2
2.	138	56290.6	RUB	RCC Box	1x5x4	2
3.	139	56465.0	Balancing Culvert	RCC Box	1x5x4	2
4.	140	56755.0	Balancing Culvert	RCC Box	1x5x4	2
5.	141	57167.9	RUB+ Culvert	RCC Box	1x5x4+1x2x2	2
6.	142	57546.0	Balancing Culvert	RCC Box	1x5x4	4
7.	143	57670.8	RUB	RCC Box	2x7x5.25	5
8.	144	57987.0	Balancing Culvert	RCC Box	1x2x2	5
9.	145	58203.1	RUB	RCC Box	1x5x3	5
10.	146	58564.9	Balancing Culvert	RCC Box	1x2x2	5
11.	148	59884.9	RUB	RCC Box	2x5x5.25	2
12.	149	60161.3	RUB+ Balancing Culvert	RCC Box	2x5x3+1x2x2	2
13.	154	61163.5	Balancing Culvert	RCC Box	1x2x2	2

*Main line Chainages start from Prithla station of HORC.

CONNECTING LINES						
S.No.	**Br. No.**	**Chainage (m) From Centre line of New Patli station**	**Type Of Crossing**	**Type of Bridge**	**SPAN No. x L (in m) x H (in m)**	**No. of Tracks**
NEW PATLI TO PATLI						
14.	1	1046.5	RUB	RCC Box	1x5x3.25	1
15.	2	1277.9	Balancing Culvert	RCC Box	1x2x2	1
16.	3	1986.8	RUB	RCC Box	1x4x3.25	1
17.	4	2518.4	RUB	RCC Box	1x5x5.25	1
18.	5	2687.0	Balancing Culvert	RCC Box	1x2.5x3	1
NEW PATLI TO SULTANPUR						
19.	2	1548.9	Balancing Culvert	RCC Box	1x2x2	1
20.	4	2189.8	Balancing Culvert	RCC Box	1x2x2	1
21.	5	2823.6	RUB	RCC Box	1x5x4.25	1

ANNEXURE-F-2

LIST OF MAJOR BRIDGES

A. MAIN LINE

S. No	Br. No.	*Chainage (m)	Type of Crossing	Type of Bridge Superstructure	Span Arrangement Number of Span	Type of Foundation to be provided	No. of Tracks
1.	136	55724.7	Rail Fly Over (RFO)	**CG+OWG	18.3(CG)+ 76.2(OWG)+ 18.3(CG)	Pile foundation	2
2.	147	59107.0	Road Crossing (RUB)	OWG	1x45.7 m	Open foundation	2
3.	150	60457.6	Road Crossing KMP (RUB)	CG	1x30.5 m	Open foundation	2
4.	151	60563.3		CG	1x24.4 m	Open foundation	2
5.	152	60642.6		CG	1x24.4 m	Open foundation	2
6.	153	60754.5		CG	1x30.5 m	Open foundation	2

*Chainages start from Prithla station of HORC.

**CG- Composite Steel Girders

B. CONNECTING LINE

New Patli to Sultanpur

7.	1	951.4	Road Crossing (RUB)	OWG	1x45.7 m	Open Foundation	1
8.	3	1767.9	RUB	PSC U-Slab	1x12.2	Open Foundation	1

*Chainages start from centre line of New Patli station of HORC.

ANNEXURE-F-3
PASSENGER FACILITIES *TO BE PROVIDED AT STATIONS*

The following passenger facilities to be provided in New Palti and Sultanpur Stations:

S. No	Passenger Facilities	New Patli	Sultanpur
1.	Platform	01 No. Island platform and 01 No. end platform as per tender drawings	01 No end platform as per tender drawings
2.	Drinking Water Booths	05 Nos on each platform	05 Nos on each platform
3.	Waiting Hall	As per tender drawings	As per tender drawings
4.	PF shelter	02 Nos. of 20 m each on both platforms for entire width.	-
5.	PF mini shelter	04 Nos on each platform as per tender drawings.	04 Nos on each platform as per tender drawings
6.	Toilet block	01 on each platform as per tender drawings.	01 on each platform as per tender drawings
7.	Seating arrangement	50 Nos stainless steel seats on each platform	20 Nos stainless steel seats on each platform
8.	Subway with staircase	01 No. as per tender drawings	-
9.	Lifts	03 Nos	-
10.	*Mild Steel* Station name board at platform	At each end of platform	At each end of platform
11.	RCC underground storage tank of net capacity (cum)	50	25
12.	RCC overhead water storage tank of net capacity (cum)	20	10
13.	Septic tank with connecting sewer lines to toilets in station area	As per tender drawing 01 No. at each platform for 50 users and 01 No. at station building for 100 users.	As per tender drawing 01 No. at each platform for 50 users and 01 No. at station building for 50 users.

Annexure-F-4
Tentative Details of Retaining Wall under Schedule 'B'

Main Line (LHS)				
S. No.	Chainage (m)		Length (m)	Approx. Height(m) above ground level
	From	To		
1	55760	55780	20	2.00-2.50
2	55780	55860	80	2.50-3.50
3	55880	55920	40	3.50-4.50
4	55920	56020	100	2.50-3.50
5	56040	56120	80	3.50-4.50
6	56120	56160	40	2.50-3.50
7	56160	56200	40	1.00-1.25
8	56200	56220	20	1.00-1.25
9	56220	56320	100	0.50-1.00
10	56320	56480	160	2.50-3.50
		Total	680	
Main Line (RHS)				
S. No.	Chainage (m)		Length (m)	Approx. Height(m)above ground level
	From	To		
1	55760	55820	60	2.50-3.50
2	55820	55860	40	2.00-2.50
3	55860	55880	20	1.75-2.00
4	55880	55960	80	1.25-1.75
5	55960	55980	20	0.50-1.00
6	55980	56000	20	1.00-1.25
7	56000	56040	40	1.25-1.75
8	56040	56160	120	2.50-3.50
9	56160	56220	60	1.25-1.75
10	56220	56260	40	1.00-1.25
11	56260	56280	20	3.50-4.50
12	56280	56460	180	2.50-3.50
13	56520	56560	40	1.75-2.00
14	56560	56580	20	1.25-1.75
15	56640	56660	20	1.75-2.00
16	56660	56740	80	1.25-1.75
17	56740	56780	40	1.00-1.25
18	56780	56820	40	0.50-1.00
19	56880	56900	20	1.75-2.00
20	56900	56960	60	0.50-1.00
21	57080	57100	20	0.50-1.00
22	57140	57160	20	0.50-1.00
23	57160	57260	100	3.50-4.50
24	57260	57300	40	2.50-3.50
25	57340	57360	20	0.00-0.50
26	57360	57380	20	1.25-1.75

27	57380	57400	20	3.50-4.50
28	57400	57420	20	4.50-5.50
29	57420	57440	20	4.50-5.50
30	57440	57460	20	4.50-5.50
31	57460	57500	40	4.50-5.50
32	57500	57540	40	4.50-5.50
33	60040	60060	20	0.50-1.00
34	60660	60720	60	2.50-3.50
35	60800	60860	60	2.50-3.50
36	60860	60940	80	2.00-2.50
37	60940	61000	60	2.50-3.50
38	61000	61100	100	2.00-2.50
39	61100	61140	40	1.25-1.75
40	61140	61180	40	0.50-1.00
		Total	**1860**	
New Patli- Sultanpur Connectivity (LHS)				
S. No.	Chainage (m)		Length (m)	Approx. Height(m) above ground level
	From	To		
1	720	1020	300	4.50-5.50
2	1020	1040	20	3.50-4.50
3	1040	1080	40	4.50-5.50
4	1160	1200	40	3.50-4.50
5	1220	1240	20	3.50-4.50
6	1240	1340	100	4.50-5.50
7	1380	1440	60	3.50-4.50
8	1640	1680	40	1.25-1.75
9	1720	1740	20	0.50-1.00
10	1740	1800	60	1.00-1.25
11	1800	1820	20	1.25-1.75
12	1820	1840	20	1.75-2.00
13	1840	1880	40	1.25-1.75
14	1880	1940	60	1.00-1.25
15	1940	1960	20	1.25-1.75
16	2200	2220	20	2.00-2.50
17	2280	2300	20	2.00-2.50
18	2300	2320	20	1.75-2.00
19	2320	2340	20	1.25-1.75
20	2560	2580	20	1.25-1.75
21	2580	2600	20	2.00-2.50
22	2700	2720	20	2.00-2.50
23	2720	2760	40	1.75-2.00
24	2760	2780	20	1.25-1.75
25	3960	4000	40	0.50-1.00
		Total	1100	
New Patli- Sultanpur Connectivity (RHS)				
S.No.	Chainage (m)	Length (m)		Approx. Height(m)
		From	To	

				above ground level
1	700	820	120	3.50-4.50
2	1080	1100	20	0.50-1.00
3	1100	1120	20	1.25-1.75
4	1120	1140	20	2.00-2.50
5	1180	1220	40	2.00-2.50
6	1220	1240	20	1.75-2.00
7	1240	1300	60	1.25-1.75
8	1300	1320	20	0.50-1.00
9	1480	1520	40	0.50-1.00
10	1520	1540	20	2.00-2.50
11	1640	1660	20	1.25-1.75
12	1720	1800	80	1.25-1.75
13	1800	1860	60	2.00-2.50
14	1860	1880	20	1.75-2.00
15	1880	1960	80	1.25-1.75
16	2120	2180	60	0.50-1.00
17	2180	2200	20	1.25-1.75
18	2200	2220	20	1.75-2.00
19	2220	2320	100	0.50-1.00
20	2400	2420	20	3.50-4.50
21	2620	2760	140	0.50-1.00
22	3980	4020	40	1.25-1.75
		Total	**1040**	
New Patli-Patli connectivity (LHS)				
S.No.	Chainage (m)		Length (m)	Approx. Height(m) above ground level
	From	To		
1	1080	1100	20	2.00-2.50
2	1100	1120	20	1.00-1.25
3	1120	1160	40	0.50-1.00
4	1200	1220	20	1.25-1.75
5	1300	1480	180	3.50-4.50
6	1480	1540	60	2.50-3.50
7	1540	1580	40	3.50-4.50
8	1580	1640	60	2.50-3.50
9	1640	1700	60	1.00-1.25
10	1700	1740	40	0.50-1.00
11	2120	2140	20	2.50-3.50
12	2140	2200	60	3.50-4.50
13	2220	2280	60	2.50-3.50
14	2600	2700	100	3.50-4.50
		Total	780	
New Patli- Patli Connectivity (RHS)				
S.No.	Chainage (m)		Length (m)	Approx. Height(m)
	From	To		

				above ground level
1	760	880	120	2.00-2.50
2	880	900	20	1.75-2.00
3	900	1080	180	1.25-1.75
4	1140	1180	40	3.50-4.50
5	1180	1200	20	0.50-1.00
6	1240	1320	80	1.25-1.75
7	1320	1340	20	1.00-1.25
8	1360	1420	60	0.50-1.00
9	1420	1460	40	1.00-1.25
10	1460	1540	80	0.50-1.00
11	1540	1640	100	3.50-4.50
12	2400	2420	20	2.00-2.50
13	3430	3610	180	2.50-3.00
		Total	960	

Attachment 4
to
Corrigendum No. 5

Sub-Clause 8.1 (b) Static Inspection

8.1 Inspection

b) Static Inspection

The inspection listed in the following table shall be conducted by the Engineer, in coordination with Interfacing Contractors as necessary.

The Contractor shall prepare and submit for review and approval by the Engineer a Static Inspection Plan detailing and explaining how the Contractor will plan, perform and document all tests and inspections that shall be conducted to verify and validate the Works. The Static Inspection Plan shall consist of a narrative description supported by graphics, diagrams and tabulations as required.

Structure	**Inspection Item**		**Inspection Method**		
			Confirmation of "As-Built" Records	**Visual Inspection**	**Measurement Test Check**
Earthwork	Formation width	At every 100m on straight line, at every 20m on curved line, at each terminal point of structures	✓		✓
	Cross section	Drawings *at every 100m on straight line, at every 20m on curved line, at each terminal point of structures.*	✓		✓
	Retaining wall	List of location of retaining walls	✓	✓	
	Construction	Soil *test records*, compaction records, *CBR &* deformation modulus (Ev_2) records, construction photos	✓		
	Blanket	*Blanket material test records, compaction test records, CBR & deformation modulus (Ev2) test records.*	✓		
		Thickness	✓		✓
	Structures Crossing	List of structures crossing the Railway (earth cover, overhead clearance, etc.)	✓		✓

Structure	Inspection Item		Inspection Method		
			Confirmation of "As-Built" Records	Visual Inspection	Measurement Test Check
	Drainage system	Drainage works at embankment/*cutting,* drainage diagram	✓		✓
Bridges	Formation width	At each bridge	✓		✓
	Construction	Quality records of aggregate used, reinforcement, concrete quality control data, measurement records of cast-in-situ piles/ open foundation etc.	✓		
	Repairing of structures	Records of repaired parts of structures	✓	✓	
	Rebar cover	Records of measurement of rebar cover	✓		
	Clearance under girder/slab	Above roads/rail	✓		✓
	Abutment/pier structures/RCC box etc.	All Structural drawings	✓	✓	
	Concrete strength	Schmidt hammer tests	✓		✓
	List of bridges	List of bridges	✓	✓	
	Pile load test	Pile load test parameters	✓		
	Steel Girder	*Material test record, fabrication, welding & trial assembly records, dead load camber*	✓		✓
	Bearings	*Acceptance test record*	✓	✓	
	Track on OWG	*Track parameters at every sleeper location*	✓		✓
	Load test	Load test parameters	✓		✓

Structure	Inspection Item		Inspection Method		
			Confirmation of "As-Built" Records	Visual Inspection	Measurement Test Check
		of superstructure (OWG/CG/PSC girders)			
		Load test parameters of skew RCC box	✓		
Station	Platform length, width	At every 10m on straight line, at every 5m on curved line, control points of curve	✓		✓
	Clearance of isolated and continuous structures on platform as per SOD	All structures	✓		✓
	Staircase and pavement	Results of stair width measurement	✓	✓	
	Drainage of platform & *yard*	*Section & slope* at every 20m	✓		✓
	Safety fence, etc.	List of facilities (clearance from platform end to fixed/movable fence, etc.)	✓	✓	
Protective facilities	Fire protection	Fire extinguisher layout and numbers	✓	✓	
	Abutment/ Pier protection	Drawings	✓	✓	
	Slope protection works	List, location and Drawings of slope protection works	✓	✓	

After Static Inspection of the Works as mentioned above the Contractor shall submit the Inspection Report in the agreed format in four (4) signed copies to the Engineer for review and approval.

Attachment 5
to
Corrigendum No. 5

Section VII- Employer's Requirements
Section VII-6: Outline Construction Specifications (OCS)-Civil
Chapter 06: Roadwork

Chapter 6. ROADWORK

6.1 CONTROL OF TRAFFIC

The contractor shall take all necessary precautions in co-ordination with and to the requirements of all the competent authorities concerned to protect the work from damage until such time as the seal coat or surface treatment has developed sufficient strength to carry normal traffic without any damage to it.

The new work shall be opened to traffic only after it is authorised by the Engineer.

The contractor shall submit a detailed traffic diversion/or control and regulation plan taking all safety measures during the course of work permitted by the concerned authorities to the Engineer for his consent before start of work.

The contractor shall take all precautions to avoid or minimise delays and inconvenience to road users during the course of the work. Where adequate detours or side tracks are available, traffic shall be temporarily diverted while the work is in progress depending on volume of traffic and subject to approval by Traffic Police. Adequate signs, signals, barriers and lamps for the warning and guidance of traffic shall be provided at all times during the course of the work till it is opened to traffic.

The Contractor shall take all reasonable precautions to protect traffic against accident, damage or disfigurement by construction equipment, tools, and materials, splashes and smirches of bitumen/ bituminous material or any other construction materials and shall be responsible for any claims arising from such damage or disfigurement.

Traffic signs erected shall be in accordance with the IRC Standards and/or as prescribed and approved by the Traffic Police Department.

6.2 GRANULAR SUB-BASE (NON-BITUMINOUS)

This work shall consist of laying and compacting well-graded material on prepared subgrade in accordance with the requirements of these specifications or as per MORTH standards. The material shall be laid in one or more layers according to lines, grades and cross-sections shown on the drawings.

6.2.1 Material

The Material to be used for the work shall be natural sand, moorum, gravel, crushed stone, or combination thereof depending upon the grading specified in MORTH specifications for Roads and Bridges. The material shall be free from organic or other deleterious constituents.

6.2.2 Physical requirements

The material shall have a 10 percent fines value of 50 KN or more (for sample in soaked condition) when tested in compliance with BS:812 (Part III). The water absorption value of the coarse aggregate shall be determined by IS:2386 (Part 3); if this value is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS:383. CBR Value shall be determined at the density and moisture content likely to be developed in equilibrium conditions which

shall be taken as being the density relating to a uniform air voids content of 5 percent.

Table 6.2.1: Grading for Close-Graded Granular Sub-base Material

S.N.	I S Sieve Designation	Percentage by weight passing the IS Sieve		
		Grading I	Grading II	Grading III
1	75.0 mm	100	-	-
2	53.0 mm	80-100	100	-
3	26.5 mm	55-90	70-100	100
4	9.5 mm	36-65	50-80	65-95
5	4.75 mm	25-55	40-65	50-80
6	2.36 mm	20-40	30-50	40-65
7	0.425 mm	10-25	15-25	20-35
8	0.075	3-10	3-10	3-10
9	CBR Value (Minimum)	30	25	20

Note- Material passing 0.425 mm sieve for all the three gradings when tested according to IS:2720 (Part 5) shall have liquid limit and plasticity index not more than 25 and 6 percent respectively.

6.2.3 Strength of sub-base

It shall be ensured prior to actual execution that the material to be used in the sub-base satisfies the requirements of CBR and other physical requirements when compacted and finished.

6.2.4 Construction Operations

(i) Preparation of sub-grade

Immediately prior to the laying of sub-base, the sub-grade already finished or existing surface shall be prepared by removing all vegetation and other extraneous matter, lightly sprinkled with water if necessary and rolled with two passes of 80 – 100 KN smooth wheeled roller. Damage to the subgrade shall be made good before sub base is laid.

(ii) Spreading and compacting

The approved sub-base material shall be spread on the prepared sub-grade by a grader of suitable type and adequate capacity.

When the sub-base material consists of combination of materials, mixing shall be done mechanically by the mix-in-place method.

The equipment used for mix-in-place construction shall be approved equipment capable of mixing the material to the desired degree.

Moisture contents of the loose material at the time of compaction shall be checked

in accordance with IS: 2720 (Part 7) and suitably adjusted.

Rolling procedure shall be as described under relevant Subsection except stated herein.

Rolling shall be continued till the density achieved is at least 98% of the maximum dry density for the material determined as per IS:2720 (Part 8).

6.3 WATER-BOUND MACADAM SUB-BASE/ BASE (NON-BITUMINOUS)

6.3.1 Description

The work shall consist of furnishing, placing, watering and compacting sub-base material mechanically interlocked by rolling and bounded together with screening and/ or binding material to the required degree on a prepared sub-grade/ sub-base or the existing surface as the case may be in accordance with these Specifications, and to the lines, levels, grades, dimensions and cross sections as shown on Drawings and/ or required by the Engineer.

6.3.2 Materials

a) Coarse aggregate

The coarse aggregates shall be hard and durable crushed stones, free from deleterious matter conforming to one of the gradings as set forth in Table 6.3.1, the physical requirements given in Table 6.3.2 subject to the Engineer's consent.

Table 6.3.1 Grading requirements of coarse aggregates

Grading	Size Range	IS Sieve Designation	Percent Passing by weight
1.	90 mm to 45 mm	125 mm	100
		90 mm	90-100
		63 mm	25-60
		45 mm	0-15
		22.4 mm	0-5
2.	63 mm to 45 mm	90 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0-15
		22.4 mm	0-5
3.	53 mm to 22.4 mm	63 mm	100
		53 mm	95-100
		45 mm	65-90
		22.4 mm	0-10
		11.2 mm	0-5

Note: The compacted thickness for a layer with Grade 1 shall be 100 mm while for a layer with

Grade 2, it shall be 75 mm.

Table 6.3.2

Physical requirements of coarse aggregates or water-bound macadam sub-base and base courses

S.No.	Test	Test Method	Requirement (Maximum)
1.	* Los Angeles Abrasion value	IS 2386 (Part-4)	50 per cent
2.	* Aggregate Impact value	IS 2386 (Part-4)	40 per cent
3.	Flakiness Index	IS : 2386 (Part-1)	15 per cent

* Aggregate may satisfy requirements of either of the two tests

b) Screenings

Screenings to fill voids in the coarse aggregate shall generally consist of the same material as the coarse aggregate or of gravel (other than round material) or moorum as approved by Engineer. However, where permitted non-plastic material such as moorum may be used for this purpose provided liquid limit and plasticity index of such material are below 20 and 6 respectively and fraction passing through 75 micron sieve does not exceed 10 percent.

As far as possible screenings shall conform to the gradings set-forth in Table 6.3.3 Screenings of type A shall be used with coarse aggregate of grade I of Table 6.3.1 Screenings of type A or B as specified shall be used with coarse aggregates of grading 2. Type B screenings shall be used with coarse aggregates of grading

TABLE 6.3.3
Grading for Screenings

Grading Classification	*Size of Screenings*	*IS Sieve Designation*	*Percent by Weight Passing Sieve*
A	13.2 mm	13.2 mm	100
		11.2 mm	95 -100
		5.6 mm	15 - 35
		180 micron	0 – 10
B	11.2 mm	11.2 mm	100
		9.5 mm	80-100
		5.6 mm	50 - 70
		180 micron	05 - 25

Binding material

Binding material to be used for water-bound macadam as a filler material meant for preventing ravelling, shall be a suitable material and having a Plasticity Index (PI) value of less than 6 as determined in accordance with IS : 2720 (Part-5).

6.3.3 Construction Method

a) Preparation of Sub-grade/ sub-base

(i) The surface of the sub-grade/ sub-base or existing surface shall be shaped and prepared to the lines, levels, grades, dimensions and cross sections as shown in drawings. Damage to or deterioration of sub-grade/ sub-base shall be made good before sub-base/ base is overlaid.

(ii) Inverted Choke

If water bound macadam is to be laid directly over the sub grade, without any intervening pavement or soling course, a 25 mm course of screenings or coarse sand shall be spread and compacted on the prepared subgrade before application of the coarse aggregate. In case of fine sand or silty or clayey sub grade, a 100 mm insulating layer of screenings or coarse sand shall be laid, the gradation of which will depend on drainage requirements. Alternatively, appropriate geosynthetics performing functions of separation and drainage layer may be used over the prepared sub-grade subject to the satisfaction of the Engineer.

(b) Spreading coarse aggregates

i. The coarse aggregates of specified size and grading shall be spread uniformly to proper profile in layers with each compacted layer thickness not more than 100mm for Grading 1 and 75 mm for Grading 2 and in a manner that prevents segregation into fine and coarse materials.

ii. Immediately following at spreading of the coarse aggregate, it shall be compacted to the full width by rolling with either the three- wheel- power -roller of 8 to 10 tonnes capacity or an equivalent vibratory roller. Initially, light rolling is to be done, which shall be discontinued when the aggregate is partially compacted with sufficient void space in them to permit application of screenings. The rolling shall begin from the edges and progress gradually towards the centre, only slight sprinkling of water may be done during rolling, if required.

iii. After the coarse aggregate has been lightly rolled to the required true surface, screenings shall be applied gradually over the surface to completely fill the interstices.

iv. The screenings shall be applied at a slow rate (in three or more applications) so as to ensure filling of all voids. Rolling and brooming shall continue with the spreading of the screenings. Damp and wet screenings shall not be used under any circumstances.

v. After spreading the screening and rolling the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to sweep the wet screening into the voids and to distribute them evenly. Additional screenings applied where necessary until the coarse aggregates are well bonded and firmly set for the entire depth.

vi. After the application of screenings and rolling, a suitable binding material shall be applied at a uniform and slow rate in two or more successive thin layers. After each application of binding material, the surface shall be copiously sprinkled with water and the resulting slurry swept in with brooms so as to fill the voids properly. The surface shall then be rolled by a 8-10 tonne roller.

(c) Tolerance

The finished sub-base/ base at any point shall not vary more than 15mm below and 12mm above the planned grade or adjusted grade with 3m straight edge applied to the surface parallel to the centreline of the road. With the template laid transversely the maximum permissible variation from specified profile shall be 12mm and 8mm respectively.

The sub-base/ base course completed in each day's work shall have an average thickness not less than the required thickness. Sub-base/ base course which does not conform to the above requirements shall be reworked.

6.4 B ITUMINOUS MATERIALS

Materials

Materials shall meet the requirements of the relevant IS Codes. These shall be of the following types.

a) Cut back Bitumen

Cut back bitumen shall be Rapid Curing (RC), Medium Curing (MC) or Slow Curing (SC) conforming to IS : 217.

b) Cationic Emulsion

Bitumen emulsions of the cationic type for roads shall conform to IS: 8887. Emulsified bitumen shall be Rapid Setting (RS), Medium Setting (MS), or Slow Setting (SS).

The physical and chemical requirements of the three types emulsions shall comply with the requirements specified in Table 1 of IS: 8887.

c) Paving Bitumen

Paving bitumen shall be conforming to IS: 73 and of the following two types:

Type 1 Paving bitumen from non-waxy crude shall satisfy the requirements given in Table 1 of IS: 73.

Type 2 Paving bitumen from waxy crude shall satisfy the requirements given in Table 2 of IS: 73.

The temperature at application of bituminous materials shall be maintained as per manufacturer's instructions and/or as directed by the Engineer's Representative.

An anti-stripping and bonding agent should be used in all final restoration road works. It should confirm to IS: 14982-2001 Specifications. The percentage can be from 0.5% to 1.25% by weight of bitumen content. The optimum dose can be ascertained using M.O.S.T. / BIS guidelines.;

6.4.2 Methods of Storage and Handling

Asphaltic material shall be handled and stored with due regard for safety and in such a way that at the time of use in the work the material conforms to the Specifications.

Following precautions shall be taken while using these materials:

a) Work with these materials shall be carried out in good weather conditions and it shall be carried out in warm and dry weather, and not in wet or extremely cold weather.

b) Emulsified asphalt shall be handled with care and not subjected to mechanical shocks or extremes of temperature likely to cause separation of the asphalt. Emulsified asphalt showing sign of separation shall not be used.

c) During heating, no water or moisture shall be allowed to enter the boiler.

d) Heating of bitumen shall be done to the correct temperature range, as prescribed by the manufacturer for the grade used. The temperature shall be controlled with the use of a suitable thermometer, and the material shall be drawn and used while still at such temperature as is prescribed by manufacturer or in accordance with MOST specifications.

e) It shall be ensured that mixing of ingredients is through and all particles of aggregates are coated uniformly and fully.

6.5 TACK COAT

6.5.1 Description

This work shall consist of furnishing and applying bituminous material to a new WBM surface or to an existing road surface before laying another premix carpet layer over it.

6.5.2 Materials

Bitumen: This shall be straight-run bitumen of grade VG- 10 conforming to IS 73 specifications

(a) 0.75 kg/sqm on W.B.M./ W.M.M. Surface

(b) 0.50 kg/sqm on bitumen surface

6.5.3 Construction Methods

a) Cleaning Surface

Prior to the application of bitumen, all vegetation, loose sealing compound, caked mud, dust, dirt and foreign material shall be removed from the entire surface of the pavement by means of mechanical sweepers and blowers, otherwise with steel wire brushes, small picks, brooms or other implements as approved by the Engineer-in-Charge.

b) Weather Limitation

The tack coat shall not be applied nor any bitumen work done during rainy weather or when the surface is damp or wet or when the atmospheric temperature in the shade is not more than 16o C.

c) Application of tack coat material

Bitumen shall be heated in a boiler to a temperature of 165 deg. C to 175 deg. C and maintained at that temperature.

Hot bitumen shall be applied evenly to the clean, dry surface by means of a pressure sprayer at specified rate. Even and uniform distribution of bitumen shall be ensured. Bitumen shall be applied longitudinally along the length of the pavement.

6.6 B ITUMINOUS MACADAM

6.6.1 Description

The work shall consist of one or more applications of compacted crushed aggregates premixed with bituminous binder (suitable grade) to a primed non-bituminous surface or previously constructed bituminous surface and in conformity with the lines, grades, dimensions and cross-sections shown on the Drawings This shall comprise of a single course of 50mm to 75mm thickness as specified in the approve or as Directed by Engineer.

6.6.2 Materials

a) Bitumen

The bitumen shall be paving bitumen of suitable grade approved by the Engineer and conforming to IS : 73.

b) Additives

Adhesion and Ant-stripping agent shall be added to the bitumen subject to Engineer's consent at the required percentage of additive. The additive shall be thoroughly mixed with the bituminous material in accordance with the manufacturer's instructions.

c) Aggregates

Aggregates shall consist of clean and hard crushed stone free from dust, clay, dirt and any other deleterious matter. The physical requirements shall be as given in Table 6.7.1.

Aggregates shall conform to one of the two gradings given in Table 6.7.2 depending on the compacted thickness; the actual grading shall have the consent of the Engineer.

Table 6.7.1

Physical requirements of aggregates for bituminous macadam

S.No	Test	Test Method	Requirement (maximum)
1.	* Los Angeles Abrasion value	IS :2386 (Part-4)	40 per cent
2.	* Aggregate Impact value	IS :2386 (Part-4)	30 per cent
3.	Flakiness Index and Elongation Indices (Total)	IS : 2386(Part-1)	30 per cent
4.	Coating and Stripping of Bitumen aggregate mixtures	AASHT T-182 O	Minimum retained coating 95%

5.	Soundness : (i) Loss with Sodium Sulphate 5 cycles (ii) Loss with Magnesium Sulphate 5 cycles		12 percent 18 percent
6.	Water absorption	IS : 2386(Part-3)	2 per cent

* Aggregates may satisfy requirements for either of the two tests.

Table 6.7.2

Aggregate grading for bituminous macadam

IS Sieve Designation	Per cent by weight passing the sieve	
	Grading 1	Grading 2
45.0mm	100	-
26.5mm	75-100	100
22.4mm	60-95	75-100
11.2mm	30-55	50-85
5.6mm	15-35	20-40
2.8mm	5-20	5-20
90.0 micron		

Bitumen content for pre mixing shall be 4% by weight of total mix unless otherwise approved by Engineer.

6.6.3 Construction Methods

a) Weather and Control of Work

The work of laying shall not be undertaken during rainy or foggy weather or when the base course is damp or wet, or during dust storm or when the atmospheric temperature in shade is 15 degree C or less.

The Engineer may order work to cease temporarily on account of adverse weather, unsatisfactory condition of materials, equipment or any conditions which he considers may affect the work adversely.

b) Cleaning and Preparation of Surface

Prior to the application of binder, loose dirt and other objectionable material shall be removed from the surface to be treated by means of the power broom or blower or both. If this does not provide a uniformly clean surface, additional sweeping shall be done by hand, using stiff brushes or similar brooms. The areas inaccessible to the cleaning means shall be cleaned manually. The sweeping shall extend 200mm beyond each edge of the area to be treated.

Adherent patches of objectionable material shall be removed from the surface by steel scraper or other approved method and where the Engineer so directs

the scraped area shall be washed down with water and hand brooms.

No application of bituminous material shall be undertaken until the surface has been cleaned to the satisfaction of the Engineer.

Before application of the bituminous material any necessary preliminary patching of the surface of the road (To fill in potholes.) shall be done to the complete satisfaction of the Engineer.

Tack coat shall be applied in accordance with these Specifications. Prime coat if required, shall conform to Subsection 6.5.

c) Plant and Equipment

All plant used by the Contractor for the preparation, hauling and placing of asphalt mixtures shall be subject to the consent of the Engineer and shall minimise smock, dust and noxious emission and odours. These shall generally meet the following requirements:

i. The mixing plant shall be a batching plant and shall have adequate capacity sufficient to supply the finisher on the road continuously when spreading the asphaltic mix at normal speed and required thickness.

ii. Scale for any weigh box shall be designed to be accurate to within 1% of the maximum load required and shall be fully automatically controlled.

iii. The Contractor shall provide and have at hand not less than ten 25 kilograms weights for frequent testing of all scales.

iv. Weigh box or hopper shall include a means for accurately weighing each bin size of aggregate in a weight box or hopper, suspended on scales, ample in size to hold a full batch without running over.

v. The asphaltic materials shall be stored in storage tanks designed to keep the temperature of the asphaltic material at maximum temperature of 110 degree C. The properties of the asphaltic material kept in that storage tanks shall be in good condition before mixing.

vi. The plant shall be provided with a circulating system to ensure continuous circulation between the storage tank and the mixer.

vii. The plant shall be provided with a cold bin for feeding the aggregates. Bin shall have a calibration gate and a mechanical means to insure uniform feeding of the aggregates into the drier as required by the Engineer.

viii. The rotary drier shall be capable of drying and heating the aggregates to the specified temperature.

ix. The plant shall be provided with plant screens capable of screening all aggregates to the specified sizes.

x. The plant shall include at least 3 hot bins for storing the aggregates fed from the drier after passing through the screen. Each bin shall be

provided with an overflow pipe to prevent any backing up of material into other bins.

xi. The plant shall be provided with asphaltic control unit by weighing to obtain the proper amount of asphaltic material in the mix within the tolerance specified for the job-mix.

xii. The batch mixer shall be an approved twin pugmill type and capable of producing a continuous uniform mixture within the job-mix tolerances. The mixer capacity shall not be less than 1,000 kilogram batch.

xiii. An armoured thermometer reading from 50 degree C to 200 degree C shall be fixed in the asphaltic feed line at a suitable location near the discharge valve at the mixer unit.

xiv. The plant shall be further equipped with an electric pyrometer, or other approved thermometric instrument so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregate.

xv. The plant shall be equipped with a dust collector.

xvi. The plant shall be equipped with accurate positive means to govern the time of mixing and to maintain it constant. The time of mixing shall be divided into two steps, dry mixing and wet mixing. For dry mixing, the aggregate from hot bins shall be mixed for a period of 5-15 seconds. For wet mixing, the mixing time shall begin with the start of the asphalt spray after dry mixing. The wet mixing shall take about 30-45 seconds. The mixing time shall be extended if in the consideration of the Engineer the material obtained is not homogeneous.

d) Equipment for Hauling and placing

i. Trucks for hauling asphaltic mixtures shall have tight, clean, and smooth metal beds that have been sprayed with soapy water, thinned fuel oil, or lime solution to prevent the mixing from adhering to the beds (The amount of sprayed fluid shall however be kept to the practical minimum. Each load shall be covered with a canvas or other suitable material of such size as to protect the mixture from the weather). Any truck causing excessive segregation of material by its spring suspension or other contributing factors, or that shows oil leaks in detrimental amounts, or that causes undue delays, shall upon direction of the Engineer be removed from the work until such conditions are corrected.

ii. The equipment for spreading and finishing shall be mechanical, self powered pavers, capable of spreading and finishing the mixture true to the lines, grades, dimensions and cross sections.

The pavers shall be equipped with hoppers and distributing screws of the reversing type to place the mixture evenly.

The pavers shall maintain trueness of grade and confine the edges of the

pavement to true lines without the use of stationary side forms. The equipment shall include blending or joint levelling devices for smoothing and adjusting longitudinal joints between lanes. The assembly shall be adjustable to give the cross-section shape prescribed and shall be so designed and operated as to place the thickness or weight per square metre of material required.

Pavers shall be equipped with activated screeds and devices for heating the screeds to the temperature required for the laying of the mixture without pulling or marring.

The term "screed" includes any cutting, crowing, or other practical action that is effective in producing a finished surface of the evenness and texture specified, without tearing, shoving, or gouging.

If, during construction, it is found that the spreading and finishing equipment in operation leaves in the pavement surface tracks or indented areas or other objectionable irregularities, the use of such equipment shall be discontinued and other satisfactory spreading and finishing shall be provided by the Contractor forthwith.

e) Preparation and transport of mix

Bituminous macadam mix shall be prepared in a hot-mix plant either owned by the Contractor or it may be taken from an approved hot mix plant before supply of mix for the work, consent for the use of the mix shall be taken from the Engineer. The hot-mix plant should be of adequate capacity of batch mix type with the features as described under Subsection 6.7.3 or otherwise approved by Engineer unless some work specific features are required and capable of yielding a mix of proper and uniform quality with thoroughly coated aggregates. The plant shall meet the overall requirements through stringent quality control practices.

The mineral aggregates shall be dried and heated to a temperature between 150 degree C and 163 degree C

The contractor shall submit for consent the exact temperature to the Engineer. Surfaces of aggregates shall be clean and free of carbon and unburnt fuel oil. The aggregates, immediately after heating, shall be screened into three or more fractions and conveyed into separate bins ready for combining and mixing with asphaltic material.

The dried mineral aggregates prepared as prescribed above, shall be combined in the plant in the amount of each fraction of aggregate required to meet the job-mix formula for the particular mixture. The proper amount of asphaltic material shall be distributed over the mineral aggregate and the

whole thoroughly mixed for a period of at least 30 seconds, or longer if necessary to produce a homogeneous mixture in which all particles of the mineral aggregates are coated uniformly. The total mixing time shall be regulated by a suitable locking means.

The mixture shall when emptied from the mixer be at a temperature between 150degree C and 163degree C even for tolerances.

The mixture shall be transported from the mixing plant to the point of use in vehicles conforming to the requirements of Subsection 6.7.3 unless otherwise approved by the Engineer.

f) Application of the Pre-mix

The application of the mix shall proceed immediately after application of tack coat. The mix shall be spread immediately by means of self-propelled mechanical paver with suitable screeds capable of spreading, tamping, and finishing the mix true to lines, levels, dimensions and cross-sections specified. Any bare or insufficiently filled areas shall be re-treated by the mechanical spreader or covered by hand as necessary to give uniform and complete coverage. Any aggregate spread in excess of the agreed rate shall be scattered and evenly distributed on the road or otherwise removed and stockpiled.

The temperature of the mix at the time of laying shall be in the range of 120 or 160degree C.

g) Rolling

After the spreading of the mix, the rolling shall be done by road roller of suitable type and capacity. Rolling shall start as soon as possible after the material has been spread and it shall be completed within limited time frame, and to meet this, the Contractor shall deploy a set of rollers. Rolling shall be done with care to avoid unduly roughening of the pavement surface. It shall commence at the edges and progress towards the centre longitudinally except that on super-elevated and unidirectional cambered portions, it shall progress from the lower to the upper edge parallel to the centre line of the pavement.

The speed of the rollers shall not exceed 5 kilometre per hour for steel wheeled rollers and 7 kilometre per hour for pneumatic tired rollers and shall be at all times slow enough to avoid displacement of the hot mixture. Any displacements occurring as a result of reversing the direction of the roller or from any other cause shall at once be corrected with rakes and fresh mixture where required. Care shall be exercised in rolling not to displace the line and grade of the edges.

Rolling shall progress continuously as may be necessary to obtain uniform

compaction while the mixture is in a workable condition and until all roller marks are eliminated.

Heavy equipment or rollers shall not be permitted to stand on the finished surface until it has thoroughly cooled or set.

Any petroleum products dropped or spilled from the vehicles or equipment employed by the Contractor upon any portion of the pavement under construction is cause for the removal and replacement of the contaminated pavement by the Contractor.

When the roller has passed over the whole area once, any high spots or depressions which become apparent shall be corrected by removing or adding premixed material. Rolling shall then be continued until the entire surface has been rolled to 95 % of the average laboratory density, and there is no crushing of aggregates. and all roller marks are eliminated. In each pass of the roller, preceding track shall be overlapped uniformly by at least 1/3rd width. The roller wheels shall be kept damp to prevent premix from adhering to the wheels and being picked up. In no case shall fuel/ lubricating oil be used for this purpose.

Along kerbs, man-holes etc., and at any other locations where proper consolidation by rollers is not practicable, alternative means such as steel rammers shall simultaneously be used to secure adequate consolidation.

6.6.4 Surface Control

a) Surface Regularity

Maximum permissible undulation in longitudinal profile with 3m straight edge shall be as 12mm.

Maximum permissible variation from specified cross profile under camber template shall be as 8mm.

Surface evenness requirements in respect of both longitudinal and cross profiles should be simultaneously satisfied.

Tests for conformity with the specified crown and grade shall be made immediately after initial compaction, and variations shall be corrected by removing or adding materials as may be necessary. Rolling shall then be continued as specified. After final rolling, the smoothness of the course shall be checked again and any irregularity of the surface exceeding the permissible limits corrected as agreed by the Engineer's Representative, including removal and replacement.

b) Surface Finish

The bituminous macadam shall be covered with either the next pavement course or wearing course, as the case may be, without any delay. If there is to be any delay, the course shall be covered with the seal coat. The seal coat in such cases shall be considered incidental to the work and shall not be paid separately.

6.7 PPE-MIX CARPET

6.7.1 Description

This work consists of applying a tack coat on the prepared base followed immediately by spreading aggregates pre-coated with specified binder to camber and consolidated. The consolidated thickness of this type of treatment shall be 2 cm or 2.5 cm as specified.

Premix carpet shall not be laid during rainy weather or when the base course is damp or wet or, when the atmospheric temperature in the shade is not more than 16 degree C.

6.7.2 Materials

a) Binder

Binder shall be bitumen paving asphalt grade VG-10/VG-30 of suitable grade meeting the requirements of the work and other environmental conditions. This shall be conforming to the requirements of IS : 73.

b) Coarse aggregates

Coarse aggregates consist of crushed stones and shall be clean, strong, durable, and free from organic or other deleterious materials. The aggregates shall be hydrophobic and of low porosity.

The aggregates shall meet the requirements given in Table 6.7.1 except that the water absorption shall be limited to 1 per cent. The Stone Polishing Value as measured by BS : 812-(Part-114) shall not be less than 55.

c) Proportioning of Materials

They shall comprise of a mix of stone chipping 13.2mm size (passing 22.4 mm sieve and retained on 11.2 mm size) and 11.2 mm size (passing 13.2 mm sieve and retained on 5.6 mm sieve.) The contractor shall propose material proportions to the Engineer for his consent.

6.7.3 Construction Methods

a) Tack Coat

This shall be applied as per Subsection 6.5.

b) Preparation and transport of Premix

The binder shall be heated to a temperature appropriate to the grade of bitumen in boilers of suitable design avoiding local overheating and ensuring a continuous supply.

The aggregates shall be dry and suitably pre-heated to the required temperature before they are placed in a mixer. After about 15 seconds of dry mixing, the heated binder shall be distributed over the aggregates at the rate specified. Mixing shall be continuous and thorough to ensure a homogeneous mixture in which all particles are coated uniformly and the discharge temperature shall be within the specified range.

The mixing of binder with chippings shall be continued until the chippings are thoroughly coated with binder. The mix shall be discharged and immediately transported from mixer to the point of use in suitable vehicles or wheel barrows. The vehicles employed for transport shall be clean and the mix being transported should be covered in transit and protected from any kind of damage.

c) Spreading and Rolling

Immediately after the application of tack coat, premixed material shall be spread by means of mechanical paver finisher truly to lines, levels, dimensions and cross section as specified. The areas not covered by the mechanical means shall be treated with manual means for which the Engineer has given his consent.

d) Rolling

This shall be carried out as per Subsection 6.6.3

6.8 B ITUMINOUS CONCRETE

6.8.1 Description

This work shall consist of a surfacing of single-layer bituminous concrete of specified thickness on previously prepared bituminous surface to the lines, grades, dimensions and cross section as shown on Drawings. It shall be 25mm/40mm thick as required by Engineer.

Materials

a) Bitumen

The bitumen shall be paving bitumen of suitable penetration grade within the range S 35 to S 90 or A 90 to IS: 73. The actual grade of bitumen to be used shall be appropriate to the requirements of the work and environmental conditions.

b) Coarse aggregates

The aggregates shall satisfy the physical requirements given in Table 6.7.1. Flakiness index shall not exceed 30% and water absorbed not more than 1%

c) Fine aggregates

Fine aggregates shall be the fraction passing 2.36 mm sieve and retained on 75 micron sieve, consisting of crushed run screenings, natural sand or a mixture of

both. These shall be clean, hard, durable, uncoated, dry and free from any injurious, soft or flaky pieces and organic or other deleterious substances.

d) Filler

Filter shall consist of finely divided mineral matter such as rock dust, hydrated lime or cement. The filter shall be graded within following limits:

IS Sieve	Per cent passing by weight
600 micron	100
300 micron	95 – 100
75 micron	85 – 100

The filter shall be free from organic impurities and have a Plasticity Index not greater than 4. The Plasticity Index requirement shall not apply if filter is cement or lime. When coarse aggregate is gravel, 2 per cent of mass of total aggregate of Portland cement or hydrated lime shall be added and percentage of fine aggregate reduced accordingly. Cement or lime is not required when the gravel is lime stone.

e) Aggregate gradation

Mineral aggregates, including filler shall be so graded or combined as to conform to gradings set forth in Table 6.9.1 below.

Table 6.9.1

Sieve Designation	Per cent by weight passing through sieve for		
	25mm thick Grade 1	25-40mm thick Grade 2	>40mm thick Grade 1
26.5mm	--	--	100
22.4mm	--	100	75-100
13.2mm	100	80-100	--
11.2mm	90-100	75-95	50-85
5.6mm	60-80	55-75	20-40
2.8mm	40-55	40-55	5-20
710micron	20-30	20-30	--
300micron	15-25	15-25	--
180micron	10-20	10-20	--
90micron	5-11	5-11	0-5

6.8.2 Mix Design

a) Requirement of Mix

Apart from conformity with grading and quality requirements of individual ingredients, the mix shall also meet the requirements set forth in Table 6.9.2.

Table 6.9.2

Requirements of Bituminous Concrete Mix

S.NO	Description	Requirements
1.	Marshall stability (ASTM Designation: D-1559) determined on Marshall specimens compacted by 75 compaction blows on each end	820 Kg (1800 pounds)
2.	Marshall flow (mm)	Minimum 2-4
3.	Per cent air voids in mix	3-5
4.	Per cent voids in mineral aggregate (VMA)	Minimum 11-13
5.	Percent voids in mineral aggregates filled by bitumen (VFB)	65-75
6.	Binder content, per cent by weight of mix	Minimum 4.5
7.	Water sensitivity (ASTM : D-1075) loss of Stability on immersion in water at 60 deg. C	Minimum 75% Retained strength
	Swell Test (Asphalt Instt. MS-2, No. 2)	Maximum 1.5%

b) Binder content

Binder content shall be so determined as to achieve the requirements of the mix set forth in Table 6.9.2. Marshall method for arriving at binder content shall be adopted.

c) Job Mix Formula

Before starting work the Contractor shall submit to the Engineer for his consent. The job mix formula for the mixture shall fix a single percentage of aggregate passing each required sieve size, a single percentage of asphalt to be added to the aggregate, and a single temperature at which the mixture is to be delivered on the road, all of which shall fall within the ranges of the composition and the temperature limits. The formula shall give the following details:

I. Source and location of all materials

II. Proportions of all materials as described under :

III. Binder- as percentage by weight of total mix Coarse aggregate/Fine aggregate/ Mineral Filler- as percentage by weight of total aggregate including Mineral Filler

IV. A single definite percentage passing each sieve for the mixed aggregate (Vide Table 6.9.1)

V. The results of test as per specifications obtained by the contractor

VI. Test results of physical characteristics of aggregates to be used

VII. Mixing temperature and compacting temperature

d) Application of job-mix formula and Allowable Tolerances

The approved job mix formula shall remain effective unless and until modified. Each day as many samples of the materials and mixtures shall be taken and tested considers necessary for checking the required uniformity of the mixture. All mixture furnished shall conform to the job-mix formula within the range of tolerances set in forth in Table 6.9.3.

Table 6.9.3

Permissible variations from the job-mix formula

SL No	Description of Ingredients	Permissible Variation by Weight of Total mix in Percentage
1	Aggregate passing 13.2mm sieve and larger	± 8
2	Aggregate passing 9.5mm sieve and 4.75mm sieve	± 7
3	Aggregate passing 2.36mm sieve & 1.18mm sieve	± 6
4	Aggregate passing 600 micron sieve & 300 micron sieve	± 5
5	Aggregate passing 150 micron sieve	± 4
6	Aggregate passing 75 micron sieve	± 3
7	Binder	± 0.3
8	Mixing Temperature (Centigrade)	± 10

When unsatisfactory results or changed conditions make it necessary, a new job mix shall be submitted to the Engineer.

Should a change in a material be encountered or should a change in a source of material be made, a new job mix formula shall be submitted before the mixture containing the new material is delivered.

6.8.3 Construction Methods

a) Weather Limitation

The control over the weather conditions shall be as described under Subsection 6.5.3 above.

b) Progress of Work
No work shall be performed when there is insufficient hauling, spreading or finishing equipment, or labour to ensure progress at a rate not less than 75% of the capacity of the mixing plant.

c) Preparation of Existing Surface
The surface on which the mix is to be laid shall be swept thoroughly and cleaned of all loose dirt and other objectionable material using mechanical broom immediately before start of work. In portions where mechanical means cannot reach, the surface shall be prepared, shaped and conditioned to specified levels, grade and cross-fall (camber).

d) Preparation of Mix
A Hot-mix plant of adequate capacity and capable of producing a proper and uniform quality mix shall be used for preparing the mix. The plant may be either a weigh batch type or volumetric proportioning continuous or drum mix type. The plant shall have co-ordinated set of essential units capable of producing uniform mix as per the job-mix formula. The temperature of the binder at the time of mixing shall be in the range of 150 to 163 degree C and of aggregates in the range of 155 to 163 degree C, provided also that at no time shall the difference in temperature between the aggregates and binder exceed 14 degree C. The Contractor shall submit the exact temperatures and total mixing time for the consent of the Engineer. Mixing shall be thorough to ensure that a homogeneous mixture is obtained in which all particle of mineral aggregates are coated uniformly.

e) Transportation and Delivery of Mix.
The mix shall be transported from the mixing plant to the point of use in suitable tipper vehicles. The vehicles employed for the transport shall be clean and be covered in transit.

f) Spreading and Finishing
The mix transported from the hot mix plant to the site and shall be spread by means of a self- propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix to specified grade, elevation, and cross-section. However, in restricted locations and narrow widths, where available equipment cannot be operated, other suitable means shall be employed subject to the consent of the Engineer. The mixture shall be laid upon an approved surface and only when weather conditions are considered suitable.

The temperature of the mix, at the time of laying, shall be in the range of 120 degree C to 160 degree C.

The prime coat and tack coat to be applied shall be as per Subsections 6.4 and 6.5 respectively.

Spreading, finishing and compacting of the mix shall be carried out during daylight hours only, unless satisfactory illumination is provided by the Contractor.

g) Compaction of Mixture

Immediately after spreading of mix by paver, it shall be thoroughly and uniformly compacted by rolling with a set of self-propelled rollers moving at a speed not more than 5 km per hour, immediately following close to the paver. Generally with each paver, two steel wheeled tandem rollers and one pneumatic tired roller will be required. The initial or breakdown rolling shall be with 8 to 10 ton static weight smooth three wheeled steel roller and finish rolling with 6 to 8 ton tandem roller. The breakdown rolling shall preferably be followed by an intermediate rolling with a smooth wheel pneumatic roller of 10 to 25 ton having a tire pressure of 7kg/sqcm moving with a speed not more than 7 km per hour and shall be at all times slow enough to avoid displacement of the hot mixture. Means shall be provided for checking and adjusting the tire pressure on the job at all times. All compaction operations, i.e., breakdown rolling can be accomplished by using vibratory roller of 8 to 10 ton static weight. During initial or breakdown rolling and finished rolling, the vibratory shall be switched off. The joints and edges shall be rolled with a 8 to 10 ton three wheeled static roller.

No delays in rolling the paved surface shall be tolerated, the breakdown roller must be right up to the paver at all times and the intermediate pneumatic roller right up to the breakdown roller. The compaction of the asphaltic concrete shall be controlled by temperature as follows:

Roller	Temperature
Breakdown	120˚C - 135˚C
Pneumatic	95˚C - 115˚C
Finishing	< 65˚C

Rolling procedure shall be as specified under Subsection 6.6.3

Rolling shall be continued till the density achieved is at least 98% of that of laboratory Marshall specimen. Rolling operations shall be completed in all respects before the temperature of the mix falls below 100 degree C.

h) Joints

Both longitudinal and lateral joints in successive courses shall be staggered so as not to be one above the other. Longitudinal joints and edges shall be constructed true to delineating lines parallel to the centre line of the road. Longitudinal joints shall be offset by at least 150mm from those in the lower course.

Longitudinal and transverse joints shall be made in a careful manner so that well bonded and sealed joints are provided for the full depth of the course.

i) Surface regularity

Surface shall be tested for undulations in longitudinal and cross profiles with 3 m straight edge and crown template respectively. Crown template shall conform to the typical cross section.

Maximum permissible undulation in longitudinal profile with 3m straight edge shall be as 8mm.

Maximum permissible variation from specified cross profile under camber template shall be as 4mm.

Surface evenness requirements in respect of both longitudinal and cross profiles should be simultaneously satisfied.

j) Protection of the pavement from traffic

Subsection 6.1 shall apply except as stated below.

Section of the newly finished works shall be protected from traffic of any kind until the mixture

has cooled to approximately ambient air temperature and well set.

6.9 SEAL COAT

6.9.1 Description

This work shall consist of application of a seal coat for sealing the voids in a bituminous surface laid to the specified levels, grade, and cross fall. Seal coat used shall be of premix type unless otherwise approved by the Engineer.

6.9.2 Materials

a) Binder

The binder shall be bitumen of a suitable grade appropriate to the requirements of the work and other environmental conditions as directed by the Engineer and satisfying the requirements of IS : 73, 217, 454 or other cut back as applicable.

b) Aggregates

The aggregates shall be sand or grit and shall consist of clean, hard, durable, dry particles and shall be free from dust, soft or flaky/ elongated material, organic matter or other deleterious substances. The aggregates shall pass 2.36mm sieve and be retained on 180 micron sieve. The quantity used for premixing shall be 0.06

cum per 10 sq m area.

6.9.3 Construction Methods

a) Preparation of base

The seal coat shall be applied immediately after laying of bituminous course which is required to be sealed. Before application of seal coat materials, the surface shall be cleaned free of any dust or other objectionable matter.

b) Preparation and Application of Mix

Mixtures of approved type shall be employed for mixing aggregates with suitable bituminous binder.

The binder shall be heated in boilers of suitable design, to a temperature appropriate to the grade of bitumen. The aggregates shall be clean, dry and suitably heated to a temperature before the same are placed in the mixture. Mixing of binder with aggregates to specified proportions shall be continued till the latter are thoroughly coated with the former.

The mix shall be immediately transported from the mixing plant to the point of use and spread uniformly on the bituminous surface to be sealed.

c) Rolling

As soon as sufficient length has been covered with pre-mixed material, the surface shall be rolled with 8-10 ton smooth wheeled steel, suitable vibratory or other equipment.

As regards procedure for rolling it shall be as specified under Subsection 6.7.3.

d) Control of Traffic Subsection 6.1 shall apply.

6.10 C EMENT CONCRETE PAVEMENTS

6.10.1 General

This work shall consist of constructing Plain/ or Reinforced Cement Concrete Pavements as required in accordance with these Specification and in conformity with the lines, levels, grades and dimension in accordance with the design.

6.10.2 Materials

a) General

The concrete materials viz. cement, aggregates, water, steel reinforcement, admixtures shall be in accordance with Annexure OCS -1 (Concrete: Plain and Reinforced) except as specified herein.

b) Dowel and Tie bars

Dowel bars shall be plain round bars. They shall be free from burring or other deformation restricting slippage in the concrete. Before delivery to the Works, one half of the length of each dowel bar shall be painted with one coat of bituminous material.

Tie bars shall be deformed bars free from oil, dirt, loose rust and scale.

These shall conform to the requirements of IS : 432, IS : 1139 and IS : 1786 as relevant.

c) Sleeves

The sleeves for dowel bars of expansion joints shall be of plastic material. This shall be designed to cover the dowels specified by the Designer, with a closed end, and with a suitable stop to hold the end of the sleeve a distance equal to the thickness of joint filler or at least 30mm from the end of the dowel bar. These shall be of such design that they do not deflect or collapse during construction, and the arrangement of sleeves shall be in accordance with these Specifications.

d) Waterproof Membrane

Where Waterproof membrane is to be provided, it shall be an impermeable polythene plastic sheeting. Where an overlap of underlay material is necessary this shall be at least 300mm. Water shall not be allowed to pond on the membrane which shall be completely dry when the concrete is laid.

e) Jointing Materials

i. Joint Filler

The expansion joint fillers shall conform to the requirements of IS: 1838. They

shall be punched to admit the dowels where called for as specified by the Designer. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint. When the use of more than one piece is authorized for a joint, the abutting ends shall be fastened closely together securely and accurately to shape by stapling or other satisfactory positive fastening.

ii. Joint Primer

Joint primer shall be fully compatible with the joint sealant and shall be applied strictly in accordance with the manufacturer's instructions.

iii. Joint Sealing Compound

The Sealing Compound of hot poured, elastomeric type shall conform to AASHTO M282 and cold applied sealant shall be in accordance with BS 5212 (Part 2).

6.10.3 Equipment and Tools

a) General

The concrete paving shall be carried out by use of mechanised method. Equipment and tools necessary for handling materials and performing the work shall have the consent of the Engineer as to design, type, capacity and mechanical, condition shall be at the site of the work before work is started. In special cases like a very short length of road to be laid at a location, other methods may be approved by Engineer.

b) Batching and Mixing Plant

This shall be of suitable type, capacity and make meeting the requirements of work.

i. Paving Equipment

The concrete shall be placed with an approved fixed form or slip form paver with independent units designed to (i)spread, (ii)consolidate, screed and float finish, (iii)texture and cure the freshly placed concrete in one complete pass of the machine in such a manner that a minimum of hand finishing will be necessary and so as to provide a dense and homogeneous pavement in conformity with the plans and Specifications.

Vibrators for full width vibration of concrete paving slabs may be either the surface pan type or the internal type. They may be attached to the spread finisher. They shall not come in contact with the joint, sub base or side forms.

The frequency of the surface vibrators shall not be less than 3500 impulses per

minute and for the internal type not less than 5000 impulses per minute. The variable vibration setting shall be provided in the machine.

At least two spare vibrators and one generating unit shall be on hand in case of any breakdown of the vibrating equipment being used.

ii. Concrete Saw for joint cutting

The mechanical saw for cutting concrete shall be adequately powered to cut rapidly with a water-cooled diamond edge saw blade to the depth required. A water tank with flexible hoses and pump shall be made available in this activity on priority basis. The Contractor shall have at least one standby saw in good working condition.

iii. Forms

Straight side forms shall be metal forms having a thickness of at least 5mm and have a depth equal to the prescribed edge thickness of the pavement slab. Curved forms shall be of the radius called for as specified by the Designer and acceptable flexible forms shall be installed with that radius. Built-up forms with horizontal joints shall not be used. Forms shall be free from kinks, bend or wraps. Forms shall not deflect more than 6 mm when tested as a simple beam with a span of three metres under a load equal to that which the finishers or other construction equipment will exert on them. The top of the form shall not vary from a three metre straight edge by more than 3mm at any point and the side by more than 6mm at any point. The forms shall contain provision for locking together tightly the ends of abutting from sections and for secure setting.

iv. Curing Compounds

The curing compounds shall have a water retention efficiency index of 90% in accordance with BS 7542.

6.10.4 Construction Methods

a) Preparation of Sub-base

The sub-base, which shall generally be of water-bound macadam (WBM) conforming to Subsection 6.3.3. The sub base shall be wetted adequately or provided with a water proof membrane so that it dose not absorb any water from the concrete to be laid over it. Concrete shall not be placed on any portion of the sub-base until the consent of the Engineer is given.

b) Setting Forms

The sub-base under the forms shall be compacted and cut to grade so that forms,

when set to the position are within + 3mm of a straight line formed by the top of the forms. If the sub-base is found to be below the required grade at the form line, the grade line shall be lifted by placing lean concrete mix 1:4:8 beneath the form and setting the form when it is set. Imperfections and variations above grade shall be corrected by tamping or cutting to the degree required.

The alignment and grade elevations of the forms shall be checked and the necessary corrections made by the Contractor immediately before and after placing the concrete. When any form has been disturbed or any roadbed has become unstable, the form shall be reset and rechecked.

On final setting of the forms, these shall be checked for at least half the length of pavement to be concreted in a particular day before concreting commences on that day. While concreting long lengths, the setting up of forms to the exact grade and alignment shall be in advance of the concreting operation by at least 60 m.

Forms shall be cleaned and oiled prior to the placing of concrete. The forms shall be removed not earlier than 24 hours after the concrete has been laid.

c) Preparation of Concrete

i. Trial Mix / Mix Design Subsection 6.2.1 shall be followed Minimum grade of concrete to be used is M25.

ii. Batching, Mixing and Transporting Materials Subsection 6.2.4 shall apply. The Ready-Mixed Concrete (RMC) shall conform to Subsection Annexure OCS-1.

d) Placing Concrete

Concrete shall be placed only on a prepared sub-base as specified in Subsection 6.3.3. No concrete shall be placed around structures until they have been brought to the required grade and alignment nor until expansion joint material has been placed around them.

The concrete shall be spread, compacted and finished by a mechanical paver and in accordance with Subsection 6.10.3. The mixing and placing of concrete shall progress only at such a rate as to permit proper finishing, protecting and curing of the pavement.

The truck mixers, truck agitators and other approved hauling equipment shall be equipped with means for discharge of concrete into the hopper of the paver without segregation of the materials. In all cases, the temperature of the concrete shall be measured at the point of discharge from the delivery vehicle.

The acceptance criteria regarding level, thickness, surface regularity, texture, finish, strength of concrete and all other quality control measures for hand laid concrete shall be the same as in the case of machine laid work.

The concrete shall be thoroughly consolidated against and along the faces of all forms by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the sub-base or a side form. In no case shall the vibrator be operated longer than 30 seconds in any location. The vibrator shall be inserted in the concrete and worked along the full length and both sides of a joint.

Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them, but shall not be dumped from the discharge bucket on to a joint assembly.

Except at construction joints, concrete shall be shovelled against both sides of the joint simultaneously, maintaining equal pressure on both sides. It shall be deposited to a height of approximately 5 cm more than the depth of the joint, and shall be vibrated so that all honeycombing and voids are prevented. The vibrator shall be inserted in the concrete and worked along the full length and both sides of the joints.

e Initial strike-off and Placement of Reinforcement

Where the concrete is laid in two layers, the bottom layer of concrete shall be struck off for the full width between longitudinal construction joint true to crown at the required distance below the finished surface elevation, for placement of reinforcement or for placement of a top layer of the required thickness.

The striking-off shall be accomplished by use of the finishing machine, unless some other approved device is allowed. The reinforcement shall be placed as called for by the Designer and pouring of concrete over it shall only be allowed after placement of reinforcement is proper in all respects and approved by the Engineer.

f Joints

i) General

Joints shall comply with the design approved for the construction.

A strip of the preformed expansion joint filler shall be placed around each structure which extends into or through the pavement before concrete is placed.

ii)Transverse Expansion Joints

These shall be formed at the design spacings. The material for a transverse joint shall be assembled at the roadbed, and placed into position as a unit.

iii) Transverse Contraction Joints

Transverse Contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement. Transverse contraction joints shall also include load transfer dowel-bars where these are specified by the Designer.

The contraction joints shall be cut as soon as the concrete has undergone initial hardening and is hard enough to take up the load of joint sawing machine without causing damage to the slab. Grooves shall be at right angles to the centreline of the pavement and shall be true to line, subject to a tolerance of 5 mm in the width of the slab.

Any procedure for sawing joints that results in premature and uncontrolled cracking shall be revised immediately by adjusting the sequence of cutting the joints or the time interval involved between the placing of the concrete and cutting of the joints.

Load transfer assemblies for transverse contraction joints shall consist of dowel bars without sleeves and an approved auxiliary spacing and supporting element.

The assembly shall be placed into position so that the dowels are parallel to the centreline and shall be staked into position in such a way as to hold the assembly securely in position throughout construction.

iv) Longitudinal Joints

Longitudinal joints shall be constructed in conformity with the design. Planes of weakness shall be created by forming or cutting grooves in the surface of the pavement in accordance with the applicable provisions of this Section.

When adjacent lanes of pavement are constructed separately, steel side forms shall be used which will form a keyway along the construction joint. The bars may be bent at angles against the form of the first lane constructed and straightened into final position before the concrete of the adjacent lane is poured.

V) Transverse Construction Joint

Transverse construction joints shall be placed whenever concreting is completed after a day's work or is suspended for more than duration permissible for continuous pouring of concrete.

Joints shall be formed by placing installing bars or suitable bulkhead material so that a vertical face with approved key is formed or shall be butt joints formed with suitable material so that a vertical face is formed with no key. No tie bars shall be necessary when key joints are formed but dowel bars of the same dimensions and at the same spacing as for contraction joints shall be necessary at all butt joints.

g)Finishing

i)Machine Finishing

As soon as the concrete has been placed, it shall be struck off and screeded by an approved finishing machine or tools to the grades and cross sections specified by the Designer and to a level slightly above grade so that when properly consolidated and finished the surface of the pavement will be at the exact level and grade. The machine or tool shall go over each area of pavement as many times and at such intervals as necessary to give the proper compaction and to leave a surface of uniform texture, true to grade and cross section.

Excessive operation over a given area shall be avoided. The tops of the forms shall be kept clean by an effective device attached to the machine and the travel of the machine on the forms shall be maintained true without lift, wobble or other variation tending to effect the precision finish.

After concrete has been placed on both sides of the joint and struck off, the installing bar or channel cap shall be slowly and carefully withdrawn, the concrete shall be carefully spaded and additional freshly mixed concrete worked into any depression left by the removal of the installing bar.

A diagonal finishing machine shall be used if available.

ii) Hand Finishing

A portable screed shall be provided for use. The screed shall be at least 60 cm longer than the width of the slab to be struck off and consolidated. It shall be of approved shape, sufficiently rigid to retain its shape and constructed either of metal or of other material shod with

metal. (If necessary, a second screed shall be provided for striking off the bottom layer of concrete).

The screed shall then be placed on the forms and slip along them, without lifting, in a combined longitudinal and transverse shearing motion moving always in the direction in which the work is progressing. If necessary this shall be repeated until the surface is of uniform texture, true to grade and contour, and free from porous areas.

h) Edging at Forms and Joints

After the concrete's initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, planes of weakness except when sawed transverse construction joints, and emergency construction joints shall be worked with an approved tool and rounded to a radius of 5 mm. A well defined and continuous radius shall be produced and a smooth, dense mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting of the tool during use.

All joints shall be tested with a straight edge before the concrete has set, and correction shall be made if one side of the joint is higher than the other or if they are higher or lower than the adjacent slabs.

i) Surface Texture

The surface of the carriage-way shall be textured by wire brushing in a direction at right angles to the longitudinal axis of the carriage-way. The pavement shall be given this broomed texturing as soon as surplus water has risen to the surface.

The wire brushes shall be either mechanically operated or manual methods may be allowed depending upon the type of paver being used on the Work. In either case the wire broom shall be not less than 450 mm wide with two rows of spring steel. At least two brooms in working order shall be on the site at all times.

The surface texturing shall be completed before the concrete is in such condition that the surface is torn or unduly roughened by the brooming. The broomed surface shall be free from rough areas, porous areas, irregularities, or depressions.

j) Surface Requirements

After the concrete has hardened sufficiently, the surface shall be given a further test for tureens, using an approved 3 m straight edge laid on the surface. Any portion of the surface, when tested in the longitudinal direction, which shows a variation or departure from the testing edge of more than 3.5mm but not exceeding 7mm shall be marked and immediately ground down with an approved grinding tool until the variation does not exceed 3.5mm.

Whenever the variation or departure from the testing edge is more than 7.0mm the pavement shall be removed and replaced. Such removal shall be of the full depth and width of the slab and at least 3m long.

k) Curing

Immediately after the surface texturing, the surface and sides of the slab shall be cured by approved curing method for not less than 7 days. During this period measures shall be taken to prevent the loss of moisture.

The concrete shall not be left exposed between stages of curing.

The surface shall be inspected regularly to ascertain the earliest time at which it is able to withstand the spreading of moisture retaining material. This shall be by ponding of water or spreading and wetting either two layers of burlap or two mats of cotton / jute or a layer of sand or other approved highly absorbent material. Whatever material is used it shall be kept continuously moist for not less than 7 days and to a degree which will ensure that 100% humidity is maintained adjacent to the concrete surface. A membrane curing compound meeting the requirements of BS 7542 may be used subject to the consent of the Engineer.

Concrete surfaces which are subjected to heavy rainfall within three hours after the curing compound has been applied shall be resprayed by the method and the coverage specified above.

Concrete surfaces to which membrane curing compounds have been applied shall be adequately protected for the duration of the entire curing period from the pedestrian and vehicular traffic, except as required for joint sawing operations and surfaces tests, and from only other cause which will disrupt the continuity of the membrane. The

curing membrane so formed shall be maintained intact for a period of not less than 14 days. The entire surface shall be protected from the effects of solar radiation and in addition by the use of frames covered with material with heat and light reflecting properties.

Concrete liable to be affected by running water shall be adequately protected from the damage during the setting period.

l) Removing Forms

Forms shall be removed only after stipulated period and carefully so as to avoid damage to the pavement.

m) Protection of Pavement

The Contractor shall erect and maintain suitable barricades and shall employ watchmen to exclude public traffic and that of his employees and agents from the newly constructed pavement until opened for use. These barriers shall be arranged as not to interfere with public traffic on any lane intended to be kept open and necessary signs and lights shall be maintained by the Contractor clearly indicating any lanes open to the public.

Where any stipulated public traffic lane is contiguous to the slab or lane being placed, the Contractor shall provide, erect, and subsequently remove a substantial temporary guard fence along the prescribed dividing line, which shall be maintained there and protected by signages until the slab is opened to traffic. The Contractor's plan of operation shall be such as to obviate any need for encroachment on the public traffic lane or lanes under use .

The same shall be approved by the local competent authority. Any part of the pavement damaged by traffic or other cause prior to its final acceptance shall be repaired or replaced by the Contractor.

n) Sealing Joints

Before the pavement is opened to traffic, and as soon after the curing period as is feasible, all joints both longitudinal and transverse, shall be filled with the material approved for use as seal.

Both primer and sealing compound shall be treated and applied strictly in accordance with the manufacturer's specifications/ instruction and by use of approved equipment.

The sealing material shall be poured into each joint opening as directed by the Engineer. The pouring shall be done in such a manner that the material will not be spilled on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned.

Attachment 6 to Corrigendum No. 5

Section VII: Employer's Requirements

Section VII-7: Particular Specifications (PS)-OHE and General Electrical Services/R1

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CHAPTER – 1 INTRODUCTION AND OVERVIEW

1.1 INTRODUCTION &OVERVIEW: -

1.1.1 The Site of the HORC Project in this tender comprises of Section from HORC km 49+700 to km 61+500 i.e. Manesar – Badsa(Excl.) Double Main line including two, single line connectivity i.e. 1. Patli to New Patli single line connectivity 2. New Patli to Sultanpur single line connectivity in the State of Haryana. The land and other structures comprising the Site are described below:

1.1.2 Transmission lines crossing the Right of Way

The Site includes the following transmission lines crossing in the Right of Way:

Table -1.1:Manesar to Badsa (Excl.) Section (LT/HT Crossings up to 33 kV): -

Sr. No.	Section	HORC Chainage	Description	OH/ UG	Height above GL (Approx.)	Tentative date of Undergrounding/shifting/modification of crossing
1	Manesar Badsa (Excl.)	50+700 - 50+800	HT Line 11 kV	UG	-	Completed
2	Manesar -Badsa (Excl.)	52+800 - 52+900	HT Line 11 kV	UG	-	Completed
3	Manesar –Badsa(Excl.)	52+800 - 52+900	HT Line 11 kV	UG	-	Completed
4	Manesar –Badsa (Excl.)	53+700 - 53+800	HT Line 11 kV	UG	-	Completed
5	Manesar –Badsa (Excl.)	54+400 - 54+500	HT Line 11 kV	UG	-	Completed
6	Manesar –Badsa (Excl.)	54+850 – 54+950	HT Line 11 kV	UG	-	Completed

Sr. No.	Section	HORC Chainage	Description	OH/ UG	Height above GL (Approx.)	Tentative date of Undergrounding/shifting/modification of crossing
7	Manesar –Badsa (Excl.)	50+620	LT Line 440 V	UG	-	Completed
8	Manesar –Badsa (Excl.)	53+750	LT Line 440 V	UG	-	Completed
9	Manesar –Badsa (Excl.)	54+100	LT Line 440 V	UG	-	Completed
10	Manesar –Badsa (Excl.)	54+890	LT Line 440 V	UG	-	Completed
11	Manesar –Badsa. (Excl.)	55+100	LT Line 440 V	UG	-	Completed
12	Manesar –Badsa. (Excl.)	3+500 (Manesar to Patli connecting line)	LT Line 440 V	UG	-	Completed
13	Manesar –Badsa. (Excl.)	4+400 (Manesar to Patli connecting line)	LT Line 11 KV	UG	-	Completed
14	Manesar –Badsa (Excl.)	3+000 (Manesar to Patli connecting line)	LT Line 440 V	OH	9.00	30.9.2022

Sr. No.	Section	HORC Chainage	Description	OH/ UG	Height above GL (Approx.)	Tentative date of Undergrounding/shifting/modification of crossing
15	Manesar –Badsa (Excl.)	55+900 - 56+000	HT Line 11 kV	OH	6.00	30.9.2022
16	Manesar –Badsa (Excl.)	55+900 - 56+000	HT Line 11 kV	OH	6.00	30.9.2022
17	Manesar –Badsa (Excl.)	55+900 - 56+000	HT Line 11 kV	OH	6.00	30.9.2022
18	Manesar –Badsa (Excl.)	57+600 – 57+650	HT Line 11 kV	OH	7.50	30.9.2022
19	Manesar –Badsa (Excl.)	58+950- 59+000	HT Line 11 kV	OH	9.00	30.9.2022
20	Manesar –Badsa (Excl.)	59+040 – 59+080	HT Line 11 kV	OH	6.00	30.9.2022
21	Manesar –Badsa (Excl.)	59+100 – 59+200	HT Line 11 kV	OH	6.00	30.9.2022
22	Manesar –Badsa (Excl.)	59+050 – 59+150	LT Line 440V	OH	7.00	30.9.2022
23	Manesar –Badsa (Excl.)	59+150 – 59+200	LT Line 440V	OH	9.00	30.9.2022

Sr. No.	Section	HORC Chainage	Description	OH/ UG	Height above GL (Approx.)	Tentative date of Undergrounding/shifting/modification of crossing
24	Manesar –Badsa (Excl.)	61+000	HT Line 11 kV	OH	7.50	30.9.2022
25	Manesar –Badsa (Excl.)	60+200 - 61+300	HT Line 11 kV	OH	6.00	30.9.2022
26	Manesar –Badsa (Excl.)	61+545	HT Line 11 kV	OH	6.00	30.9.2022
27	Manesar –Badsa (Excl.)	61+555	HT Line 11 kV	OH	7.50	30.9.2022
28	Manesar –Badsa (Excl.)	61+565	HT Line 11 kV	OH	7.50	30.9.2022

Table : 1.2 Patli to New Patli Section (LT/HT Crossings up to 33 kV): -

Sr. No.	Section	HORC Chainage	Description	OH/ UG	Height above GL (Approx.)	Tentative date of Undergrounding/shifting/modification of crossing
1	Patli – New Patli	1+600 – 1+700	HT Line 11 kV	OH	6.00	30.9.2022
2	Patli – New Patli	2+100 – 2+200	LT Line 440 V	OH	9.00	30.9.2022

Table 1.3 New Patli to Sultanpur Section (LT/HT crossings up to 33 Kv): -

Sr. No	`Section	HORC Chainage	Description	OH/ UG	Height above GL (Approx.)	Tentative date of Undergrounding/ shifting/modification of crossing
1	New Patli - Sultanpur	1+500	LT Line 440 V	OH	7.50	30.9.2022
2	New Patli - Sultanpur	1+670	LT Line 440 V	OH	9.00	30.9.2022
3	New Patli - Sultanpur	1+960	LT Line 440 V	OH	6.00	30.9.2022
4	New Patli - Sultanpur	1+970	HT Line 11 kV	OH	7.50	30.9.2022
5	New Patli - Sultanpur	1+975	HT Line 11 kV	OH	9.00	30.9.2022
6	New Patli - Sultanpur	2+100	LT Line 440 V	OH	6.00	30.9.2022
7	New Patli - Sultanpur	3+000	HT Line 11 kV	OH	7.50	30.9.2022
8	New Patli - Sultanpur	3+430	LT Line 440 V	OH	9.00	30.9.2022
9	New Patli - Sultanpur	3+450	HT Line 11 kV	OH	6.00	30.9.2022
10	New Patli - Sultanpur	3+550	HT Line 11 kV	OH	7.50	30.9.2022
11	New Patli - Sultanpur	3+700	HT Line 11 kV	OH	9.00	30.9.2022

Sr. No	`Section	HORC Chainage	Description	OH/ UG	Height above GL (Approx.)	Tentative date of Undergrounding/ shifting/modification of crossing
12	New Patli - Sultanpur	3+940	HT Line 11 KV	OH	7.50	30.9.2022
13	New Patli - Sultanpur	4+230	HT Line 11 KV	OH	9.00	30.9.2022
14	New Patli - Sultanpur	4+240	HT Line 11 KV	OH	7.50	30.9.2022

Note: -

1. The shifting/modification work (Undergrounding the Overhead LT/HT Crossing) is being executed by Employer separately. Tentative date of completion is 30.9.2022.
2. The Nos. of above crossings are indicative & may vary at site as Nigam authority keep on executing their own works of LT/HT.

Table 1.4 Manesar to Badsa(Excl.) Section (EHT Crossings): -

Sr. No.	Section	HORC CH	Feeder	kV (Owner)	Lowest Conductor from Ground	Tentative date of Undergrounding/shifting/modification of crossing
1	Manesar –Badsa (Excl.)	50+040	Manesar - Pataudi Line	66 kV (HVPNL)	14.800	31.12.2022
2	Manesar –Badsa (Excl.)	53+000	Mau Line LILO at Transport nagar Manesar(Sec-95)	220 kV (HVPNL)	22.700	31.12.2022
3	Manesar –Badsa (Excl.)	54+400	Harsaru - Pataudi Line	66 kV (HVPNL)	8.500	31.12.2022
4	Manesar –Badsa(Excl.)	54+825	Sec-95 - Mau Line	220 KV (HVPNL)	9.500	31.12.2022

Sr. No.	Section	HORC CH	Feeder	kV (Owner)	Lowest Conductor from Ground	Tentative date of Undergrounding/shifting/modification of crossing
5	Manesar –Badsa (Excl.)	59+195	Harsaru - Farukhnagar Line	66 KV (HVPNL)	13.307	30.09.2023
6	Manesar –Badsa (Excl.)	59+280	Dadri - Samaypur - Balabhgarh Line	220 KV (BBMB)	20.654	30.09.2023
7	Manesar –Badsa (Excl.)	60+210	Dhanonda - Daulatabad Line	400 KV (HVPNL)	25.030	30.09.2023

Table 1.5

Sr. No.	Section	HORC Chainage	Feeder	kV (Owner)	Lowest Conductor from Ground	Remarks
1	Manesar –Badsa (Excl.)	50+660	Sec-95 - Mau Line LILO	220 kV (HVPN)	46.500	May not required to be modified
2	Manesar –Badsa(Excl.)	52+910	Sec-95 - Mau Line LILO at Transport nagar Manesar	220 kV (HVPN)	29.560	May not required to be modified
3	Manesar –Badsa(Excl.)	52+955	Sec-95 - Mau Line LILO at Transport nagar Manesar	220 kV (HVPN)	27.830	May not required to be modified
4	Manesar –Badsa(Excl.)	60+000	Agra - Jhatikra Line	765 kV (PGCIL)	32.197	May not required to be modified

Table 1.6: **Patli to New Patli Section (EHT Crossings): -**

Sr. No.	Section	HORC Chainage	Feeder	kV (Owner)	Lowest Conductor from Ground	Remarks
1	Patli - New Patli	2+450 (Connectivity line)	Sec-95 - Mau Line	220 KV (HVPNL)	23.144	May not required to be modified
2	Patli - New Patli	1+860 (Connectivity line)	Sec-95 - Mau Line	220 KV (HVPNL)	At centre of HORC Connecting line	30.09.2023

Table 1.7:**New Patli – Sultanpur section (EHT Crossings)**

Sr. No.	Section	HORC CH	Feeder	KV (Owner)	Lowest Conductor from Ground	Remarks
1	New Patli - Sultanpur	2+150 (Connecting line)	Agra-Jhatikra	765 KV (HVPNL)	25.130	May not required to be modified
2	New Patli - Sultanpur	3+940 (Connecting line)	Dhanonda-Daulatabad Line	400 KV (HVPNL)	24.169	May not required to be modified

Note: - The shifting/modification work of EHT crossings as per Railway Board guidelines is being executed by respective owner of crossings as deposit work for Employer. Tentative date of completion for this Package area is 30.09.2023.

a) Network: -

Following table shows the approved Section under C-2 Package Area of HORC: -

S.No	Name of Section	
1	Manesar to Badsa (Excl.) including Manesar and New Patli Station yards	The Jurisdictional Electrification works of C-2 Package of HORC Sections are shown in Appendix 15B.
2	Patli to New-Patli Connectivity	
3	New-Patli to Sultanpur Connectivity	
4	OHE Modification& Electrification works of Sultanpur Yard	

1.2 SCOPE AND PURPOSE

The works to be executed under this Contract includes design, validation of design, delivery, installation, testing, including integrated testing and commissioning, technical support, maintenance, training of staff and documentation for a complete System necessary to deliver the requirements of this Specification.

1.2.1 Purpose of this Document

a) This Specification defines the objectives, guidelines and requirements for design, supply, installation, testing and commissioning of 25 kV High Rise Overhead Equipment (OHE) for HORC Section and SCADA system (for 01 Sultanpur SP only) for Manesar to Badsa (Excl.)

Double Main Line including Manesar & New Patli Station Yards, OHE Modification & Electrification works at Sultanpur Yard and 02 Nos. single line connectivities: -

i. Patli to New-Patli single line connectivity
ii. New Patli to Sultanpur single line connectivity

In this section 4 SSP (2 at Manesar and 2 at New Patli) and 1 SP at Sultanpur will be constructed.Contractor shall have to install SCADA equipment at Sultanpur SP only as per site requirement**.**

Note: - SSP – Manesar-South will have CB arrangement for Maruti Siding**.**

b) In this section Manesar, New Patli & Sultanpur station building will be constructed (Detail shown in respective chapter). The Contractor has to do the electrification work of all these station buildings/Yard with allied facilities including provision of 03 Nos lifts (13 Passengers) at Manesar & New Patli station building each, On grid solar plant of rated capacity at each Proposed station area , Sub-Station (11/0.44 kV, 2x500 kVA CSS with silent type DG of 160 kVA capacity including AMF , APFC Panel& LT panel) for Manesar station and a Sub-Station (11/0.44 kV, 2x250 kVA CSS with silent type DG of 125 kVA capacity including AMF , APFC& LT Panel) for New Patli station with all safety equipment as per specification and satisfaction of Engineer.

1.2.2 Relevant Documents

This Specification should be read in conjunction with the General Conditions of Contract, the Particular Conditions of Contract (PCC), the General Specification (GS), the Engineer's conceptual drawings and any other document forming part of the Contract.

1.2.3 Design and Drawing

i. The Responsibility for the complete design work as per RDSO/CORE & Railway Board guidelines lies with the Contractor.

ii. Notwithstanding anything given anywhere else all work execution shall be as per latest design and drawing of RDSO/CORE and latest guideline issued by Railway Board.

iii. The contractor should follow all the clearances as per latest CEA regulations.

iv. All materials used in the work shall be procured from RDSO/ CORE approved sources only.

1.3 OVERVIEW OF PROJECT

1.3.1 Approved Section for OHE (HIGH RISE) and General Services work: -

As stated in Para 1.2 above, the C-2 Package area of HORC comprises of following sections: -

a) Manesar to Badsa (Excl.) – including Manesar & New Patli Station Yards - Double Main line

b) Patli to New- Patli - Single line Connectivity

c) New- Patli to Sultanpur – Single line Connectivity

d) OHE Modification & Electrification works in Sultanpur Yard Area.

Note: - The Jurisdictional Electrification works of C-2 Package of HORC Sections are shown in Appendix 15B..

1.3.2 Various General Services work details: -

Design and Electrification of Proposed MANESAR, NEW PATLI & SULTANPUR Station Building, Platform, Circulating/yard area with allied facilities as per requirement and guidelines issued by Railway Board. Provision of (11/ 0.44 kV) Sub- Station of rated capacity at Manesar & New Patli Station each , 03 Nos of lifts (13 Passengers,884 Kg) at Manesar & 03 Nos lifts (13 Passenger,884 Kg) at New Patli station as per RDSO/CPWD/Railway Board specification and On grid solar plants of rated capacity at each proposed station area are also included in scope of this tender.

1.3.3 Power Supply for Section: -

The section covered under this tender will be charged by extending the existing feed at PATLI station of Indian Railway. All the material/equipment etc. required for feed extension shall also be in the scope of this tender.

CHAPTER –2 SCOPE OF WORK

2.1 GENERAL

A general description of the broad scope of work, relating to works covered in this Tender under schedule A, is given below. It shall, however, be clearly understood that the description is for the purpose of general guidance only and is not exhaustive. For complete appreciation of the Scope, the Specifications, drawings and other relevant paragraphs of the Tender documents shall be referred to.

2.1.1 Items of Work

The following items of work are within the Scope of this Tender:

i. Design of 25 kV, 50 HZ single phase AC electrification with HIGH RISE OHE System, as per guideline/specification/standard issued by RDSO/CORE/Railway Board.

ii. Supply and Erection of 25 kV Traction Overhead Equipment for HORC Sections including connectivities in Station Yard, Open line ,Elevated lines and Bridge Masts on Bridge piers etc./Drop Arm arrangement on various Bridges in Section lines. Provision of Switching Stations (SP and SSP) with complete electrical equipment and civil work for sectioning and supply of traction power to rolling stock with necessary protection of the line.

iii. Civil works w.r.t OHE i.e. Foundations (Conventional Block type or Cylindrical type as per approval of Engineer) and w.r.t switching stations i.e Battery room, Control room, fencing work etc.

iv. Concrete for Normal Foundations /Conventional Block Type shall be of Grade M 10 with concrete for grouting and Muffing of Grade M 15 in accordance with IS 456.Concrete for Cylindrical Foundations shall be of Grade M 15 with concrete for grouting and Muffing of Grade M 20 in accordance with IS 456.

v. Provision of track bonding and earthing system at etc.

vi. Supply and Erection of 25 kV/415 V Auxiliary Transformers of rated capacity with all associated switch gears and equipment at station and switching post.

vii. Supply and Erection of CLS PANEL with cabling arrangement of suitable size and rating at each station and switching post as per RDSO specification.

viii. Modifications to existing OHE including dismantling of OHE, removal of brackets, cutting of masts, dismantling and removal of existing auxiliary transformer.

ix. Supply and Erection of SCADA System, RTU's equipment (to be installed only at Sultanpur SP) including Modification/up gradation, testing & commissioning in existing standard SCADA software at RCC Equipment's for configuration, integration/ hooking up of additional RTUs of adjacent section with master station at TPC/ control of Delhi Division.

x. Provision of Bridge/Elevated Mast and Anchor shall be suitably designed (Bolt Diameter, Spacing) by contractor and bolt to be installed at the time of Casting.

xi. Contractor shall provide openings/Pulpit and HDPE pipe for carrying cables inside the station at Track crossing as per the requirement and shall take in consideration the bending radius of cable and covering of cables in public area.

xii. Electrification of Manesar, New Patli and Sultanpur station building with allied facilities and complete power supply arrangement as per Standard Railway Practice and guideline issued by Railway Board/ RDSO/ CPWD specification.

xiii. Supply, Installation, Testing and Commissioning of 3 Nos Lifts(G+1) (13 Passenger ,884 Kg) at Manesar and 03 Nos lifts(G+1) (13 Passenger,884 Kg) at New Patli station with all

safety equipment and 02-year or warranty given by OEM whichever is higher including all schedule maintenance as per OEM, attending breakdown with in prescribed time.

xiv. Supply, Installation, Testing and Commissioning of substation (11/0.44 kV, 2x500 kVA CSS with DRY type transformer (500 kVA) and silent type DG of 160 kVA capacity including AMF,APFC Panel of 200 kVAR & LT Panel) including earthing system and all Safety equipment with complete power supply arrangement at Manesar station as per specification. The Location of Compact Sub Station (CSS) with all accessories shall be proposed by contractor in Station Area for approval of Engineer

xv. Supply, Installation, testing and commissioning of substation (11/0.44 kV, 2x250 kVA CSS with DRY type transformer (250 kVA) and silent type DG of 125 kVA capacity including AMF,APFC Panel of 200kVAR & LT Panel) including earthing system and all Safety equipment with complete power supply arrangement at New Patli station. The Location of Compact Sub Station (CSS) with all accessories shall be proposed by contractor in Station Area for approval of Engineer.

xvi. Provision High Mast Towers (16 mtrs) and octagonal poles (5 mtrs) at yards, platform and circulating area with complete cabling arrangement to meet standard LUX level as per guideline issued be RDSO/ Railway Board.

xvii. Supply, installation, Testing and commission of ON- Grid solar plants of rated capacity with complete accessories in all respect and Net Metering System at Manesar, New Patli and Sultanpur station area. (Location of solar plants will be proposed by contractor and to be got approved by engineer).

xviii. Provision of Man power for maintenance of all the work that is to be done in this package during **Maintenance Period (One year)** as per latest SMI's and other instruction issued by RDSO/ Railway Board. This also includes manning of all switching post and 11 kVA Sub-Station round the clock as per specification. Under this, all labour law's will be applicable.

xix. Supply, Installation Testing and Commissioning of fire Detection & Alarm system (air aspiration) as per RDSO/SPN/NEW/2010 or latest at various locations (A per guideline issued by Railway Board) of each station building.

xx. All equipment testing, system acceptance test, integrated testing, and Commissioning of all erected equipment.

xxi. Provision of all the construction drawings, documents and as-built drawings required to supply, install, test and commission the above installations.

xxii. Deal and resolve in co-ordination with the Engineer the Interface with other Contractors to ensure timely completion of the Works;

xxiii. Ensure Technology Transfer and Training to Engineer's staff.

2.1.2 Section Covered in the Scope of the Tender

The Jurisdictional Electrification works of C-2 Package of HORC Sections are shown in Appendix 15B.

2.2 SCOPE

2.2.1 General

In general, EPC Contractor is responsible for all electrical works relating to 25 kV Traction Overhead Equipment, Switching Post, SCADA system and electrification of station building/Yard including provision of lifts and (11/0.44 kVA) substation of rated capacity in this Section

Table -2.1 Scope of work

S.NO	NAME OF SECTION	SCOPE
1	Manesar to Badsa (Excl.) including Manesar & New Patli Station Yards - Double main Line	High Rise OHE, Switching Post &Various Electrical General Services Work
2	Patli to New-Patli connectivity	High Rise OHE, Switching Post &Various Electrical General Services Work
3	New Patli to Sultanpur connectivity	High Rise OHE, Switching Post& Various Electrical General Services Work
4	Sultanpur Yard Area	High Rise OHE Modification & Electrification With Switching Post & Various Electrical General Services Work
5	Design	OHE, SCADA, PSI, General Services Work
6	SCADA installation and integration at Sultanpur SP with Northern Railway RCC	SCADA work
8	Extension of feed to HORC from Patli station of IR	All work related to the feed extension.

2.2.2 Contractor's Scope

A) Table 2.2:Scope For OHE Work: - (High Rise OHE)

S.NO	Section	
1	Manesar to Badsa (Excl.) Double Line including Manesar and New Patli Station Yard	The Jurisdictional Electrification works of C-2 Package of HORC Sections are shown in Appendix 15B.
2	Patli to New-Patli single line Connectivity	
3	New-Patli to Sultanpur single line Connectivity	
4	OHE Modification & Electrification works of Sultanpur Yard	

B) Scope for Switching Stations

Design, supply, erection, testing and commissioning of single phase, 25 kV, 50 Hz, AC Switching Stations (SP/SSP) including foundations, structures and all ancillary equipment etc. as per following details along with earthwork, construction of buildings, fencing, retaining wall, internal wiring with switch/fittings/equipment's, battery set, PTFE in case of SP all types of caution, warning, instruction, protection, location/name and schematic diagram boards, earthing stations, safety items (i.e. Firefighting equipment, First Aid box, Shock treatment chart, key box etc.), manning of SCADA during maintenance period and all necessary documentation for EIG sanction and CRS Inspection, supply of required drawings and breakdown maintenance till maintenance period.

(a) The following works shall form part of this Tender:

Design, Supply, Installation, Testing and Commissioning of all Switching Stations (SP and SSP) inthe Section, including, but not limited to: -

i. 25 kV Switchgears
ii. Jumpers and connecting cables
iii. Measuring and protection equipment
iv. LT and Control Cables for Switching Station
v. Structures and foundations to support the equipment and all other related works to make the Switching Station complete for its successful and satisfactory working.
vi. All control cables required for switching post.
vii. All LT cables required for interconnection of equipment's etc. in the AT connection including CLS panel.
viii. Batteries and battery chargers at each switch post.
ix. Cable paths and earthing arrangements
x. Safety equipment and all other items required for successful and satisfactory working of each switching post.

(b) The Tentative Locations of Switching Posts are as follows:

S. No	Location	HORC Chainage	Length (Mtr)	Width (Mtr)
1	SSP NEW PATLI – South (Double Line)	57.136	21.00	06.00
2	SSP NEW PATLI- North (Double Line)	59.136	21.00	06.00
3	SP SULTANPUR (Double Line)	385.686 Meter F/CSB	21.00	06.00
4	SSP MANESAR-South(Double Line)	50.872	21.00	06.00
5	SSP MANESAR – North (Double Line)	52.872	21.00	06.00

Note: -

1. The Location of SP/SPP are only indicative, the final location shall be proposed by contractor as per site feasibility, location of signals, location of overlaps, Location of Cross overs and operation requirement etc.
2. The contractor shall provide Circuit Breaker (CB) arrangement at SSP MANESAR- South for Maruti Siding.
3. PTFE shall be installed by contractor to segregate HORC lines from IR line in Sultanpur SP.
4. The Indicative plan of GPS cum Sectioning arrangement is given in Appendix 15C for reference only. Contractor shall submit GPS and Sectioning along with all other drawings as per Railway practice for OHE and PSI works for approval of Engineer.

C) Site for Service Building: -

S. No.	Location	Length(m)	Width (m)
1	2	3	4
Service Building	Manesar Station Building	As per Details given in Civil Engineering part of this tender	
	Manesar Sub-Station (11/.440 Kv)		
	New-Patli Station Building		
	New-Patli Sub-Station (11/.440 Kv)		
	Sultanpur Station Building		

D) 10KVA/25 KVA Auxiliary transformer stations

Design, supply, erection, testing and commissioning of single-phase Auxiliary Transformer Station of different capacity as per following details, complete with all structures and fittings etc. along with anti-climbing device and all types of caution, warning, instruction, protection boards and location/Name boards, junction box and all necessary documentation for EIG sanction and CRS Inspection and supply of required drawings and Breakdown attention and maintenance till maintenance period.

i. 10 KVA AT requirements: -

S.N.	Location	Capacity	Quantity of AT	Remarks
1	New Patli SSP –South	10 KVA	01	Required at Station Building and Switching Post
2	New Patli SSP- North	10 KVA	01	
3	Sultanpur- SP	10 KVA	01	
4.	Sultanpur Station	10KVA	02	
5	Manesar SSP- South	10 KVA	01	
6	Manesar SSP- North	10 KVA	01	
		TOTAL	**07 Nos**	

ii. 25 KVA AT requirements: -

SN	Location	capacity	Quantity of AT	Remarks
01	Manesar Jn.	25 KVA	2 Nos.	Required at Station Building
02	New Patli Jn.	25 KVA	2 Nos.	
		TOTAL	**04 Nos.**	

E) Supervisory Control and Data Acquisition System (SCADA): -

i. Scope of SCADA work for supply, erection & commissioning through SCADA approved vendors with defect liability period of 2 years is a part of main EPC contract **as per RDSO Specification No. TI/SPC/RCC/SCADA/0130 (Rev-2) with A&C slip No.-1, 2 & 3 and latest amendments.** Brief of the scope for SCADA system given as below:

Section	**C-2 Package Area**		
Item No.	**Description**	**Unit**	**Qty.**
1	Design and Drawings required in connection with Modification/up gradation, testing & commissioning in existing standard SCADA software at RCC Equipment's for configuration, integration/ hooking up of additional RTUs of adjacent section with master station.	LS	01
2	Modification/up gradation, testing & commissioning in existing standard SCADA software at RCC Equipment's for configuration, integration/ hooking up of additional RTUs of adjacent section with master station.	LS	01
3	Supply, Erection, Testing & Commissioning of RTUs at remote stations.		
(a)	Sectioning Posts (SP) for Sultanpur SP	Nos.	01
(b)	Sub Sectioning Posts (SSP)	Nos.	NIL

ii. Modification Required at RCC (Remote control center) at Designated locations: -TPC control, State entry Road, Delhi division, New Delhi.

F) Various electrical General services work:

i. Electrification of Proposed Manesar, New Patli and Sultanpur Station Building.

Sr. No.	Description of Work	Manesar station Building (G+3) and substation	New- Patli Station Building (G+1) and Sub station	Sultanpur Station Building	Total Qty
1	Wiring for light/ceiling fan/exhaust fan/call bell/ Power plug/socket/ etc. points including circuit wiring, sub-main wiring with Fire Retardant (FR), PVC insulated, multistranded, copper	490 Points	240 Points	115 Points	845 Points

Sr. No.	Description of Work	Manesar station Building (G+3) and substation	New- Patli Station Building (G+1) and Sub station	Sultanpur Station Building	Total Qty
	conductor, single core cable on surface/in recessed PVC conduits, distribution boards, sub distribution boards, earthing with suitable number of modular switch and socket. Wiring shall be done as per standard sizes of cables. Number of points permissible in each circuit and sub main as per standard. It also includes fixing of DB (SPN, TPN) of suitable Nos of MCB and RCCB as per technical specification and standard.				
2.	Supply, installation, testing and commissioning of prewired 22 watt energy efficient Tube light fitting(4 feet) on wall bracket of GI class "B" pipe (Or suitable fixing arrangement)& connections from junction box/overhead line/light point etc. to luminary with 1.5 sq.mm FRLS PVC insulated multistranded copper conductor single core/three cable as instructed & earthing etc. as required.	320 Nos	160 Nos	80 Nos	560 Nos
3.	Supply, installation, testing and commissioning of 230V A.C. ceiling fan (1200 MM/1400 MM) and Modular fan Regulator as per requirement and specification	112 Nos	46 Nos	23 Nos	181 Nos
4	Supply, installation, testing and commissioning of Bus Trunking System (Rising Main structure) in station building as per requirement and specification.	1 Job (G+3)	-	-	01 Job
5	Provision of High Mast Tower (16 Mtr.) with LED Flood light fitting (200 Watt) with complete accessories and as per specification.	As per instructions/specifications for standard LUX level o circulating area of any station issued by Railway Board.			
6	Provision of Octagonal poles (5 metres) with street light fitting (40 Watt) and 70-30%	75 Nos	70 Nos	30 Nos	175 Nos

Sr. No.	Description of Work	Manesar station Building (G+3) and substation	New- Patli Station Building (G+1) and Sub station	Sultanpur Station Building	Total Qty
	arrangement with complete accessories, as per requirement and specification.				
7	Supply, Installation Testing and Commissioning of Passenger Lifts (13 Passengers, 884 Kg) complete in all respect with all accessories as per requirement and specification.	03 Nos (G+1)	03 Nos(G+1)	-	06 Nos
8	Supply, Installation Testing and Commissioning of Sub-Station (11/0.440 KV) including CSS-1, CSS-2. Each CSS Shall be consisting of 11KV Compact VCB/SF6 CB panel (1 incoming isolator + 2 outgoing VCB/SF6 CB with air insulated BUS PT metering module) + Transformer (500 KVA)/250 kVA DRY Type + L.T. Switchgear with all HT & LT inter- connections, accessories, fittings & auxiliary equipment inside GI Enclosure as per technical specification. CSS also include 1 RMU 11KVA 630 Amp 21 KA, LT panel as per spec., APFC panel 200 KVAR MPP type heavy duty, all HT and LT cable with proper termination arrangement of suitable size and length, Suitable H-pole arrangement with GO/DO switch, supply, fixing and commissioning of 160 kVA DG set with AMF panel, Provision of Copper Plate earthing as per requirement and as per technical specification. This also includes supply & fixing of all safety items required for (11/0.440) substation as per IS .	01 Job 02-CSS including (2X500 transformer with Silent type DG of 160 kVA Capacity and AMF and APFC Panel) and complete in all respect.	01 Job 02-CSS including (2x250 kVA transformer with Silent type DG of 125 kVA Capacity and AMF and APFC panel) and complete in all respect.	-	02 Job
9	Provision of Inverter type Split AC (1.5 Ton, Heavy duty, 5 Star Rating with Stabilizer) and other accessories as per site requirement and specification.	12 Nos	10 Nos	09 Nos	31 Nos
10	Supply, Installation Testing and Commissioning of LED Signage Board & LED Station Name Board (Single Sided/Double	300 Sqft	256 Sqft	186 Sqft	742 Sqft

Sr. No.	Description of Work	Manesar station Building (G+3) and substation	New- Patli Station Building (G+1) and Sub station	Sultanpur Station Building	Total Qty
	Sided) with all accessories. As per specification and satisfaction of Engineer.				
11	Supply, laying, Testing and Commissioning of 1.1 kV grade LT XLPE insulated armoured, aluminium conductor cable, in trench/ air/ HDPE pipe. making good the damages, end terminations with aluminium crimping sockets/lugs, provision of cable route markers, as per specification and satisfaction of Engineer.	Approx. Qty of cables: - 4x16=2500 mtrs 4x35= 1300 mtrs 4x50=600 mtrs 4x120= 500 mtrs 4x185= 500 mtrs	Approx. Qty of cables: - 4x16=2200mtrs 4x35= 1300 mtrs 4x50=600mtr 4x120= 500mtrs 4x185=500 mtrs	Approx. Qty of cables: - 4x16=1000 mtrs 4x50=500 mtrs 4x120= 500mtrs	-
12	Supply, Installation, Testing and Commissioning of Water Cooler (150 Ltrs) capacity with around MS Cage & suitable protection arrangement (RCCB with enclosure) as per site requirement and specification.	10 Nos	05 Nos	03 Nos	18 Nos
13	Supply, Installation, Testing and Commissioning of Water Pumping Arrangement system with3 Phase ,10 HP Submersible Pump set of discharge- 310 LPM or Above and Head range: 85 Meters or above with rated capacity of soft starter and with 3 Phase ,10 HP Submersible monoblock Pump of discharge- 850 LPM or Above and Head range: 35 Meters or above with rated capacity of soft starter and 3 core copper cable 10 Sq. mm and other accessories as per site requirement and satisfaction of Engineer.	Submersible pump set (10 HP) – 02 Nos Submersible Mono block pump (10 HP) – 02 Nos 3x10 sqmm CU cable as per site requirement.	Submersible pump set (10 HP) – 02 Nos Submersible Mono block pump (10 HP) – 02 Nos 3x10 sqmm CU cable as per site requirement.	Submersible pump set (10 HP) – 02 Nos Submersible Mono block pump (10 HP) – 02 Nos 3x10 sqmm CU cable as per site requirement	06 Nos (10 Hp) submersible pump set. & 06 Nos(10 Hp) Submersible Mono block pump
14	**Provision of Earthing System**				
14(a)	Supply, Installation, Testing and Commissioning of Earthing system with3-meter-long, 50 mm dia, G.I. pipe class 'B' earth electrode, adding of charcoal or coke and salt, providing masonry enclosure and cover plate with	60 Nos	40 Nos	30 Nos	130 Nos

Sr. No.	Description of Work	Manesar station Building (G+3) and substation	New- Patli Station Building (G+1) and Sub station	Sultanpur Station Building	Total Qty
	lifting arrangement etc. including connections with 8 SWG G.I wire from earth electrode as per specification.				
14(b)	Supply, Installation ,Testing and Commissioning of Maintenance free Earthing as per specification	10 Nos	05 Nos	05 Nos	20 Nos
14(c)	Supply, Installation ,Testing and Commissioning of Copper Earthing system with 600x600x 3 mm thick Cu earth plate and suitable size and length of 40x5 mm copper strip as per specification.	14 Nos	06 Nos	-	20Nos
15	Supply and fixing of suitable size feeder pillars and Junction Box as per requirement and specification.	10	05 Nos	02 Nos	17 Nos
16	Supply, Installation Testing and Commissioning of CLS panel suitable for 25 kVA/10 KVA capacity AT supply with complete accessories and protection system As per RDSO specification.	02 Nos (25 kVA) for Station Building 02 Nos (10kVA) for each SSP	02 Nos (25 kVA) for Station Building 02 Nos (10kVA) for each SSP	02 Nos (10 KVA) for station Building 01 No(10kVA) for SP	04 Nos (25 kVA) & 07 Nos(10kVA)
17	Supply, Installation ,Testing and Commissioning of Phase selector of size (610x450x190mm) with I/P MCCB- 100/ 63 amp and O/P MCCB- 63 Ampas per requirement and specification	01 Nos	01 Nos	01 Nos	03 Nos
18	Design, supply, testing Erection and commission of Indoor type LT panel with one incoming MCCB of suitable rating and Min 6 Nos of Output MCCB of suitable rating as per requirement and specification.	01 Nos	01 Nos	01 Nos	03 Nos
19	Design, Supply, Installation Testing and Commissioning of fire Detection & Alarm system (air aspiration) as per RDSO/SPN/NEW /2010 at various location of each station, complete in all respect and satisfaction of Engineer.	01 Job	01 Job	01 Job	03 Job
20	Supply, fixing commissioning,	02 Nos	02 No	01 No	05 Nos

Sr. No.	Description of Work	Manesar station Building (G+3) and substation	New- Patli Station Building (G+1) and Sub station	Sultanpur Station Building	Total Qty
	installation and testing of 2 kVA pure sine wave 24-volt online inverter consist of intelligent battery charging mechanisms with adaptive battery charging and 150 AH tubular battery of voltage 12 volt suitable for heavy duty application. Warranty of invertors is 24 months and for Battery -36 months And as per specification.				
21	Supply, fixing, commissioning and installation of Perforated Cable Tray of size 150x50 mm made out of MS sheet and hot dip galvanized (85 microns) 1.6 mm thick with suitable fixing Arrangements as per requirement and specification.	500 Mtrs	200 Mtrs	100 Mtrs	800Mtrs
22	Supply, Installation ,Testing and Commissioning of Solar Plants with 380 watt panels, hybrid type inverter, Galvanised structure, DCDB, ACDB, connectors, MCCB, earthing system, LA, Surge protector and other wiring material complete in all respect and satisfaction of Engineer.	160 kWp	80 kWp	10 kWp	250 kWp

Note: -

1) All the quantity of above Electrical items is indicative it may vary as per site condition and Design and Drawing of station/service Building. The Contractor Shall submit the Load Calculation and design all electrical equipment accordingly
2) The type of items and their quantity shown above is as per the minimum requirement. The contactor shall have to install this minimum quantity at site. The contractor shall meet all the Specification/ Standard/Lux level issued by RDSO/Railway Board,
3) The Contractor shall arrange the approval of Sample of all required items, Lay Out Plan and Complete HT/LT power supply arrangement of each station buildings, Platform, Circulating/Yard area from Engineer.
4) The location for installation of Solar Plant/Panels in Manesar, New Patli & Sultanpur Station area shall be proposed by contractor as per Site feasibility for approval of Engineer.

a) Extension of LT power supply for CLS Work at Manesar, New Patli and Sultanpur stations.

i. 10 KVA AT Cable Requirement: -

S. N.	Location	Size of conductor (Approximately)	Quantity of AT	Cable Quantity in meter /AT	Remarks
1	Sultanpur Station	4X70 sqmm	02	50 Mtrs	1.One spare cable also to be provided of the same length and size. 2.In double line section, track crossing may also be involved with HDPE Pipe. 3. In platform area or concrete structure the cable may be required to laid by insertion of HDPE pipe by Boring/Drilling method. 4. Suitable capacity of CLS panel will be installed at each AT location with proper earthing arrangement.
2	New Patli SSP - North	4 x 70 sqmm	01		
3	New Patli SSP - South	4X70 sqmm	01		
4	Sultanpur SP	4X70 sqmm	01		
5	Manesar SSP - North	4X70 sqmm	01		
6	Manesar SSP - South	4X70 sqmm	01		
TOTAL			**07 Nos**	**350 Mtrs**	

Note: QTY of Cable shown above Para is approximate and indicative only. It may vary as per site condition

ii. 25 KVA AT Cable requirement

SN	Location	Size of conductor	Quantity of AT	Cable Quantity in meter per AT	Remarks
01	Manesar Jn	4 X 95 sq mm	2 Nos.	900	1. (450+450=900 mts) For all locations. 2. One spare cable also to be provided of the same length and size. 3. In double line section, track crossing may also be involved with HDPE Pipe.
02	New Patli Jn	4 X 95sq mm	2 Nos.	900	

SN	Location	Size of conductor	Quantity of AT	Cable Quantity in meter per AT	Remarks
					4. In platform area or concrete structure, the cable may be required to laid by insertion of HDPE pipe by Boring/HDD method. 5. Suitable capacity of CLS panel will be installed at each AT location with proper earthing arrangement.
TOTAL			**04 Nos.**	**1800 Mtrs**	

Note: QTY of Cable shown above Para is approximate and indicative only. It may vary as per site condition.

b) Extension/Augmentation of electrical power supply arrangements and associated works:

SN	Extension/Augmentation of electrical power supply
1	New HT Connection (11kV) of 190 KW at Manesar Sub Station/Jn.
2	New HT connection (11 kV) of 80 KW Connection, at New Patli Jn
3	New LT connection (1 Phase, 230 Volt) of 10 KW (or as decided by Engineer at the time of execution) Connection, at SULTANPUR Station

G) Modifications of Sultanpur Yard:OHE modification in Sultanpur yard includes OHE transfer, dismantling, new OHE erection, slewing/re-slewing/readjustment, extension of OHE by providing splices or otherwise etc of all the components of OHE including brackets, insulators, feeder wire/return conductor/contact wire/catenary wire, terminations, ATDs, isolators, section insulators, IOL shifting, PTFE neutral section, traction bond cross over OHE etc as per approval of Engineer as per Jurisdictional Sketch for Electrification works of C-2 Package shown in Appendix 15B. The 'In Principle' approved Layout Plan(LOP) of Sulatanpur (Incl.) to Farukhnagr (Excl.) of existing OHE is attached as Annexure 15D for reference

Note :- Loading, leading, Transportation and Unloading of steel structure and other overhead equipments etc. from dismantling site to concern Engineer Incharge store is also within the scope of this package.

H) Inventory electrical:

List of inventory is given in Appendix 14.

I) Bridge Masts on Bridge piers etc. /Drop Arm arrangement/OHE Arrangement on various Bridges in Section

The scope of work also includes provision of bridge masts on piers/ abutments by drilling/bolting/grouting or other suitable arrangements as per site conditions, Cantilever Assembly on Vertical member of bridge, Drop arm arrangement, any other OHE arrangement on bridge as per site requirement.

SN	Section	No. of Bridge Masts
1	**The Jurisdictional Electrification works of C-2 Package of HORC Sections are shown in Appendix 15B**	As per RDSO/CORE/Railway Board guidelines applicability on bridges in the section along with emergency arrangement.

NOTE: This item shall be part of OHE Electrification Work.

J) Design and Drawings: -

The complete design of OHE, PSI, SCADA, General Services work etc. will have to be as per design and specification of RDSO/CORE/Railway board.

2.3 DOCUMENTS AND MANUALS

The contractor shall have to supply documents and Manuals in English language as per RDSO/CORE/Railway board guideline.

2.3.1 As Built Drawings

i. The contractor shall prepare the as built and other drawings defined as:

ii. As built drawing depicting the completed works that have been certified as complete.

iii. Shop drawings containing information related to the permanent works.

iv. Working drawings containing information related to the temporary works depicting the construction of permanent works.

2.3.2 Electronic Drawing Format

All the drawings shall be prepared in AUTOCAD 2018(or latest version) which shall be compatible with window 98/XP/7/10/10professional as well as in latest pdf.

2.4 Defects Liability Period (DLP)

The Contractor shall be responsible for all the Defects and deficiencies, till the expiry of a period of **01 (One) year**. The Contractor shall repair or rectify all Defects and deficiencies observed by the Engineer during the Defects Liability Period with in time period as may be determined by the Engineer in accordance with Good Industry Practice.

2.5 Warranty Certificates from OEM:

i. All Original Warranty Certificates of OEMs of all Electrical system or equipment including contract spare, Commissioning spare, DLP spares, inventory and Special tools & Test and Measuring equipment shall be valid for three years or as specified in RDSO Specification of the equipment whichever is later and registered in the name of Employer. These warranty certificates received from the OEMs should be passed on to Engineer before final Taking over.

ii. Validity of period of Warranty Certificates shall start from date of Commissioning.

iii. Original invoice shall also be submitted with the OEM warranty certificates in a booklet form before Commissioning.

iv. Warranty support shall start from the date of Commissioning.

2.6 Coding and Tagging of Spare Parts and Special Tools and Test Equipment

i. All Spares/Spare Parts and Special Tools and Test Equipment to be delivered to the Engineer shall each carry a tag suitably marked, bar-coded (as directed by the Engineer) and numbered.

ii. The numbers on the tags shall correspond with those on the coding system developed by the Contractor for all Electrical components, parts and equipment's.

2.7 Maintenance Activity:

All type of maintenance activity of all Works will be conducted by the contractor staff under his supervision, till the expiry of a period of 01 (One) year from taking over. All type of Routine, preventative and schedule maintenance work will be carried out at regular intervals based on SMI's/ Instructions issued by RDSO/CORE/Railway Board and equipment manufacturers' recommendations. (List of SMI's issued by RDSO is attached at Appendix 15A for reference). Under this, all the labour laws would be applicable and contractor has to submit all the records (EPF/ESI and other certificates) to Engineer.

To perform maintenance activity, the Contractor shall deploy supervisory staffs along with skilled staff who are expert in all levels of fault finding, maintenance and repair of the various systems supplied under the Contract. The detail of deploying staff is as under:

S. No	Personnel	Qualification	Total work experience(in year)	Required No of staff	Remark
1	Maintenance In-charge	Graduate Degree in Electrical Engineering	Min. 05 Years of working experience on any OHE project and Min 02 years' experience of General power supply arrangement.	01	Over all in charge of all type of Electrical(OHE+GS) maintenance work
2	Maintenance Engineer	Diploma in Electrical Engineering	Min. 03 Years of working experience on any OHE project or any OHE maintenance activity	01	Required as Site engineer for all type of OHE work
3	Maintenance Engineer	Diploma in Electrical Engineering	Min. 03 Years of working experience of General Services work of any GS maintenance activity.	01	Required as Site engineer for all type of General Services work
3	Skilled Staff for Maintenance activity	ITI in Electrical Trade	Min. 02 Years of working experience on any OHE project/General power supply arrangement	10	Required to perform day to day maintenance activity for OHE and GS work
4	Skilled Staff for Manning Purpose	ITI in Electrical Trade	Min. 02 Years of working experience on any OHE project/General power supply arrangement	21	Required for Manning of Switching post(SP/SSP) and 11 kV Substation of Manesar and New Patli station.

CHAPTER3—PROJECT PROGRAMME REQUIREMENT

3.1 General Requirements

i. The Contractor shall develop in detail, a logical method of executing the Works taking into account their complex nature and different phases and shall provide programmes which reflect the detailed planning undertaken.

ii. The programmes shall start with the Commencement Date of the Works as day one, are to be realistic, achievable and shall be accompanied by the detailed supporting Management Plans.

iii. The Program activities shall be discrete items of work, which when combined and produces the definable elements, components, Milestones, Stages and Sections of the Works and clearly identify the completion obligations of the Contractor.

iv. Milestones shall be an integral part of all programmes and all activities. Sequencing and interrelationships required to achieve each completion obligation shall be shown. Milestones shall not impose constraints that in a way affect the programme logic. Milestones shall not be introduced into any programme as constrained dates.

v. The critical path shall be clearly identified in the programme and fully described in the accompanying programme narrative.

vi. Activity descriptions shall clearly convey the nature and scope of the Works. Programmes shall take into account the activities of Precursor, concurrent, adjacent and follow on project contractors and any other activity that may affect the progress of the Works.

vii. The Contractor shall also incorporate the Engineers requirement for additional activities, to further explain or subdivide complex or long duration tasks, without affecting completion dates.

viii. The Contractor shall monitor its and its subcontractor's performance against programmes to ensure its compliance with its obligations under the Contract. Monitoring of the Works shall include direct, daily monitoring of the progress of the Works and the preparation of return and computerised reports to be submitted to the Engineer. The reports shall include all necessary supporting data to apprise the Engineer of the status of the completion of the Works as described below.

3.2 The Execution Phases

Theexecutionactivitywillincludevariousphasesoftheimplementationasunder.

(1) Design Phase,

(2) Manufacturing/Supply Phase,

(3) Construction/Installation Phase,

(4) Testing & Commissioning Phase and

(5) Operation & Maintenance Phase;

3.2.1 Design Phase

The contractor shall deploy a qualified team of the Design Engineers and Experts as approved by the Employer, evidencing the experience of the design in relevant field and technology with the approval of the Engineer, before commencement of Design Phase. The Design Phase shall have 4 stages as detailed below:

(a) Preliminary Design

(b) Detailed Design

(c) Construction/Installation Design

(d) As Built Documents

3.2.2 Manufacturing/Supply Phase

The manufacturing/supply will constitute the following:

(a) Manufacturing/Procurement;

(b) Factory Acceptance Tests(FAT);

(c) Delivery to the contractor's stores at site; and

(d) Storage at the site Stores, including establishing the Material Procurement tracking, receipt and issue procedures.

3.2.3 Construction/Installation Phase

Construction/Installation Phase will constitute of the following:

(a) Site Management including access/ROW preparation;

(b) Availability of Construction Reference Drawings;

(c) Installation preparatory works like Foundations, first fix, site safety and quality assurance procedures etc.;

(d) Equipment installation; and

(e) Training of Employer's Personnel

3.2.4 Testing and Commissioning Phase

Testing and commissioning phase will constitute of the following:

(a) Testing and Commissioning of all subsystems;

(b) Quality assurance;

(c) Integrated Testing & commissioning;

(d) Trial run including service trials; and

(e) Submission of verified and As Built Documents

3.2.5 Operation and Maintenance Phase

Operation and Maintenance Phase will constitute of the following

(a) Operation and Maintenance activity

(b) Defect rectification

(c) Workshop Repair Services

(d) Support and Call Out Services

(e) Supply of O&M Manuals, Maintenance schedules and Warranty certificates

3.3 Works Programme

(a) TheWorksProgrammetobesubmittedunderthecontractshallbedevelopedfromthe OutlineWorksProgrammesubmittedanddevelopedduringthetenderperiod according to Key Dates given in the bid documents.

(b) Within 30 days of the Commencement Date of the Works the Contractor shall submit for review by the Engineer, his proposed initial version of the Works Programme which shall provide full programme details for the first six months of the contract and shall provide outline details for the remaining period of the contract.

(c) Within 60 days of the Commencement Date of the Works, the Contractor shall submit for review by the Engineer the proposed full version of the Works Programme.

(d) The Works Programme shall demonstrate by reference to its Sub Programmes, Supplementary Programmes and associated Management Plans, the sequence and duration of the activities and any restraints there to that the Contractor shall adopt to achieve Milestones and to fulfil all Contract obligations. The Works Programme shall become the basis of administration of the time-related aspects of the Contract.

(e) The Contractor shall provide the Engineer with substantiation for each constraint whether target start, target finish or mandatory constraint entered by the Contractor into the Works Programme. The number of constraints shall be kept to an absolute minimum.

(f) The Works Programme shall include activities for all the phases and stages of the Works, clearly showing all logical interdependencies and stages in the development of the Contractors design, procurement, installation, commissioning and setting to work. As a minimum, it shall include'

i. All works comprising the permanent works;

ii. Preparation, submission and review of Design Documents show in gall items where're view by the Engineer is required.

iii. Procurement of all major materials and items of Contractor's Equipment for the Works, including the dates orders are to be placed, manufacture period and the expected delivery date to the Site for each item.

iv. Any software development requirements and Validation time frames.

v. All manufacture or prefabrication of materials of components.

vi. All design and installation of major Temporary Works.

vii. Allactivitiesassociatedwithsecuringnecessarypermitsandotherstatutor yapprovalsfortheworks.

viii. Access and availability dates for all Project Contractors.

ix. AllinterfacesrelatedtotheprojectthatmayaffecttheprogressoftheWorks.

x. Testing and commissioning activities requirements.

xi. Training.

(g) The Works Programme shall be divided into Sub-Programmes of manageable size addressing in more specific detail, thecontentoftheManagementPlans.TheSub-Programmeshallbeasfollows:

a) Design Submission Programme

b) Procurement and Manufacturing Programme;

c) Installation Programme

d) Testing and Commissioning Programme; and

e) Training Programme

(h) The submission of the full version of the Works Programme shall include the Design Programme, Procurement and Manufacturing Programme and a preliminary version of the Installation Programme and the Testing and Commissioning Programme identifying all major installation, testing activities and associated interfaces.

(i) The Sub-Programmes shall be further substantiated by the supplementary programmes as required by the Engineer.

(j) The Contractor's Works Programme shall comply with the following;

a) All programmes submitted in both hard copy and electronic data format.

b) All programmes shall be prepared using the latest version of CPM scheduling software Primavera Project Planner or similar.

c) A standard Gregorian calendar shall be used for planning and execution of the Works. All programme submissions shall include tails of the Contractor's allowance for Public Holidays and known-work periods. If a Milestone falls on a public holiday or non-workday, it shall be effective then ext working day.

d) The planning unit for the duration of all programme activities shall be the day. Any activity having a duration of more than thirty (30) days shall be divided into sub activities that shall not exceed thirty days.

e) CPMprogrammesshallreflectstatususingremainingdurationandpercentcomplete.

f) All programmes shall be fully resource loaded as appropriate or required by the engineer covering all stages and aspects of the Contract and shall include, but not be limited to:

(i) Major manpower for both design and installation.

(ii) Number of items of Contractor's Equipment.

(iii) Number of drawings and other design deliverables.

(iv) Principal quantities of components or parts.

(v) Principle quantities of bulk materials inclusive of cabling, pipe, duct work and equipment item etc.

(k) All programmes constituting the Works Programme shall be organised in a logical work breakdown structure including work stages or phases. Each activity shall be coded to indicate, as a minimum, the work group or entity responsible for the activity, the area, facility or location and the Cost Centre in which the activity is included, from information provided in the pricing schedules. Milestones shall be coded so as to be separately identifiable. The Contactor may be required to assign additional activity codes as required by the Engineer.

3.4 Design Submission Programme

(l) The Contractor shall, submit a Design Submission Programme covering all proposed submissions to the Engineer. The Design Submission Programme shall be broken down into a submission programme for each of the Management Plans of which shall define the dates for individual submissions and shall confirm to the base line dates shown in the Works Programme.

(m) The Submission Programme shall include the requirements of the Design Submission including the procurement activities of all sub-contractors and suppliers.

(n) The Submission Programme shall include each submission for every item listed in the Specification as being required to be submitted.

(o) The Submission Programme shall ensure that all submissions are properly co-ordinated with the Contractor's overall Works Programme, particularly in respect of the following: -

(1) Progress of design, manufacture, installation and testing work;

(2) Co-ordination with other Contractors; and

(3) Including due allowance for the Engineer review process to be undertaken, including the time needed for any re-submissions.

(p) The Design Submission Programme shall specifically include a date of submission by the Contractor of the Final Design on completion of the Preliminary Design stage. The Final Design shall include at least but not limited to; details showing all of the proposed equipment, interconnections, physical layout, installation locations and interfaces to other suppliers.

3.5 Procurement and Manufacturing Programme

(a) The Contractor shall submit for review by the Engineer a procurement and manufacturing programme that shall be an integrated part of the overall Works programme.

(b) The Procurement and Manufacturing Programme shall show the interdependencies between Engineering disciplines as well as between the contractor and its subcontractors and suppliers. This programme shall demonstrate compliance with the requirements of the Submissions Programme.

(c) The Procurement and Manufacturing Programme shall include a separate breakdown, supported by Material Controlled Schedule, which shall be a complete amplification of the Contractor's Programme and equipment list, including those items which are subject to long lead time or component parts which are manufactured from countries outside the country of assembly and testing.

(d) The Material Controlled Schedule shall be automated, and shall detail the following information for each permanent major and minor material and significant component. The format such a schedule shall include:

(1) Name, description, supplier/sub-supplier details.

(2) Drawing information (where appropriate), title, drawing status, submission dates, shop drawings/fabrication drawing preparation etc.

(3) The manufacturing process, manufacturing of test pieces, trial production, Engineer inspection, monthly production of component sand monthly supply of components.

(4) The assembly process, erection and assembly sequences (particularly for the first pieces) prior to shipment, test assemblies, monthly assembly requirement, Engineers inspection, testing of assemblies and

(5) Transportation process, quality release from factory, factory storage to dock and shipment.

(e) The Contractor shall continuously maintain this schedule and report upon the status of each item as part of the Contractors regular progress reporting. From this based data, the Contractor shall prepare an exception report detailing all components that are in delay. This report shall be annotated with the reason for the delay and indicate what action the contractor is taking to recover the lost time.

(f) The Contractor shall submit, as part of the Procurement and Manufacturing Programme, a Factory Testing Programme that shall support all aspects of the Factory Testing Plan.

(g) The Factory Testing Programme shall be fully detailed, with the activities individually identifying all tests for which a certificate will be issued, and shall include activities for preparation, submittal and review of the test procedures.

(h) The Factory Testing Programme shall demonstrate the logical dependencies between the individual tests of the works, and shall also show the interfaces and dependencies with the Contractors delivery programme.

(i) The Factory Testing Programme shall include details of inspection, testing and witnessing of the contractor's and sub-contractor's procurement and manufacturing activities. As a minimum, it shall include:

(1) First article inspection;

(2) Quality Hold Points;

(3) Quality Control Points;

(4) Type Tests; and

(5) Routine Tests.

(j) The galvanized/material shall be inspected by RDSO/RITES as the case may be. And the inspection charges for the same shall be borne by the Contractor. Material which are inspected by Consignee if required to be tested in the authorized Test labs as per the instruction of the Engineer, then such testing charges shall also be borne by Contractor.

3.6 Installation Program

(a) The Installation Programme shall be submitted as stated in the PS or as directed by the Engineer. The Installation Programme shall comply with the requirements of clause 3.3 above.

(b) The Installation Programme shall include detailed activities describing all aspects of the installation of the works, to meet all Milestones given in the contract. It shall be clearly linked to the Design Program, Procurement and Manufacturing Programme and Testing and Commissioning Programme to form an integrated part of the Works Programme.

(c) The Installation Programme shall be fully supported by the Construction and Installation Management Plan.

(d) The Installation Programme shall indicate the physical areas to which the contractors requires access, access dates, duration required and the required degree of completion for civil or architectural finishes prior to the access date.

(e) The Installation Programme shall take into account the requirements for arrival at port, delivery, storage, preservation and positioning of large items of the Contractors equipment and permanent works and shall set out the contractors proposed delivery route for such items to the site.

(f) Installation tests shall be clearly shown in the Installation Programme and shall include those interface tests required to be carried out by others to establish a time table for these tests.

(g) Activities that may be expedited by the use of overtime, additional shifts or by any other means shall be identified and explained.

(h) In preparing the Installation Programme, the contractor should note that the following conditions shall apply:

(1) The Contractor shall not have exclusive access to any part of the site except by the specific consent of Engineer.

(2) The Contractor shall take note that concurrent time allocations for certain areas may be given to more than one contractor. The Contractor shall coordinate his works in such areas with that of project contractors through the Engineer.

(3) The absence of a programme date or installation period for the contractor in a specific area shall not prejudice the right of the Engineer to establish a

reasonable programme date or installation period for that area.

(4) The Contractor shall comply with the identified Milestone Dates identified in the contract.

3.7 Testing and Commissioning Programme

(a) The Testing and Commissioning Programme shall be submitted as stated in the PS or as directed by the Engineer and shall comply with the requirements of the clause 3.3. above.

(b) The Contractor shall submit the Testing and Commissioning Programme that shall fulfil all the on-site testing and commissioning requirements. The Testing and Commissioning Programme shall clearly demonstrate the logic and highlight topics listed in the On-Site Testing and Commissioning Plan.

(c) The Testing and Commissioning Programme shall be fully detailed, with activities individually identifying all tests for which a certificate will be issued, and shall include activities for preparation, submittal and review of the test procedures.

(d) The Testing and Commissioning Programme shall demonstrate the logical dependencies between the individual tests of the Works, and shall also show the interfaces and dependencies with all of the Project Contractor's tests required to commission the Works and support the Commissioning Plan.

3.8 Training Programme

(a) The Contractor shall, within 120 days of the Commencement Date of the Works, submit for review by the Engineer, a Training Programme covering all proposed formal training courses, delivery of training equipment and accesses by the Employer's personnel.

(b) The Training Programme shall be developed to the Training Plan as required.

(c) The Training Programme shall be sufficiently detailed that the Employer can ensure the availability of staff for all the courses.

(d) The Training Programme shall include the requirements of the Training activities of all sub-contractors and suppliers given in Chapter 6.

(End of Chapter-3)

CHAPTER –4 INSTALLATION AND CONSTRUCTION

4.1 REQUIREMENTS

4.1.1 General Requirements

i. The Contractor shall comply with all Enactments in executing the Works, including but not limited to all statutory provisions on occupational health and safety.

ii. The Contractor shall co-ordinate with Other Contractors in the execution of the Works.

iii. The Contractor shall also co-operate with all Relevant Authorities in the execution of the Works.

iv. The installation of all equipment shall be undertaken at all times by suitably trained and competent employees of the Contractor, to the satisfaction of the Engineer.

v. Only appropriate tools, plant, equipment and vehicles shall be used.

vi. Installation of all equipment shall be in accordance with the Construction and Installation Plan described in the drawing/plan.

vii. Installation of all equipment shall conform to the best industry practices.

viii. Precautions shall be undertaken to ensure the safety of personnel and equipment for all installation works.

ix. The Contractor shall, prior to starting any installation and construction work, identify any possible hazards, and implement measures of eliminating and/or controlling such potential hazards, in line with safe working practices.

x. Further details on Site safety management are described in Conditions of Contract on Safety, Health and Environment.

xi. The Contractor shall ensure that all areas of work are sufficiently illuminated for the works to be undertaken and that a safe system of work is employed for all activities.

xii. The Contractor shall operate a robust system for the control of persons entering or working upon the site.

The Contractor shall co-operate, always, with the Engineer and Other Contractors to ensure that the Site is protected from unauthorised admission, either wilfully or otherwise.

The Contractor shall make due provision for the safe access and egress to the Site of Works for its staff and subcontractors.

This access shall be maintained such that it is free of all hazards and is in a safe condition throughout the duration of the Works.

4.1.2 Specific Requirements

The installation and construction work pertaining to this Contract shall include, but not be limited to the following: -

i. Finalisation of the Construction and Installation Programme;

ii. Survey on Site and review the technical requirements shown in this Specification and the Engineer's Drawings.

iii. Production of the calculation sheets and installation drawings for Site installation;

iv. Production of specific site designs and drawings based on typical designs and drawings supplied;

v. Installation in accordance with the finalised installation drawings;

vi. Co-ordination with Other Contractors;

vii. Submission of the installation reports and records;

viii. Testing and commissioning, as per finalised protocol and programme.

ix. Production of as built drawings, documents, calculation sheets, and records.

4.2 Construction and Installation Plan

The Contractor shall undertake installation work in stages as shown in the detailed installation programme. Installation, testing and commissioning of later stages shall not impact revenue operation of earlier stages.

As a minimum, the detailed Construction and Installation Plan shall include but not be limited to all the activities, installation details and methods of all activities, equipment and tools to be used for installation, safety issues, supervision, temporary land occupation needed and the vehicles to be used for installation.

4.2.1 Manual Handling

To facilitate handling of equipment during installation and maintenance thereafter, the Contractor shall closely co-ordinate and interface with other contractors Travelling hoists and unloading jib cranes for traction substations. The entire material handling plan for movement of bulky item such as OHE Conductors, Steel and Concrete masts, 25 kV Switchgear and Auxiliary Transformer etc. shall be carefully planned. Crane of adequate capacity with a jib of requisite length will be arranged by the Contractor at his own cost. Road crane for handling heavy materials at the contractor's depot for loading and unloading of material will be arranged by the contractor who will also arrange his own crew for its operation and maintenance. All charges including pay and allowances of the crew and all running expenditure will be borne by the contractor.

4.2.2 Site Supervision and Safety Issues

i. The Contractor shall set up a Site supervision system, which shall be part of the overall safety, system assurance and quality management system.

ii. The Contractor shall adopt an appropriate quality management system throughout the entire Site installation period to ensure that the System performance requirements as specified in this PS are achieved.

iii. The Contractor shall provide sufficient number of suitably experienced supervisors and skilled workers as per latest guideline issues by railway board to ensure that the progress and quality of the work, both on Site and in the Contractor's workshops, are maintained to the satisfaction of the Engineer.

iv. Maintenance in charge shall have a minimum of five years' or more previous experience in a supervisory capacity on similar projects and all the skilled workers including linesmen electrician's fitters and craftsmen, shall have a minimum of two years' previous experience in installation of similar systems.

v. The Contractor's supervision system shall be responsible not only for the supervision of the concerned system installation but also for the supervision of

the installation of the primary fixing system (mast foundation), the earth mats and systems, etc. The supervisors shall work on a full-time basis during the entire installation process.

vi. The Contractor shall maintain a set of drawings at each project site which accurately reflect the current status of field changes. The Contractor shall obtain letter of no objection from the Engineer for any such changes. The Contractor shall prepare final drawings showing the as built configuration. These drawings shall be developed in a logical format to facilitate routine system maintenance and troubleshooting. All drawings and details shall be endorsed by the Contractor.

vii. The Engineer reserves the right to undertake, at any time, checks on the proficiency of the Contractors staff, licensing and all associated documentation. If any of the Contractors staff be found incompetent or unlicensed he shall be removed from the site until their Competency has been established.

4.2.3 Installation of Cables

The Contractor shall co-ordinate with the Civil Contractors wherever necessary, for the installation of cables in cable galleries, trenches, ducts, troughs, risers and other locations.

The cable system shall, during installation, be fully protected from mechanical damage and be generally accessible at all points for inspection along its entire route. Suitable cable markers shall be provided for covered cables upon completion of installation.

Should it prove necessary to cut any cable during installation, all cut ends shall be properly sealed.

The maximum pulling force of any cable during installation shall not exceed the design force of cables.

All cables shall be installed in the formed cable trenches, shafts, hangers, trays and brackets. The minimum recommended bending radius of the cables shall be adhered to during installation.

All materials used for termination, jointing and installation of cables in confined spaces shall have flame retardant, low smoke, halogen free characteristics.

4.2.4 Workmanship

All the installation shall be carried out according to the instructions shown in these specifications and Engineer's Drawings (as approved).

All assemblies of equipment and their components and parts shall be completely interchangeable if they are of similar type

The style and procedure of the workmanship shall be consistent throughout the Works.

Unless otherwise specified, the Engineer shall decide the final colours for all paint work and other finishes to be applied to any part of the Works.

All parts, which are subject to, wear or damage by dust, shall be completely enclosed in dust proof housings.

XXXXXXX

CHAPTER – 5 TESTING AND COMISSIONING

5.1 TESTING

This Chapter describes the testing & commissioning related to the Traction Overhead Equipment, SCADA and General Services equipment in conformity with the requirements of RDSO/CORE/Railway Board Standards and Railway practices.

Testing constitutes an essential obligation to satisfy the railway System.

5.2 Testing Conditions and Equipment Acceptance

The Contractor will have to carry out all the tests and checks required guaranteeing the Engineer of the good construction and the satisfactory operation of all power supply installation.

Also, the contractor shall co-ordinate & arranges testing equipment etc. required for testing facilities.

The various high, medium and low voltage equipment will be subjected to all the tests required under equipment test sheets, (lists are not exhaustive) as per the relevant IEC or other standards mentioned in the technical specification of each equipment or otherwise.

It is reminded that the contractor is totally entrusted with full responsibility of assembly and installation of all pieces of equipment mentioned in this specification, with supplying the maintenance equipment and the special tooling which shall be delivered as soon as equipment installation will be completed and with the various duties he is bound to regarding witnessing of tests at commissioning and supervision after energising.

5.2.1 In-plant testing: -

In plant testing concern type, routine tests and factory acceptance test.

i. Type tests are tests performed on one or two of an equipment series
ii. Routine test are tests performed on each equipment
iii. Factory acceptance Tests are tests on a sample size as per standards.
iv. These tests will enable checking the quality of the equipment and its compliance with the specifications.
v. Following equipment, if desired by the Engineer shall be tested at third-party (duly approved by the Engineer)/ RITES during Factory Acceptance Test.:
vi. Catenary Wire
vii. Contact Wire
viii. Mast and Portal
ix. Transformer of any capacity
x. Switch gears
xi. Parts cantilever assemblies
xii. Insulators or other OHE equipment
xiii. Different size of cables (LT/HT)
xiv. High Mast Tower
xv. Octagonal Poles (5 metres)

xvi. Led light fittings

xvii. CSS panel, DG and APFC panel

Once the equipment will have passed the in-plant acceptance tests, it shall be delivered and installed under the contractor responsibility.

Concerning some type tests, test certificates issued by recognised agencies will be able to be supplied if the contractor cannot carry out these tests himself and if the test certificates are related to a similar equipment of same capacity and design.

The final factory tests will be carried out on the fully assembled equipment as specified. Thereafter, if required and permitted by the technical features of the equipment, the equipment may be dis-assembled for transportation purposes. The dis-assembly should not, however, cause any deterioration of the technical performance of the equipment.

These tests will be carried out by the contractor, under his responsibility and in the presence of the Engineer and of the consulting Engineer. The cost of Factory Inspection/Site Inspection/Lab Test/Documentations will be borne by contractor.

Each of these tests will be subjected to a certificate. Provisional acceptance will be granted only after execution of the both sets of tests.

NOTE: For type tests, the contractor can provide test reports performed according to the corresponding IEC standard, on similar equipment of same capacity and design.

5.2.2 Third Party Tests

i. During execution stage Engineer may conduct the Test on any type of equipment from third party independent lab at its own cost, to ensure the quality of material supplies. If any of the samples fail in the test, the cost of the Test along with the complete replacement of whole lot shall be borne by the Contractor.

ii. If contractor represents, two random samples from the failed Lot shall be collected by the contractor in the presence of Engineer duly sealing the samples and send to two different NABL accredited labs (as approved by Engineer) for conducting all those tests, which were conducted on the failed sample. Cost of the testing including the collection of sample and transportation of sample will be borne by the contractor.

iii. If both the samples pass all the Tests, the Lot will be deemed as accepted by HRIDC, but in the case of failure of any of the samples collected by the contractor, complete Lot will be deemed as rejected and contractor will replace the whole Lot.

iv. The delay, if any for the procurement of the material due to failure, shall be considered as non-compliance and applicable penalty shall be imposed on the contractor.

5.2.3: System Acceptance Tests

At least six weeks in advance of any particular site testing, the contractor shallsubmitdetailsoftestsanddetailsforthetestequipmentheproposestouseforthattestingtothe engineerforhisapproval.

All tests for statutory requirements and insurances including arrangements for such tests, inspections by authorized bodies, persons or insurers, as necessary and the provision of certificates in the prescribed and approved forms necessary to enable plant and equipment

to be put into service, shall be made by the contractor.

Energization: -

The Contractor shall prepare operation safety rules and procedures for the review of the Engineer before Energization.

TheContractorshallcarryoutallnecessarycheckstoensuresafe Energization.

All power equipment shall be subject to inspection by inspectors from the Electrical Inspectorate of Employer before Energization. The Contractor shall ensure all Employer's requirements are met.

Contractor shall be responsible for reliable operation of Traction Power equipment. As per requirement of Employer Contractor shall disconnect and subsequent reconnect the jumper of OCS or operate Circuit Breaker/Interrupter.

Tests: -SAT shall include but not be limited to: -

i. Short Circuit Tests on OCS.

ii. ShortCircuitTestsonthe25kVOCSshallbecarriedouttoprovecorrect Operation of protection equipment and to ensure that the dynamic strength requirements of overhead equipment are met.

iii. Short Circuit Tests shall be carried out on every overhead equipment line feeder.

5.3 COMMISSIONING

5.3.1 General

The Commissioning description, based on the following frame, will have to be defined by the contractor and submitted to the Engineer.

Once the contractor will have completed the above tests, and the various pieces of equipment installation, the assignment should include:

i. Putting into service tests

ii. After energising

The engineer will be empowered to ask for any additional testing they may deem necessary.

The contractor will have to supply the testing installations and measuring apparatuses required to this effect.

In accordance with the stipulations, provisional acceptance will then take place, followed by final acceptance at the end of the guarantee time.

5.3.2 Putting into Service Tests

It should be performed at this stage the tests verifying that the different equipment is acting correctly when energised.

5.3.3 Integrated Testing and Commissioning

The general testing having shown proper operation, an overall integrated test of the installations, should be performed, after the first 15 days of operation, during which the various actuation and operation situation (putting into service, normal actuation, failure tripping) will be simulated.

5.3.4 Joint Test report/ check List

Once the installation of the various pieces of equipment are complete, Joint tests and tests as per CRS checklist will be conducted at site by the contactor jointly with Engineer and submitted in standard format. (Given in Appendix 15- Testing And Commissioning of Section VII-12: Appendices of Part 2, Employer's Requirements).

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CHAPTER – 6 MAINTENANCE AND TRAINING

6.1 INTRODUCTION

This Chapter describes the maintenance philosophy and training of maintenance staff for power supply, OHE SCADA and General services system considering RDSO/CORE Railway board standards and Railway practices.

The Contractor shall provide comprehensive training and documentation to the engineer staff in accordance with the requirement of this chapter and the chapter of General Specifications.

This training shall enable all the installations, to be operated and maintained in the most efficient and safe manner, to achieve the maximum reliability and economy required by such System.

Note: - All type of Routine, Preventative and Schedule Maintenance work will be carried out at regular intervals based on SMI's/ Instructions issued by RDSO/CORE/Railway Board and equipment manufacturers' recommendations. (List of SMI's issued by RDSO is attached for reference at Appendix 15A, Section VII-12: Appendices of Part 2, Employer's Requirements)

6.1.1 Maintenance Management

The management of the maintenance process entails defining various levels of responsibility and enabling them to implement the strategic orientations defined by the directing authority:

i. by defining their respective missions,

ii. by setting objectives for each person,

iii. by translating these objectives into action plans,

iv. by implementing the means required to carry out action plans,

v. by diagnosing the causes of any deviation from the set objectives,

vi. by taking corrective measures concerning the action plans or the objectives.

This management process requires a global approach and helps to improve the performance of the maintenance work of different components with quality, on time and at low cost.

It must be implemented at three levels:

i. at the level of human resources and management in the context of the scheduling of work, the allocation of human resources and the training of personnel,

ii. at the skills level to ensure quality, safety and suitable working conditions,

iii. at an economic and financial level to ensure responsible management of production, spare parts, purchasing and miscellaneous costs.

The quality of this management depends on the capability of those entrusted with operation and maintenance responsibilities:

i. to exploit the results of management within their field of responsibility,

ii. to react in the event of any deviation from the action plans defined with a view to achieving the set objectives.

Within the context of this approach, the management control function ensures timely advice to be given to those with operational and maintenance responsibility:

i. by placing at their disposal, the tools and information required for piloting and diagnosis,

ii. by participating in carrying out this diagnosis,

iii. by participating in the task of defining the objectives to be achieved.

In conclusion, the process of maintenance management must incorporate two major components: the management of human resources and the study of the most suitable means of achieving the set objectives.

This is one of the first guidelines of maintenance organisation in the various relevant centres.

6.1.2 Determining Requirements in Terms of Facilities and Tools

The achievement of the objectives assigned to the maintenance division about quality, safety and regularity for the lowest possible overall cost requires the implementation of a number of resources which must be perfectly tailored to the requirements.

The facilities and tools are part and parcel of the resources placed at the disposal of the maintenance division to achieve the set objectives.

Owing to the cost of these facilities, the number of maintenance centres to be equipped and the necessity of keeping the maintenance actions consistent and uniform, the main choices of facilities and tools are integral part of the System maintenance policy and program.

When determining these requirements, in-depth knowledge in the dedicated maintenance plan is needed while taking due account of the experience acquired in similar fixed installation which has been in service for several years.

6.2 SUPERVISION AND PLANNING OF MAINTENANCE

6.2.1 General

The following outlines the Engineer maintenance strategy, various levels of maintenance, the Maintenance Management System and the arrangement for maintenance.

The Contractor shall make use of all relevant information to provide supervision of maintenance.

6.2.2 Engineer's Maintenance Strategy

According to the maintenance strategy, all equipment and infrastructure supplied for the 'Project' must be such as to ensure for minimum or no maintenance. Maintenance activities required must be capable of being performed with little or no impact on the train service. In addition, the maintenance work systems shall ensure safety of personnel and equipment.

The Contractor shall ensure that to supervise maintenance during the DLP, personnel are always available with the relevant skills and level of competence.

The Contractor, upon noticing any defects, deficiency in quality and quantity of spares and materials shall without delay, arranges for alternative source of supply and submit his proposal to the Engineer for review.

6.2.3 Planned Maintenance

Routine preventative maintenance will be carried out at regular intervals based on condition, reliability, usage, and service history and equipment manufacturers' recommendations. The Operating and Maintenance Manual shall describe the different levels of planned maintenance.

6.2.4 Supervisory Staff

The Contractor shall provide supervisory maintenance staffs who are expert in all the different levels of fault finding, maintenance and repair of the various relevant systems supplied under the Contract:

i. 25 kV OHE

ii. Switching Stations, including associated switchgear

iii. SCADA

iv. General Services work

6.2.5 Maintenance

Maintenance Management System (MMS) and Maintenance Arrangement. The contractor will develop maintenance management system and get it approved from Engineer for schedule maintenance of OHE, PSI, General Services and SCADA Installation's electrical as indicated in Appendix 15A, Section VII-12: Appendices of Part 2, Employer's Requirements.

Competency of Personnel

During the One-year Maintenance and DLP period the Contractor shall support the Engineer with sufficient trained and competent personnel (Detail given in scope of work chapter) Such persons shall have their generic competence established and must demonstrate their specific competence and knowledge in the particular systems, environment and procedures.

The Contractor shall provide evidence of specific competence and knowledge, which shall include:

i. assessment and certified training in particular software applications and operations;

ii. recording of competence and work in the license holder's logbook; and

iii. Receiving or in receipt of sufficient and current exposure to the area of work that the holder is licensed for.

Routine spot checks on licensing may be carried out from time to time by the Engineer qualified personnel on the proficiency of the Contractor staff.

In the event of a failure, the Contractor shall undertake the management and investigation necessary to identify and rectify the cause.

If the Engineer, during the DLP requires further investigations at other Sites throughout the system, the Engineer will formally request the Contractor to undertake such investigations.

Maintenance requirements

1) Testing and Re-commissioning of System and Equipment

In the event of a failure requiring modifications to the System, the Contractor shall undertake any testing and re-commissioning required.

Any such modification shall be submitted for Engineer review.

2) Temporary Alterations to Restore Service

The Contractor shall undertake any temporary modifications necessary to maintain service.

Any such modification shall be submitted for Engineer review.

3) Discrepancies between Installation and Design Records

Should the Contractor discover inconsistencies between the maintenance drawings and documentation and the installed equipment, the Contractor shall correct all such errors within two weeks.

Communications

The Contractor shall ensure that adequate communication facilities are provided to its staff during the DLP and maintenance period as per approval of Engineer.

Location of Staff

The Contractor shall be responsible for locating staff such that the Contractor meets its contractual obligations and as per approval of Engineer.

Storage of Equipment and Materials during the Maintenance Period

The Contractor shall ensure that no equipment is to be stored along the trackside.

The Engineer will provide defined storage locations for the support all the different levels of Maintenance as per approval of Engineer.

The Contractor shall satisfy itself and the Engineer that the storage locations for equipment and materials will meet the performance requirements of this PS.

Maintenance Regimes

The Contractor shall provide documented maintenance regimes to be followed by the Engineer upon substantial completion of various components of the work until the end of the DLP.

The Contractor shall produce a maintenance regime for the equipment that shall comprise two constituent parts, corrective and routine/preventative maintenance.

Routine/preventative maintenance shall be non-intrusive to the day-to-day operation of the train service and be capable of being pre-planned in advance of the work.

Corrective maintenance shall be available 24 hours per day, able to respond to all foreseeable circumstances.

The maintenance regime shall cover all parts and equipment of the system designed, installed and commissioned by the Contractor.

The Contractor shall take into account the requirements of the operations and maintenance when determining and proposing its maintenance regime.

Scope and Hours of Coverage

The regime and structure of corrective maintenance shall be robust in design.

The Contractor shall provide full 24 hour On-Call coverage and shall be such that initial response and rectification of failure are in accordance with the following:

i. assistance to first level and corrective maintenance within 30 minutes, upon request of first line maintainer;

ii. All elements of preventative maintenance shall be carried out and completed during non-traffic hours without interrupting train services.

6.3 Routine and Corrective Maintenance Procedures

Routine and corrective maintenance procedures shall be supplied for all equipment. The format shall be as follows:

i. Uniform format and layout irrespective of equipment supplier.

ii. Colour coding for each activity.

iii. Cross referenced to the Operation and Maintenance Manuals.

iv. Document control information.

6.3.1 Maintenance Manuals

The Contractor particulars of operating parameters, tools for dismantling and testing, methods of assembly and disassembly, tolerances, repair techniques and all other information necessary to set up a repair and servicing programme as per satisfaction of Engineer.

The Contractor shall provide documentation for all hardware and software for computer systems and other associated electronic equipment to meet the following requirements.

Such documents shall include but not be limited to:

i. manufacturers' documentation supplied as standard with the equipment;

ii. hardware configuration with details of expansion capabilities and options;

iii. programme loading instructions, including runtime environment configuration;

iv. programme listing including comprehensive 'comment statements' in hard copy and soft format for source code, compilers and development tools necessary to modify and recompile software;

v. flow charts, data flow diagrams and state diagrams as appropriate;

vi. description of software modules including purpose, linkage with other modules, error routines and any special considerations;

vii. memory maps for both internal and peripheral memory showing description of all programmes, data files, overlay areas, memory available for expansion and the like;

viii. loading and operating instructions for diagnostic programmes and specifically developed debugging tools; and

ix. Programming manuals relevant to operating systems, languages, development tools, etc.

The manual shall also include inspection/overhaul procedure and periodicity of various inspection/overhaul schedules in detail including the tools, special tools/plants, and facilities required.

6.4 TRAINING:

The Contractor shall provide training for Engineer's staff to enable the Engineer to make proper use of any new versions. The Contractor shall detail any effect such fixes or patches are expected to have, upon the System.

6.4.1 General Requirements

The Contractor keeping the above aspect in view shall provide comprehensive training to the Engineer's staff in accordance with the requirements contained in this Particular specification and general specification. The training shall be carried out at such locations where the greatest benefit for trainees may be gained. This may be in India, abroad, at place of manufacture, assembly or testing, or at such other locations as may be necessary. All places of training shall be subject to review by Engineer The training courses and/or sessions shall include system performance requirements and all major equipment and works designed, by the Contractor.

The specific objectives of each course, training facilities to be used, the qualification and experience of the training instructors and the assessment criteria shall be developed by the Contractor and submitted to the Engineer for review at least three months before any course is conducted.

The Contractor shall provide full-time on-Site management and co-ordination of the entire training programme to ensure the continuity of classes, and proper distribution of training materials, and be responsible for interfacing with the instructors.

The training courses shall be delivered to all relevant Engineer's staff, including instructors, operation and maintenance engineering staff.

The proposed training requirements are given at the end of this Chapter.

6.4.2 Mock-Up for Training

The Contractor shall install mock-up equipment for system and any such facility(s) considered necessary for the training of Engineer's staff in the training school.

The training mock-up shall include but not limited to the following: -

i. Clear Cut Section drawings / photographs of various power supply equipment's such as Circuit Breakers, Interrupters, Current Transformers, Potential Transformers, Lightning Arresters and Isolators.

ii. Cut Section drawings / photographs of HV & MV cables

iii. Cut Section drawings / photographs of Gas Insulated Switchgear

iv. Clear photographs of transformers, their windings, bushings etc.

v. Samples of various clamps and fittings used in OHE

vi. Samples of various conductors used in OHE

vii. Clear drawings and photographs of Control panel, protection schemes, earthing and bonding arrangement;

The Contractor shall submit full details of the training span and other mock up equipment, photographs etc. including proposed training activities and objectives, for the Engineer's review in accordance with clause 6.1 of this Specification.

6.4.3 Training of Engineer's Training Instructors (ETI)

The objective of the training is to enable the Engineer's Training Instructors to be competent to deliver future training courses for other employees of the Engineer.

The Contractor shall provide training to the Engineer's Training Instructors on the various Systems. Aspects covered shall include, but not be limited to, the following:

i. Configuration of the entire System, including interface with the HVPNL/RVPN supply system at the feeding points;

ii. Feature and functional principles of the entire System;

iii. System design aspects including but not limited to design standards, design criteria and parameters, short-circuit and other calculations, insulation and protection co-ordination;

iv. Details of major equipment and material including but not limited to 25kV circuit breakers, interrupters, isolators, voltage and current transformers, OHE Conductors, fittings, assemblies and protection relays, and cables of different types and their joints used in the System;

v. Details of 25 kV Switchgear and protection;

vi. System operation and maintenance management and procedures;

vii. Earthing and bonding arrangement, covering safety aspects of touch and step potential, safety to personnel, passengers and outsiders.

viii. SCADA System

Operations Staff Training

The objective of the training is to enable the Engineer's operations staff to be familiar with the Systems, with focus on the operational aspects under normal and emergency conditions.

The training shall also enable the trainee to acquire full capability for identification, trouble shooting and rectification of faults in the specified duration. After classroom training which includes mock ups of equipment, the staff shall be trained in actual operation.

Maintenance Staff Training

The objective of the training is to enable the Engineer's maintenance staff and Engineering staff to be familiar with the Systems focus on the maintenance aspects of the System including but not limited to the following: -

i. Full understanding of all the equipment, sub-systems and system, their function, maintenance and overall requirements.
ii. Procedures to be followed for unscheduled maintenance and repair.
iii. Identification of failed components and sub-systems in electronic equipment by use of special test kit as necessary.
iv. Modification in the software to extend or modify the control, monitoring and protection functions

6.4.4 Training Requirements

Man weeks of contractor's Training Instructors for training Engineer's maintenance personnel in India.

Training	**Man-Weeks**
OHE	1
Circuit Breakers & Switchgear	1
General services Equipment/ Cables	1
Electrical safety & Earthing	1
SCADA	10

Man, weeks of contractor's Training Instructors for training Engineer's operating personnel in India.

Training	**Man-Weeks**
OHE	1
Circuit Breakers & Switchgear	1
SCADA	10

Man, weeks of Engineer's personnel for Off-Shore training at contractor works

Training	**Personnel**	**Man-Weeks**
ATD Maintenance	Maintenance Staff	1
	Engineer 's Training Instructors	1

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CHAPTER – 7 TECHNICAL SPECIFICATION

7.1 GENERAL:

a) STANDARDS FOR DRAWINGS:

All designs, legends note on drawings and schedules of materials shall be in English and shall be prepared in the metric system. All designs and drawings shall conform to specification RE/OHE/25 and ETI/PSI/31(5/76) or latest.

b) BASIC DESIGNS:

Where the Contractor adopts designs and drawings conforming to the standard designs, drawings, and specifications of the Research, Designs and Standards Organisation. Manak Nagar, Lucknow-226 011 (RDSO) for basic arrangements, equipment, components and fittings of traction overhead equipment, switching stations booster transformer stations and LT supply transformer stations, he shall verify such designs, drawings and employment schedules and satisfy himself that these are correct before use.

c) RESPONSIBILITY

It is to be clearly understood that all original designs and drawings shall be based on a thorough study. General designs and dimensions shall be such that the Contractor is satisfied about the suitability of the designs for the purpose. The engineer approval will be based on these considerations and notwithstanding the engineer acceptance; the ultimate responsibility for the correct design and execution of the work shall rest with the Contractor in terms of the conditions of Contract.

7.2 PARAMETER for HIGH RISE OHE

The contractor has to comply with the following parameters for HIGH RISE OHE during execution of work:

Height of Double Stack Container	7100 mm
Height of Contact Wire at Support from Rail Level	7570 mm
Height of Contact Wire at mid Span from Rail Level	7520 mm
Height of Catenary Wire at Support from Rail level	8970 mm
Pre-sag at mid span	50 mm
Maximum Span length	To be decided as per New wind zone as per Table 4.13(i) & 4.13(iii) (54 metres for wind load 155 kg/Sq. m)

Maximum Stagger at Tangent Track	+150 mm
Maximum Stagger at Curves	+250 mm
Standard Encumbrance	1.400 metres
Dropper Schedule to be followed	1.400/1.400 metres Encumbrance Generally. (Based on Site conditions other prescribed standard Encumbrance may be followed)
Speed	140 kmph
Type of Mast (Fabricated)	B-150/B–175/B-200/ B-225/B-250
Mast Length	11.4 metres
Minimum Implantation	2.8 metres
Tension in Catenary Wire	1000 kgf
Tension in Contact Wire	1000 kgf
Maximum Tension Length	1.5 km
Catenary Wire	65 Sq. mm
Contact Wire	107 Sq.mm
MERGING WITH EXISTING CONVENTIONAL OHE (IF REQUIRED)	
For Mainline OHE (Height of Contact Wire at support)	5.80 metres
For High Rise OHE (Height of Contact Wire at support)	7.57 metres
Difference	1.77 metres
The High Rise OHE shall be merged with Conventional OHE with the Contact wire gradient of @ 10mm/metre.	

(1) OTHER DETAILS

Type of Auto Tensioning Devices	:	Three Pulley modified Groove Auto Tensioning Device as per RDSO Specification No. TI/ SPC /OHE/ ATD /0060 with A & C Slip No. 1 to 3 – For total OHE Tension of 2000 kgf or latest
Stainless Steel Wire Rope	:	As per RDSO Specification No. TI/SPC/OHE/WR/1060 with A & C Slip No. 1 & 2 or latest (Length: 10 metres)
Anchor Height	:	As per RDSO Drawing No. TI/DRG/ OHE/GUYHR/RDSO/ 00001/13/0 (Sheet 1 to 4) or latest
Distance of bottom of Counter Weight Assembly from top of muff	:	2300 mm at 35o C
X-Y Adjustment Chart	:	As per RDSO Drawing No. TI/DRG/ OHE/ATD/RDSO/ 00003/99/0 – Three Pulley ATD or latest
Guide Tube	:	As per RDSO Drawing No. ETI/OHE/ G/01505 or latest

7.3 LIST OF STANDARD DRAWINGS AND SPECIFICATIONS

This Chapter contains list of documents, technical Specifications and referred to in various paragraphs of this Tender.

All references to drawings, charts, schedules, specifications, IS etc. given in this division or elsewhere in the tender document shall be taken to be the latest versions including all amendments. All other items not covered under the Drawing/Specification shall be referred to as per relevant IS and Railway practice in force.

The Drawing and RDSO specification can be purchased from TI Directorate of RDSO, Lucknow on payment basis.

The complete work will have to be planned and executed as per Drawings and specifications (Latest version) of RDSO, CORE & Railway Board.

7.3.1 LIST OF STANDARD DRAWING FOR HIGH RISE OHE: -

S.N.	Brief Description	Drawing		Mod No
		Series	Number	
1	Design handout for Overhead equipment for running double stack containers under electrified routes (High Rise OHE) with speed potential of 140 Kmph based on revised wind zone.	TI/DESIGNS/OHE/2014/00001 (Rev-1) or latest	-	-

S.N.	Brief Description	Drawing		Mod No
		Series	Number	
2	Terms of reference for consultancy contract for high speed OHE and high rise OHE.	RDSO Letter No. TI/Traction policy/2013 dated 25.04.2013	-	-
3	OHE span in view of changes in wind zones in country.	RDSO Letter No. TI/OHE/GA/2013 dated 25/30.04.2013	-	-
4	Special BFB Portal For 5 Tracks (General Arrangement)	TI/DRG/CIV/BFB-POTAL	00001/13/0	Sh No. 1
5	Special BFB Portal Details Of Upright	TI/DRG/CIV/BFB-PORTAL	00001/13/0	Sh No. 2
6	G-Type Portal Details Special Upright And End Piece	TI/DRG/CIV/G-PORTAL	00001/13/0	-
7	HIGH RISE OHE Employment Schedule Mast (11.4 m) (Wind Pressure 178 kgf/m^2) (Basic Wind Speed 50 m/s) (Without Return Conductor and Without Earth Wire)	TI/DRG/CIV/ES/	00001/13/0	Sheet-1
8	HIGH RISE OHE Employment Schedule Mast (11.4 m) (Wind Pressure 155 kgf/m^2) (Basic Wind Speed 47 m/s) (Without Return Conductor and Without Earth Wire)	TI/DRG/CIV/ES/	00001/13/0	Sheet-2
9	HIGH RISE OHE Employment Schedule Mast (11.4 m) (Wind Pressure 136 kgf/m^2) (Basic Wind Speed 44 m/s) (Without Return Conductor and Without Earth Wire)	TI/DRG/CIV/ES/	00001/13/0	Sheet-3
10	HIGH RISE OHE Employment Schedule Mast (11.4 m) (Wind Pressure 105 kgf/m^2) (Basic Wind Speed 39 m/s) (Without Return Conductor and Without Earth Wire)	TI/DRG/CIV/ES/	00001/13/0	Sheet-4

S.N.	Brief Description	Drawing		Mod No
		Series	Number	
11	HIGH RISE OHE Employment Schedule Mast (11.4 m) (Wind Pressure 73 kgf/m^2) (Basic Wind Speed 33 m/s) (Without Return Conductor and Without Earth Wire)	TI/DRG/CIV/ES/	00001/13/0	Sheet-5
12	Two Track Cantilever Structure (Ttc) General Arrangement	TI/DRG/CIV/TTC/	00001/13/0	Sheet-1
13	Two Track Cantilever Structure (TTC) Details Of Upright	TI/DRG/CIV/TTC/	00001/13/0	Sheet-2
14	11.4 M Long Standard Traction Mast "B" Series (B-150, B-175, B-200, B-225 & B-250 type Fabricated with Batten Plates)	TI/DRG/CIV/B- Mast/	00001/13/0	-
15	Volume Charts & Equivalent Charts of Foundations (Side Bearing, Side Gravity & WBC)	TI/DRG/CIV/FND/	00001/13/0	Sheet-1
16	Volume Charts & Equivalent Charts of Foundations (NG Type)	TI/DRG/CIV/FND/	00001/13/0	Sheet-2
17	Volume Charts & Equivalent Charts of Foundations for Dry Black Cotton Soil (NBC Type, 3.0 metre Depth)	TI/DRG/CIV/FND/	00001/13/0	Sheet-3
18	Volume Charts & Equivalent Charts of New Pure Gravity Foundations (500 mm exposed)	TI/DRG/CIV/FND/	00001/13/0	Sheet-4
19	Volume Charts & Equivalent Charts of Foundations for Dry Black Cotton Soil (NBC Type, 2.5 metre Depth)	TI/DRG/CIV/FND/	00001/13/0	Sheet-5
20	Employment Schedule OHE Mast (11.4 metre) Wind Pressure 155 kgf/m^2	TI/DRG/CIV/ES/	00001/13/0	Sheet-1
21	Employment Schedule OHE Mast (11.4 metre) Wind Pressure 136 kgf/m^2	TI/DRG/CIV/ES/	00001/13/0	Sheet-2

S.N.	Brief Description	Drawing		Mod No
		Series	Number	
22	Employment Schedule OHE Mast (11.4 metre) Wind Pressure 105 kgf/m^2	TI/DRG/CIV/ES/	00001/13/0	Sheet-3
23	Schedule Anchor Blocks for BG Tracks	TI/DRG/OHE/GUYHR/	00001/13/0	Sheet-1
24	Double Guy Rod Arrangement with Anchor Block for BG Tracks	TI/DRG/OHE/GUYHR/	00001/13/0	Sheet-2
25	Schedule Anchor Blocks for BG Track Black Cotton Soil	TI/DRG/OHE/GUYHR/	00001/13/0	Sheet-3
26	Guy Rod Ø 25 mm	TI/DRG/OHE/GUYHR/	00001/13/0	Sheet-4
26 A	Dropper Schedule Encumbrance 1.4m/1.4m (For 25 kV AC Regulated OHE) (65 and 107 SQ. MM)	TI/DRG/OHE/DROP/	00001/10/1	Rev-1
26 B	Dropper Schedule Encumbrance 1.4m/0.9m (For 25 kV AC Regulated OHE) (65 and 107 SQ. MM)	TI/DRG/OHE/DROP/	00002/10/1	Rev-1
26 C	Dropper Schedule Encumbrance 1.4m/0.75m (For 25 kV AC Regulated OHE) (65 and 107 SQ. MM)	TI/DRG/OHE/DROP/	00003/10/1	Rev-1
27 D	Arrangement of mounting of 25kV/240V, 50kVA LT Supply Transformer for High Rise OHE (On separate mast)	ETI/OHE/HR/AT/G/	5522 Sheet-2	-
28 E	Mounting Arrangement of Auxiliary Transformer on High Rise OHE mast	ETI/OHE/HR/AT/G/	5522 Sheet-1	-
29 F	Anchor Arrangement with Dwarf Mast for conventional and High Rise OHE	ETI/OHE/HR/ G/	1402	-
30 G	Standard Arrangement of Drop Arm for supporting Cantilevers on the Booms of Portals and TTC (For Normal as well as High Rise OHE)	ETI/C/HR/	76	-

S.N.	Brief Description	Drawing		Mod No
		Series	Number	
31 H	Drilling schedule for S-6H mast (length 13.0 m) (for High Rise OHE)	ETI/C/HR/	181	-
32 J	Drilling schedule for S-7H mast (length 13.0 m) (for High Rise OHE)	ETI/C/HR/	182	-
33 K	Drilling schedule for S-8H mast (length 13.0 m) (for High Rise OHE)	ETI/C/HR/	183	-
34 L	'P' Type Portal General Arrangement and details of upright & End Pieces (High Rise OHE)	TI/DRG/CIV/P-Portal/	00001/13/0	-
35	Cylindrical Foundations for Side Bearing Type (For High Rise OHE) (SBC-11000 Kg/m2)	TI/DRG/CIV/FND/RDSO/	00003/17/0	
36	Cylindrical Foundations for side Gravity location For High Rise OHE (SBC-8000 & 11000 Kg/m2)	TI/DRG/CIV/FND/RDSO/	00005/17/0	
37	Cylindrical Foundations for Side Bearing Location For High Rise OHE (SBC-15000 & 20000 Kg/m2)	TI/DRG/CIV/FND/RDSO/	00009/17/0	
38	Cylindrical Foundations for Side Gravity Location For High Rise OHE (SBC-15000 & 20000 Kg/m2)	TI/DRG/CIV/FND/RDSO/	00007/17/0	
39	Cylindrical Foundations in Embankment for High Rise OHE (SBC-11000,15000 & 20000 Kg/m2)	TI/DRG/CIV/FND/RDSO/	000011/17/0	
40	Details of OHE Mast Base Plate and Foundation on Drain in Cutting	TI/DRG/CIV/FND/RDSO/	000012/17/0	

Note: - The High Rise OHE foundations shall be Conventional Block type or Cylindrical type as per approval of Engineer.

7.3.2 LIST OF STANDARD DRAWINGS FOR OHE

SI. No	Brief Description	Drawing		Modification (Mod.) No.
		Series	Number	
1	Extra allowance for setting of structures on curves (1676 mm Broad gauge)	ETI/OHE/G	00111 Sh-1	C
2	Standard setting of structures in the vicinity of signals (broad gauge)	ETI/OHE/G	00112	D
3	Typical design of side bearing foundation.	ETI/OHE/G	00131	-
4	Typical design of cantilever mast.	RE/33/G	00141 Sh.3	-
5	Span and stagger chart for (conventional OHE, Cad. Cu catenary & Cu cont. wire) wind pressure 75,112.5 & l50kgf/m².	ETI/OHE/G	202	-
6	Employment schedule of bracket tubes Conventional OHE (Cad Cu Caty& Cu contact wire 1000 kgf tension each) WP-75 Kgf/ m²	ETI/OHE/G	00158 sh.1 of 3	-
7	Employment schedule of bracket tubes Conventional OHE (Cad Cu Caty& Cu contact wire 1000 kgf tension each) WP-75 Kgf/ m²	ETI/OHE/G	00158 sh.1 of 3	-
8	Employment schedule of bracket tubes Regulated Conventional OHE (Cad. Cu Cat & Cu contact wire 1000 kgf tension in each) WP-112.5 Kgf/ m²	ETI/OHE/G	00158 sh.2 of 3	-
9	Employment schedule of bracket tubes Regulated Conventional OHE (Cad Cu Caty& Cu contact wire 1000 kgf tension in each) WP-150 Kgf/ m²	ETI/OHE/G	00158 sh.3 of 3	-
10	Dropper schedule for uninsulated Overlap spans	ETI/OHE/G	169	A
11	Dropper schedule for insulated Overlap spans	ETI/OHE/G	170	A
12	Dropper schedule for conventional regulated OHE. With Zero pre sag (1400/1400)	ETI/OHE/G	177	A
13	Adjustment chart of Regulating equipment 3 Pulley Type (3:1 ratio)	ETI/OHE/G	195	A
14	Schematic arrangement of regulated OHE	ETI/OHE/G	2101	A
15	Schematic arrangement of uninsulated overlap (3 & 4 span overlaps)	ETI/OHE/G	02121 Sh.4	A
16	Schematic arrangement of insulated overlap	ETI/OHE/G	02131 Sh.3	A
17	General distribution of droppers	ETI/OHE/G	161	-

SI. No	Brief Description	Drawing		Modification (Mod.) No.
		Series	Number	
18	Outline of Pantograph (Broad gauge and metre gauge).	RE/33/G	181	A
19	General formation of single track in Embankments and cutting (Broad gauge.)	RE/33/G	01101 Sh.1	A
20	General formation of double track in embankments and cutting (Broad gauge).	RE/33/G	01102 Sh.1	A
21	General formation of multiple tracks (1676 mm gauge).	RE/33/G	01103 Sh.1	A
22	Standard anchor arrangement	RE/33/G	01401	E
23	Anchor arrangement with dwarf mast.	ETI/OHE/G	1402	B
24	Schedule of anchor block for B.G. track.	ETI/OHE/G	01403 Sh.1	E
25	Schedule of anchor block for B.G. track.	ETI/OHE/G	01403 Sh.2	D
26	Schedule of anchor block for B.G. track (Black cotton soil)	ETI/OHE/G	01403 Sh.3	D
27	Standard guide tube arrangement on a mast and structures.	ETI/OHE/G	1505	-
28	Trapezoidal counterweight arrangement on OHE structures.	ETI/OHE/G	1502	-
29	Arrangement of 3KV & 25 KV Pedestal Insulator supports on OHE masts and portals.	ETI/OHE/G	01601	-
30	Standard arrangements for mounting of number plate on OHE Structures.	ETI/OHE/G	1701	A
31	Schematic arrangement of regulated overhead equipment.	ETI/OHE/G	02101	A
32	Typical arrangements of OHE on cantilever masts for double track section.	ETI/OHE/G	02102	-
33	Typical arrangement for fixing of bracket assembly on 9.5 m mast and Structure to suit raising of tracks (in future)	ETI/OHE/G	02102 Sh.3	-
34	Details of bracket arrangement on tangent and curved tracks	ETI/OHE/G	02106 Sh.1	A
35	Details of bracket arrangement for OHE	ETI/OHE/G	02106 Sh.3	C
36	Single bracket assembly on Structures and dropped arms.	RE/33/G	2107	D
37	Box type cantilever Arrangement.	ETI/OHE/G	2108	A
38	Arrangement at anticreep.	TI/DRG/OHE/GENL/RDSO/	00001/12/0	0

SI. No	Brief Description	Drawing		Modification (Mod.) No.
		Series	Number	
39	Standard cantilever arrangement for boom anchor anticreep location.	ETI/OHE/G	2113	-
40	Schematic arrangement of uninsulated over Lap (type-I) (3 & 4 Span overlaps)	RE/33/G	02121 Sh.1	F
41	Schematic arrangement of insulated overlap.	ETI/OHE/G	02131 Sh.1	
42	General arrangement of regulated OHE at turn-outs (overlaps & crossed type).	ETI/OHE/G	2141	C
43	General arrangement of regulated OHE at cross over (overlap & crossed type).	ETI/OHE/G	2151	-
44	Arrangement of neutral section	ETI/OHE/G	02161 Sh.1	C
45	Arrangement of neutral section assembly (PTFE Type) at SWS.	ETI/OHE/G	2162	-
46	Arrangement of short neutral section.	ETI/OHE/G	02161 Sh.2	-
47	Standard termination of OHE (Regulated & un-regulated).	ETI/OHE/G	03121 Pt 1 of 3	E
48	Standard termination of OHE (Regulated & un-regulated).	ETI/OHE/G	03121 Pt 2 of 3	E
49	Standard termination of OHE (Regulated & un-regulated).	ETI/OHE/G	03121 Pt 3 of 3	E
50	General arrangement of pull off	ETI/OHE/G	03301	A
51	General arrangement of Head span	ETI/OHE/G	3201	-
52	In span jumper connection between catenary & contact wire.	ETI/OHE/G	05101	-
53	Continuity jumper connection at un-insulated overlap turnouts and cross overs	ETI/OHE/G	5102	C
54	Anti- theft jumper	ETI/OHE/G	5107	A
55	Connections at turnouts	ETI/OHE/G	5103	B
56	Potential equalizer connection at insulated overlap and neutral section	ETI/OHE/G	05104	-
57	Connections at diamond crossing.	ETI/OHE/G	05106	A
58	General arrangement of connections to OHE by copper cross feeder (150).	ETI/OHE/G	05121 Sh.1	C
59	General arrangement of connections at switching station on double track section by copper cross feeder	ETI/OHE/G	05122 Sh.1	C
60	General arrangement of connections at switching station on multiple track section by copper cross feeder	ETI/OHE/G	05123 Sh.1	C
61	Suspension of 25kV feeder(Spider)on 25KV OHE masts	ETI/OHE/G	5143	B
62	Termination of feeder, return conductor & return feeder (copper & aluminum).	ETI/OHE/G	05145-1	A

SI. No	Brief Description	Drawing		Modification (Mod.) No.
		Series	Number	
63	Arrangement of suspension of double spider 25 KV feeder and return feeder between sub-station and feeding station	RE/33/G	5152	C
64	Assembly of section insulators	RE/33/G	5181	C
65	General arrangement of earth wire on OHE Mast	ETI/OHE/G	5201	A
66	General arrangement of earth wire on OHE Mast	ETI/OHE/G	05201-1	-
67	Arrangement of transverse bonds	ETI/OHE/G	5251	A
68	Connection of return conductor to track	ETI/OHE/G	05306	F
69	Suspension arrangement of aluminum return conductor (spider) on traction Structures	ETI/OHE/G	05307	B
70	Suspension of return conductor (spider) from boom of Structures (with clevis type disc insulators)	ETI/OHE/G	05312	A
71	Connections between OHE and aluminum return conductor at booster stations	ETI/OHE/G	5413	B
72	Mounting of 25kv Isolators on OHE Structures (General arrangement)	ETI/OHE/G	05513 Sh.1	A
73	Details of small part steel work for supporting 25kv Isolator on new T.T.C. boom	ETI/OHE/G	05513 Sh.2	A
74	Connection from Isolator to OHE	ETI/OHE/G	05516	A
75	Characteristics of conductors/ bus-bar for 25kv AC traction	ETI/OHE/G	05600	A
76	Mounting arrangement of Auxiliary Transformer on OHE masts	ETI/OHE/G	5522	-
77	Chart for portal foundation	ETI/OHE/G	0005/68	
78	Muff for OHE structures	ETI/OHE/G	0007/68	E
79	Structures muff for sand cored foundations	ETI/OHE/G	0012/69	E
80	9.5 m Standard traction mast (fabricated `K' series)	ETI/OHE/G	0018-2	D
81	Remote Control Cubicle at Stn, Foundation, RCC slab, Building plant & Steel door	ETI/OHE/G	0067	B
82	9.5 m long standard traction mast (fabricated with bottom plates `B' series)	ETI/C	71	E
83 A	Details of OHE foundation in soft rock (Bearing capacity 45,000 Kgf/m²).	ETI/C	59	C
83 B	Details of OHE foundation in Hard rock (Bearing capacity 90,000 Kgf/m²).	ETI/C	60	D
84	Details of foundation for fencing upright	ETI/C	0032	B

SI. No	Brief Description	Drawing		Modification (Mod.) No.
		Series	Number	
85	Employment schedule for switching and Booster Station Main Masts	ETI/C	185	B
86	Drilling Schedule for S-1 Mast	ETI/C	30	F
87	Drilling Schedule for S-2 Mast	ETI/C	0031	D
88	Drilling Schedule for S-3 mast (length 11. 4 m)	ETI/C	0180	C
89	Drilling Schedule for 8" x 6" x 35 1bs. RSJ mast 8.0 m long for Booster Transformer station Type S-4	ETI/C	0036	E
90	Drilling Schedule for S-5 Mast (11.4m long)	ETI/C	0042	E
91	Drilling Schedule for S-6 Mast (length 12.4m)	ETI/C	0181	C
92	Drilling Schedule for S-7 Mast (length 12.4m)	ETI/C	0182	C
93	Drilling Schedule for S-8 Mast (length 12.4m)	ETI/C	0183	C
94	Drilling Schedule for S-9 mast (length 12.4m)	ETI/C	0184	C
95	General arrangement & details of fencing panels & gate for Switching Station	ETI/C	0186 Sh.1	E
96	Details of fencing uprights and anti-climbing device for Switching Station	ETI/C	0186 Sh.2	E
97	S-100 Fabricated Mast for mounting LT supply Transformer and drop out fuse switch at Switching Station	ETI/C	0043	B
98	S-101 details of Mast for supporting Isolator inside Switching Station	ETI/C	44	A
99	Details of anchor beam or SP, SSP, & FP	ETI/C	0033	D
100	Details of small part steel for Switching Station	ETI/C	0034 Sh.1	K
101	Details of bracing for switching & B.T. Masts	ETI/C	0034 Sh.2	B
102	Details of small parts steel of out rigger for Switching Station and Booster Transformer stations	ETI/C	37	C
103	Details of small parts steel for Booster Transformer stations	ETI/C	40	E
104	Details of pre-cast cable trench for Switching Station	ETI/C	0038	E
105	Standard 'R' type portal rod laced general arrangement	ETI/C	0011/69 Sh.1	C
106	'G' type portal special upright and end piece	ETI/C	0056	C
107	Short bored pile foundation for Traction Mast (permissible BM & volume)	ETI/C	0062	B

SI. No	Brief Description	Drawing		Modification (Mod.) No.
		Series	Number	
108	Dwarf Mast foundation on wet & dry black cotton soil	CORE/ALD/ OHE/SK/C	2	-
109	Typical design of new pure gravity Foundation.	ETI/SK/C	131	A
110	Typical design of side gravity foundation (Soil pressure=8,000 Kg/ M²)	ETI/SK/C	142	A
111	Rock Anchor for B.G. Track. –	ETI/SK/C	208	-
112	Bracket fitting for PSC Mast (cap 4200 Kgm) general arrangement and SPS details	ETI/SK/C	214 Sh.1of 2	E
113	SPS details for Earth wire clamp on PSC mast	ETI/SK/C	214 Sh. 2 of 2	A
114	Special arrangement of OHE under over line structure	ETI/OHE/SK	529	--
115	Earthing and bonding of PSC mast.	ETI/OHE/SK	537 Sh.1 of 2	D
116	Typical Earthing arrangement in SPUN PSC Mast with 18mm dia rod.	-do-	537 Sh.2 of 2	B
117	Arrangement of overlap	ETI/OHE/SK	566	-
118	Catenary dropper assembly	ETI/OHE/P	1190	B
119	Parallel clamp (20/20)	ETI/OHE/P	1550	E
120	Standard guide tube assembly.	ETI/OHE/P	5060-2	C
120 A	Counterweight assembly for Regulating Equipment (3:1 Ratio)	ETI/OHE/P	5090-5	E
120 B	Trapezoidal weight assembly for Regulating Equipment (3:1 Ratio)	TI/DRG/OHE/ATD/RDSO/	00004/00/ 2	-
120 C	Trapezoidal weight assembly	ETI/OHE/P/	5090-1	G
120 D	Counterweight assembly	ETI/OHE/P/	5090	F
121	Standard anti-wind clamp	-do-	2550-1/2	L
122	Multiple cantilever cross arm assembly.	RE/33/P	3120	H
123	Anchor fitting assembly on rolled sections	ETI/OHE/P	3230	C
124	Anchor fitting assembly on 'K' series, TCC Masts and 'P' type portal upright.	ETI/OHE/P	3240	D
125	Anchor assembly on 'N' and `O' type portal upright	ETI/OHE/P	3250	D
126	Structure Bonds	ETI/OHE/P	7000	F
127	Earthing Station	ETI/OHE/P	7020	B
128	Longitudinal Rail Bond	ETI/OHE/P	7030	F
129	Short super Mast assembly	ETI/C/P	8010	G
130	Long super Mast assembly	ETI/C/P	8020	C
131	Bracket attachment assembly on portal upright (N, O, R, P, G &BFB Type)	ETI/C/P	8030	B

SI. No	Brief Description	Drawing		Modification (Mod.) No.
		Series	Number	
132	Super Mast assembly on portals	ETI/C/P	8050	C
133	Medium super Mast assembly	ETI/OHE/P	8060	C
134	Compensating plate	ETI/OHE/P	5191-1/2	D
135	Suspension clamp	RE/33/P	1160	J
136	Double suspension clamp	RE/33/P	1170	K
137	Double suspension lock plate.	RE/33/P	1172	C
138	Catenary splice (65)	ETI/OHE/P	1090	-
139	Typical location & schematic connection diagram for a three interrupter switching station	ETI/PSI	3	C
140	Typical general arrangement of a three interrupter switching station	ETI/PSI	004	F
141	Typical location plan & general arrangement for sectioning & paralleling station	ETI/PSI	005	F
142	Typical location plan and general arrangement for a feeding station	ETI/PSI	6	E
143	Typical number plate for Auxiliary Transformer	ETI/PSI/P	7525	-
144	Typical fencing and anti-climbing arrangement at switching stations	ETI/PSI	104	E
145	Typical earthing layout of sub-sectioning and paralleling station	ETI/PSI	201	B
146	Typical earthing layout of a sectioning and paralleling station	ETI/PSI	202	B
147	Typical earthing layout of a feeding station	ETI/PSI	203	B
148	Earthing details for interrupter L.T. supply transformer 25 KV Lightning Arrestors P.T. Type-I (S-100 masts, S-101 mast, fencing upright and main mast)	ETI/PSI	204	C
149	Typical cable run layout of a sub-sectioning & paralleling station	ETI/PSI	301	C
150	Typical cable run layout of a sectioning and paralleling station	ETI/PSI	302	C
151	Typical cable run layout of a feeding station	ETI/PSI	303	B
152	Typical drawing for a terminal board	ETI/PSI	501	C
153	36 mm Aluminum Bus terminal for 25kv Isolator (Rigid type)	ETI/PSI/P	6480	C
154	36 mm Aluminium Bus splices	ETI/PSI/P	6490	B
155	36 mm Aluminium Bus Tee connector	ETI/PSI/P	6500	C
156	36 mm Aluminium Bus Tee terminal	ETI/PSI/P	6510	D
157	36/15 mm Top connector	ETI/PSI/P	6520	B

SI. No	Brief Description	Drawing		Modification (Mod.) No.
		Series	Number	
158	36mm Aluminum flexible bus splice	ETI/PSI/P	6550	B
159	36 mm Aluminum bus splice cum tee connector	ETI/PSI/P	6560	B
160	Typical number plate for interrupter and double pole isolator	ETI/PSI/P	7520	B
161	Typical number plate for potential transformer Type	ETI/PSI/P	7521	B
162	Typical number plate for booster transformer	ETI/PSI/P	7522	B
163	Caution plate 25 KV AC	ETI/OHE/P	7531	C
164	General Caution notice at entrance to railway Station (Hindi & English)	RE/33/P	7551	C
165	Typical details of pressed steel door, window and ventilator	RE/Civil/S	129/ 2001	R2
166	Bolted base connection for portals located in drains	ETI/C	10	C
167	Details of base plate for mast on drains in station yards	ETI/C	0002/68	A
168	Arrangement for false catenary under over line structure	ETI/OHE/SK	446	--
169	Typical arrangement of OHE with insulated copper catenary under over line structure	ETI/OHE/SK	570	--
169 A	Anti-Climbing Arrangement	TI/SK/OHE/ ANTIMON/ RDSO	00001/08/ 0	--
169 B	Anti-Climbing Arrangement	TI/SK/OHE/ ANTIMON/ RDSO	00001/09/ 0	--
169 C	GSSW Assembly	TI/DRG/OH E/GSSW	0002/09/0	--
169 D	18 mm Lug (Forged) (Compression type)	TI/DRG/OH E/GTBLUG/ RDSO	00001/04/ 0	--

7.3.3 STANDARD TYPICAL AND PARTICULAR DRAWINGS FOR SCADA WORKS

The annexure contains reference to standard, typical and particular drawings & specification referred to in various paragraph of tender document.

SI. No	Brief Description	Drawing		Modification (Mod.) No.
		Series	Number	
1	General scheme of supply for 25 kV 50 Hz Single Phase AC	ETI/PSI	702-1	D
2	Typical layout of control room at TSS	TI/DRG/PSI/CPROOM/RDSO	00001/01	0

3	Typical layout of remote control cubicle at switching stations.	ETI/PSI	10	E
4	Schematic inter connection diagram for remote control of power gear & supervision equipment at TSS.	ETI/PSI	644	C
5	Schematic inter connection diagram for remote control of power gear and supervision equipment at controlled station (SP & SSP)	ETI/PSI	645	C
6	High speed Auto reclosing Scheme for feeder Circuit Breaker at 25 kV A.C. Traction Sub-station.	ETI/PSI	0231-I	A
7	Control desk arrangement for 2 work stations of SCADA system.	ETI/PSI/SK	337	Nil
8	Setting up earthing station at switching posts (SSP & SP) with conventional earthing as per Special Maintenance No. TI/SMI/0032 Rev-1	-	-	-

Note: -

1. ThescopeofworkshallbeapprovedtosupplytheentireSCADAsystem/equipment/hardware/asper RDSOspecification No. TI/SPC/RCC/SCADA/00130/(Rev-2) with A&C slip no.1 or latest amendments. However, the software for RCC has to purchase from RDSO approved software vendors only.

2. RTUs supplied for the controlled posts shall include the necessary transducers, summation CT', PT, supply change over arrangement, digital analogue input modules, limit settings, CPU cards, power supply unit, surge arrestor, relays and contactors etc. at Traction sub-stations/ SPs/SSPs for different analogue parameters and measurements as per mentioned in the specifications and tender documents.

7.3.4 NEW WIND PRESSURES/SPEEDS AS PER RDSO: -

S. No.	Design Wind Pressure	Basic Wind Speed	
	(Kg/m^2)	metre / second	Km / hour
I	178	50	180
II	155	47	169.2
III	136	44	158.4
IV	105	39	140.4
V	73	33	118.8

7.3.5 LIST OF STANDARD DRAWING AS PER NEW WIND ZONES

SI. No	Brief Description	Drawing		Modification (Mod.) No.
		Series	Number	
1	Normal OHE Employment Schedule Mast (9.5 m) (Wind Pressure 178 kgf/m^2) (Basic Wind Speed 50 m/s) (Without Return Conductor and Without Earth Wire)	ETI/C/	0758 Sheet-1	A
2	Normal OHE Employment Schedule Mast (9.5 m) (Wind Pressure 155 kgf/m^2) (Basic Wind Speed 47 m/s) (Without Return Conductor and Without Earth Wire)	ETI/C/	0758 Sheet-2	A
3	Normal OHE Employment Schedule Mast (9.5 m) (Wind Pressure 178 kgf/m^2) (Basic Wind Speed 50 m/s) (Without Return Conductor and Without Earth Wire)(1100+1100) kgf tension CAT-65 mm^2, CONT-107 mm^2.	ETI/C/	759 Sheet-1	-
4	Normal OHE Employment Schedule Mast (9.5 m) (Wind Pressure 155 kgf/m^2) (Basic Wind Speed 47 m/s) (Without Return Conductor and Without Earth Wire) (1100+1100) kgf tension CAT-65 mm2, CONT-107 mm2.	ETI/C/	759 Sheet-2	-
5	Normal OHE Employment Schedule Mast (9.5 m) Basic Wind Speed 50 m/s Wind Pressure 178 kgf/m^2 (Without Return Conductor and Without Earth Wire) 1000 kgf tension in CAT. 65mm^2 1000 kgf tension in CONT. 107mm^2	TI/DRG/CIV /ES/RDSO/0 0001/18/0	Sheet-1/5	
6	Normal OHE Employment Schedule Mast (9.5 m) (Basic Wind Speed 47 m/s) (Wind Pressure 155 kgf/m^2) (Without Return Conductor and Without Earth Wire) 1000 kgf tension in CAT. 65mm2 1000 kgf tension in CONT. 107mm2	TI/DRG/CIV /ES/RDSO/0 0001/18/0	Sheet-2/5	-
7	Normal OHE Employment Schedule Mast (9.5 m) Basic Wind Speed 50 m/s Wind Pressure 178 kgf/m^2 (Without Return Conductor and Without Earth Wire) 1000 kgf tension in CAT. 65mm^2 1000 kgf tension in CONT. 107mm^2 (with implantation more than 2.8 m & upto 3.8 m)	TI/DRG/CIV /ES/RDSO/0 0002/18/0	Sheet-5/5	-
8	Normal OHE Employment Schedule Mast (9.5 m) (Basic Wind Speed 47 m/s) (Wind Pressure 155 kgf/m^2) (Without Return Conductor and Without Earth Wire) 1000 kgf tension in CAT. 65mm2 1000 kgf tension in CONT. 107mm2 (with implantation more than 2.8 m &upto 3.8 m)	TI/DRG/CIV /ES/RDSO/0 0002/18/0	Sheet-4/5	-

9	Normal OHE Employment Schedule Mast (9.5 m) Basic Wind Speed 50 m/s Wind Pressure 178 kgf/m^2 (Without Return Conductor and Without Earth Wire) 1000 kgf tension in CAT. 65mm^2 1000 kgf tension in CONT. 107mm^2 (with implantation more than 3.8 m &upto 4.85 m)	TI/DRG/CIV /ES/RDSO/0 0003/18/0	Sheet-5/5	-
10	Normal OHE Employment Schedule Mast (9.5 m) (Basic Wind Speed 47 m/s) (Wind Pressure 155 kgf/m^2) (Without Return Conductor and Without Earth Wire) 1000 kgf tension in CAT. 65mm2 1000 kgf tension in CONT. 107mm2 (with implantation more than 3.8 m &upto 4.85 m)	TI/DRG/CIV /ES/RDSO/0 0003/18/0	Sheet-4/5	-

7.3.6 LIST OF STANDARD RDSO SPECIFICATIONS FOR OHE, TSS AND SCADA

SI.NO.	TITLE OF SPECIFICATION	SPECIFICATION NO
1	Annealed stranded copper conductor for jumper wire.	ETI/OHE/3(2/94) with A&C slip No.1of (4/95)
2	Copper busbar	RE/30/OHE/5 (11/60)
3	Structural Steel tubes.	ETI/OHE/11 (5/89)
4	Hot dip zinc Galvanization of steel masts (Rolled and Fabricated) tube and fittings used on 25 KV AC OHE.	ETI/OHE/13(4/84) with A&C slip No. 1of (5/86),2 of (4/90) & 3 of (4/90)
5	Stainless steel wire ropes	TI/SPC/OHE/WR/1060 with A&C slip No 1 of (11/06) & 2 of (05/07)
6	Solid core porcelain insulators for 25 KV 50 Hz single phase overhead lines	TI/SPC/OHE/INS/0070 (04/2007)
7	25 KV single and double pole isolators.	ETI/OHE/16(1/94) with A&C slip No.1 of (06/2000) & 2 of (3/2004)
8	Steel fasteners & Stainless Steel fasteners	TI/SPC/OHE/Fasteners/0120
9	Aluminum alloy section and tubes	ETI/OHE/21(9/74)
10	Standard for drawings for Traction Overhead equipment	ETI/OHE/25(3/66)
11	Light Weight Section Insulators assembly. OR Section Insulator assembly without sectioning insulator.	TI/SPC/OHE/LWTSI/0060 (8/2006) OR ETI/OHE/27(8/84) with A&C slip No.1 of (10/92)
12	Enameled steel plates	ETI/OHE/33(8/85)

SI.NO.	TITLE OF SPECIFICATION	SPECIFICATION NO
13	Retro-reflective Structure Number Plates & Caution/Warning Boards	ETI/OHE/33A(12/97) Rev-8 (11/12)
14	Galvanised steel wire	ETI/OHE/36(12/73) with A&C Slip No.1 of (5/98)
15	3 pulley Type Regulating Equipment	TI/SPC/OHE/ATD/0060 (8/2006) with A&C Slip No1 of (10/2006), 2 of (5/2007) & 3 of (01/13)
16	Fitting for 25 kV 50 Hz AC Overhead equipment.	TI/SPC/OHE/Fitting/0130(10/13) {Old ETI/OHE/49 (9/95) with A&C}
17	Cadmium copper conductor for overhead Railway Traction	ETI/OHE/50 (6/97) with A&C slip No.1 to 3 (04/09).
18	Principles of OHE layout plans and sectioning diagrams for 25 KV AC traction.	ETI/OHE/53(6/88) with A&C slip no.1 of (12/88), 2 of (8/89), 3 of (6/90), 4 of (8/92) & 5 of (11/2006)
19	19/2.79mm All Aluminum alloy stranded catenary wire.	ETI/OHE/54(2/85) with A&C slip No. 1 of (11/89) &2 of (10/92)
20	Bimetallic (Al-cu) strip	ETI/OHE/55(4/90)
21	Short Neutral Section Assembly (Phase Break)	TI/SPC/OHE/SNS/0000 of (2/2000) with A&C slip No. 1
22	Code for bonding and earthing for 25 KV, AC single phase, 50 Hz traction system.	ETI/OHE/71(11/90) with A&C slip no. 1 of (8/91) & 2 of (3/93)
23	Insulated Cadmium copper catenary 19/2.10 mm dia for provision under overline structures in the 25 KV AC Electric Traction.	TI/SPC/OHE/INSCAT/0000 of (4/2000)
24	Battery charger for 110 V battery, 40 AH.	ETI/PSI/1(6/81)
25	Lightning arrestor- 7.5 KV	ETI/PSI/3(8/75) with A&C slip No.1 of (2/91)
26	220 KV or 132 KV or 110 KV or 66 KV or 25 kV Potential transformers	TI/SPC/PSI/PTs/0990 with A&C slip No.1 to 5 (01/09)
27	25 KV Dropout fuse switch & operating pole for use with 10 KVA and 100 kVA 25 kV/ 230 V L.T. Supply transformer.	ETI/PSI/14(1/86) with A&C slip no 1 of (4/87)
28	25 kV/240 V, 5 kVA,10 kVA, 25 kVA & 50 kVA, 50 Hz single phase oil filled Auxiliary Transformers.	ETI/PSI/15(8/03)
29	Low maintenance Lead Acid 40AH & 200 AH cells.	RDSO/PE/SPEC/TL/0040-2003(Rev-0) with A&C slip no 1 of (9/2005)
30	150 KVA, 25 KV, single phase, 50 Hz. Dry type Cast resin Booster Transformers	ETI/PSI/97(6/87) with A&C slip No.1 of (9/88)

SI.NO.	TITLE OF SPECIFICATION	SPECIFICATION NO
31	100 KVA & 150 KVA, 25 KV, single phase, 50 Hz, oil filled Booster Transformers	ETI/PSI/98(8/92) with A&C slip No.1 of (9/92), 2 of (1/94) & 3 of (6/94)
32 A	25 KV AC Single Pole, Double Pole mounted, Out Door Vacuum Circuit Breaker (VCB) and Vacuum Interrupter (BM).	TI/SPC/PSI/LVCBIN/0120 (December'2013) Revision-0)
32 B	220 kV/132 kV/110 kV/100 kV/66 kV Double Pole, Triple Pole, Out Door SF6 Circuit Breakers.	TI/SPC/PSI/HVCB/0120 (June'2014) with A&C slip No.1(March-16)
33	Hard drawn grooved copper Contact wire	ETI/OHE/76(6/97) with A&C slip No.1 of (4/01), 3 of (03/05) , 4 of (12/06), 5 of (7/09), 6 of (5/12) & 7 of (12/13)
34	Metal Oxide Gapless type Lightning Arrestor for use on 25kV side of Rly. Traction sub stations & switching stations	TI/SPC/PSI/MOGTLA/0100(07/10)
35	Technical Specification for Silicon Composite Insulators for 25 kV A.C. 50 Hz single phase overhead traction lines.	TI/SPC/OHE/INSCOM/1070 (01/07) OR TI/SPC/OHE/INSCOM/1071 (04/13)
36	Specification for solid core porcelain cylindrical post insulator for systems with nominal voltage of 66kV, 110kV, 132kV & 220kV.	TI/SPC/OHE/POST/0100(01/2010)
37	25kv/240V L.T. supply Transformer, 100 KVA	ETI/PSI/15 A (7/82) with A&C Slip No.1(9/89)
38	Battery charger for 110V Battery, 200 AH	ETI/PSI/24(6/81)
39	Low tension Distribution panels for Rly. A.C traction sub-stations.	ETI/PSI/29 (12/79)With A&C Slip No.1 (2/93)
40	Standard for drawings for power supply Installations.	ETI/PSI/31 (5/76)
41	Low tension distribution panels.	ETI/PSI/63(7/82)
42	Technical specification for control and relay panel for 25kV ac TSS including specification for numerical type protection relays for traction transformer, 25kV shunt capacitor bank and transmission line for 25kV ac TSS on Indian Railways.	TI/SPC/PSI/PROTCT/6071
43	Technical specification for shunt capacitor & series reactor equipment for traction sub-station	TI/SPC/PSI/FC&SR/0100(01/10)
44	Technical specification for 25kV ac, 50 Hz, single phase, oil filled, current transformer with CT ratio of I-1000-500/5A (for general purpose), II-1500-	ETI/PSI/90 (6/95) with A&C Slip No.1, 2,3,4,5,6,7 (08/2007) & 8 (April 2009).

SI.NO.	TITLE OF SPECIFICATION	SPECIFICATION NO
	750/5A (for heavy haul duties) for Railway ac traction substation.	
45	Technical specification for two zone static relay for distance protection for 25kV ac single phase 50 Hz traction overhead equipment.	ETI/PSI/101 (8/87) with A&C Slip No.1 (09/87)
46	Technical specification for current transformers. I. 220kV. 200-100/5A, II. 132kV. 400-200/5A, III. 110kV. 400-200/5A, IV. 66kV. 800-400/5A for Railway A.C traction substations.	ETI/PSI/117 (7/88) with A&C Slip No.1 (11/88), 2 (3/89), 3 (12/89), 4 (4/90), 5 (6/90), 6 (9/92), 7 (8/05), 8 (08/2007) & 9 (July 2008).
47	Specification for 21.6 MVA single phase, 50 Hz. I) 220/27kV ii) 132/27kV iii) 110/27kV, iv), 66/27kV traction power transformer for Railway A.C traction sub-station.	ETI/PSI/118 (10/93) with A&C Slip No.1 to 9 & A&C slip No.10 (08/12) or latest
48	Code of practice for earthing of power supply installations for 25kV A.C., 50 Hz, single phase traction system.	ETI/PSI/120 (2/91) with A&C Slip No1 (10/93)
49	Technical specification for i) 245 kV, (ii) 145 kV, (iii) 123 kV, (iv) 72.5 kV double pole & triple pole Isolator for Railway traction sub stations.	ETI/PSI/122 (3/89) with A&C Slip No.1(4/90)
50	Specification for Metal Oxide gapless type lightning arrestors (combined) for use on 220/132/110/66 kV side of Railway A.C. traction substation.	ETI/PSI/137 (8/89) with A&C Slip No.1,2,3 (Embodying) A&C slip No. 4(8/94) 5(04/01), 6 (9/05) & 7(07/2007)
51	Technical specification for 220 kV or 132 kV or 110 kV or 66kV or 25 kV potential transformer.	TI/SPC/PSI/PT_S/0990 with A&C Slip No.1,2,3,4,& 5 (April 09)
52	Delta I type High resistive fault selective Relay for 25 kV AC Single phase 50 Hz traction system.	TI/SPC/PSI/PROTCT/1982(12/2003) with A&C slip No.1(10/13)
53	Panto flashover protection relay for 25 kV A.C. single phase 50 Hz traction system.	TI/SPC/PSI/PROTCT/2983 (09/2001)
54	Technical Specification of SCADA system for 25kV, AC Single phase Traction supply on Indian Railway.	TI/SPC/RCC/SCADA/0130(04/2014)
55	Technical Specification for Galvanised Steel Stranded Wire for Traction Masts	TI/SPC/OHE/GSSW/0090 (10/2009)
56	Technical specification for galvanized steel stranded wire for traction bonds	TI/SPC/OHE/GALSTB/0040(09/04) Rev. 1 (08/05)
57	Setting up Earthing Station at switching posts (SSP & SP) with conventional Earthing.	Special Maintenance Instruction No. TI/SMI/0032 Rev-1
58	Design handout for Overhead equipment for running double stack containers under electrified routes (High Rise OHE) with	TI/DESIGN/OHE/2014/0001 upto latest version.

SI.NO.	TITLE OF SPECIFICATION	SPECIFICATION NO
	speed potential of 140 Kmph based on revised wind zone.	
59	OHE span in view of changes in wind zones in country	TI/OHE/GA/2013 DATED 25/30.04.2013
60	Technical guidelines and Standard Instruction for Railway Electrification Works including OHE, TSS, Transmission Line, SCADA, Electrical General Works, signaling Works, Telecom works & Civil Engineering Works.	Core/Re Tender/EPC/2014/Standard Instructions And Guidelines

Bonding And Earthing:- .Bonding all exposed metallic parts of all equipment, Civil structure and connecting them to the earthing network is a way for meeting safety requirements and to minimize noise voltage due to potential difference. Direct bonding shall be used wherever practical. Where indirect bonding via bonding strap is used to connect two isolated items. Proper bonding procedure, including appropriate surface treatment before and after the bonding process, is adopted. Proper use of bond material to minimize electrolytic corrosion.**LIST OF IS SPECIFICATION**

S. No.	IS Code No.	Descriptions
1	IS:210-1993	Grey iron castings
2	IS:269-1989	Specification for 33 grade ordinary Portland cement (4th Rev)
3	IS:282-1982	Dropper Wire
4	IS:306-1983	Tin bronze castings
5	IS:335-1993	New Insulating oil (4th Rev) Reaffirmed 2000
6	IS:371-1999	Ceiling rose spec.((3rd Rev)
7	IS: 383-1970	Specification for coarse & fine aggregates from natural sources for concrete
8	IS:398(PT.I)-1996	All Aluminum conductor
9	IS:398 Pt.II-1996	Al. conductor for overhead transmission purposes
10	IS:398(Part-III) 1976.	Aluminium conductors galvanized steel reinforced
11	IS: 432 Pt.1-1982	Specification for mild steel & medium tensile steel bars and hard drawn steel wires for concrete reinforcement
12	IS: 456-2000	Plain & Reinforced concrete Code of practice (3rd Rev)

S. No.	IS Code No.	Descriptions
13	IS: 516-1959	Method of tests for strength of concrete
14	IS:617-1994	Aluminum castings
15	IS:694:1990	Al. Jumper wire
16	IS:702-1988	Specification for industrial bitumen (2nd Rev) reaffirmed 1999
17	IS:731-1971	Porcelain Insulator for overhead power lines with a nominal voltage greater than 1000V
18	IS:732-1989	Code of practice for electrical wiring installation (3rd Rev)
19	IS:800-1984	Code of practice for general construction in steel (2nd Rev)
20	IS:808-1989	Dimensions for hot rolled steel beam, column, channel & angle sections
21	IS:816-1969	Welding
22	IS:875 (Part-3) 1987 (Reaffirmed)	Code of practice for design loads (other than earthquakes) for building and structures – Part 3: Wind loads second revision.
23	IS:1293-2005	Plugs & socket outlets of rated voltage upto and including 250V and rated current up to 16 Amp(3rd Rev)
24	IS:1387-1993	General requirements for the supply of metals and metal products
25	IS: 1489 Pt. I 1991	Specification for Portland-Pozzalana cement Pt .I Fly ash based (3rd Rev)
26	IS:1554(Part-I) 1988	PVC insulated cables
27	IS:1608-1995	Mechanical testing of metal- tensile testing
28	IS:1731-1971	Dimensions for steel flats for structural & general engineering purpose
29	IS:1777-1978	Industrial Luminaries with metal reflectors (1st Rev)
30	IS:1786-1985	Specification for high strength deformed steel bars and wires for concrete reinforcement
31	IS:1897-1983	Copper strip for formed fittings
32	IS:2004-1991	Carbon steel forgings for general engineering purpose
33	IS:2062-2011	Steel for general structural purpose

S. No.	IS Code No.	Descriptions
34	IS: 2074-1992	Ready mix Paint, air drying, Red oxide, Zinc chrome
35	IS:2121-1981	Aluminium and steel cord Aluminium conductors for (Part I & II) overhead power lines.
36	IS:2141-2000	Galvanized stay strand
37	IS:2312-1967	Propeller type AC ventilating fans (1st Rev)
38	IS: 2386 Pt.III-1963	Method of tests for aggregates for concrete Pt. III Specific gravity, density voids, absorption & buckling
39	IS:2673-2002	Dimensions for Aluminum Tubular Busbar.
40	IS:2675-1983	Enclosed distribution fuse boards ad cut-outs for voltage not exceeding 1000V AC & 1200V DC (2nd Rev)
41	IS:3043-1987	Code of practice for Earthing (1st Rev)
42	IS:3091-1999	Aluminum bronze castings
43	IS:3188-1980	Characteristics of string insulator units
44	IS:3837-1976	Accessories for Rigid steel conduit for electrical wiring
45	IS:3854-1997	Switches for domestic & similar purposes(2nd Rev)
46	IS:4826-1979	Specification for hot dipped for galvanized coatings on round steel wires (1st Rev)
47	IS:5082-1998	Material for Aluminum tubular busbar.
48	IS: 6403-1981	Code of practice for determination bearing capacity of shallow foundations (1st Rev)
49	IS:7098 (Part I) 1988	LT XLPE cables
50	IS:7098 (Part II) 1985	HT XLPE cables
51	IS: 8130-1984	Conductor for Insulated electric cables & flexible cords (1st Rev)
52	IS:9537 Pt-I-1980	Conduits for electrical installations
53	IS:9968(Pt.2)-2002	Annealed Copper Jumper Wire
54	IS:13947 Pt. III 1993	Specification for low voltage switchgear & control gear Pt.-3, disconectors & fuse combination unit

S. No.	IS Code No.	Descriptions
55	IS:14329-1995	Malleable iron castings

7.4 ABBREVIATIONS

General abbreviations used in the PS shall have the following meaning: -

Abréviations	Meaning
AC	Alternating Current
ACOCB	Alternating current outgoing circuit breaker
ACRC	Alternating current rectifier contractor
ACRCB	Alternating current rectifier circuit breaker
AMS	Auxiliary Main Sub Station
ASS	Auxiliary Sub Station
AT	Auxiliary transformer
ATCB	Auxiliary Transformer Circuit Breaker
ATIS	Auxiliary Transformer Isolator
B	Traction bus bar
BA	Batteries
BAIT	Batteries interrupter
C&C	Control & Communication
CAMS	Computer Aided Maintenance System
CB	Circuit Breaker
CCB	Coupling circuit breaker
CIS	Coupling Isolator
CTATP	Current Transformer for protection of Auxiliary Transformer
CTC	Current transformer for coupling
CTIM	Incoming Current Transformer for Measurements
CtT	Current transformer for traction transformer
CTTTP	Current Transformer for Protection of Traction Transformer
DC	Direct Current
DCAC	Direct current auxiliary contactor
DCACC	Direct current auxiliary couplingcontactor
DCOCB	Direct current outgoing circuit breaker
DCRC	Direct current rectifier contactor
DTN	Data Transmission Network
TRANSCO	Transmission Company (erstwhile DVB)
ECC	Energy Control Centre
EIS	EarthingIsolator
EMIS	Energy Management and Information System
GRC	General Remote Control
IED	Intelligent ElectronicDevice
IS	Isolator
IR	Indian Railways
IT	Interrupter

Abréviations	Meaning
OCC	Operations Control Centre
ITC	Coupling interrupter
L	Hand operated traction isolator
LAAT	Surgearrester for Auxiliary Transformer
LAN	Local Area Network
LATT	Surgearrester for Traction Transformer
LBCB	Lighting bridge circuit breaker
LBCCB	Lighting bridge coupling circuit breaker
LBCCT	Lighting bridge coupling current transformer
LBCT	Lighting bridge current transformer
LBCVT	Lighting bridge coupling voltage transformer
LBEIS	Lighting bridge earthingisolator
LBVT	Lighting bridge voltage transformer
LEIS	Line EarthingIsolator
LFCB	Lighting feeder circuit breaker (spare)
LFEIS	Lighting feeder earthing isolator
LIS	Line Isolator
LV	Low Voltage
LVACB	Low voltage auxiliary circuit breaker
LVACCB	Low voltage auxiliary coupling circuit breaker
LVAT	Low voltage auxiliary transformer
LVATCB	Low voltage auxiliary transformer circuit breaker
LVATEIS	Low voltage auxiliary transformer earthing isolator
LVCB	Low voltage circuit breaker
LVCCB	Low voltage coupling circuit breaker
MC	Metro Corridor (Underground)
MCCB	Metro corridor circuit breaker
MCEIS	Metro corridor earthing isolator
MCIS	Main coupling isolator
MMI	Man Machine Interface
HMI	Human Machine Interface
MVCB	Medium Voltage Circuit Breaker
NMS	Network Management System
NGR	Neutral Ground Resistor
OCC	Operation Control Centre
OHE	Over-Head Equipment
PCW	Power Control Workstation
PICOP	Person In Charge Of Protection
PLC	Programmable Logic Controller
PNCT	Primary neutral current transformer
PNEIS	Primary neutral earthing isolator
PNLA	Primary neutral surge arrester
RC	Rail Corridor
RCCB	Rail corridor circuit breaker
RCEIS	Rail corridor earthing isolator

Abréviations	Meaning
RSS	Receiving Sub Station
SCADA	Supervisory Control And Data Acquisition System
SNCT	Secondary neutral current transformer
SNEIS	Secondary neutral earthing isolator
SNLA	Secondary neutral surgearrester
SP	Sectioning and Paralleling Post
SSP	Sub-Sectioning and paralleling Post
T	Transformer
TCB	Traction Circuit breaker
TEIS	Transformer Earthing Isolator
TSS	Traction Sub Station
TT	Traction transformér
TTCB	Traction Transformer Circuit Breaker
TTIS	Traction Transformer Isolator
UPS	Un-interruptible Power Supply
VDU	Video Display Unit
VT	Voltage Transformer
VTB	Voltage Transformer for traction bus bar
VTBB	Bus Bar Voltage Transformer
VTC	Voltage transformér for coupling

Further abbreviations may be defined within the body of the GS or PS where there is only local applicability. Where such abbreviations exist the Contractor shall exercise great care that the abbreviation is not used out of context when communicating with the Engineer or any Third Party.

7.5 MAIN APPLICABLE RDSO STANDARDS/SPECIFICATIONS/DRAWINGS

RDSO Drawing/Standard/Specification No.	Title/ (Applicable for)
ETI/OHE/13(4/84).	Hot dip galvanization
TI/SPC/OHE/ FASTENERS/0120:	All Steel Fasteners and Stainless Steel Bolts, Screws, Nuts, Lock Nuts, Plain and Spring Washers
RDSO drawing no. ETI/OHE/G/04207 Sh-1.	Section Insulator in tramway OHE
ETI/OHE/42	107 sq. mm contact wire
ETI/OHE/50, Latest version	Bridle wire for Tramway OHE
RDSO drawing no. ETI/OHE/G/04204	Tramway OHE cantilever arrangement
ETI/OHE/16(1/94)	25 kV Isolators
ETI/PSI/71 (1/87) with A&C slip no. 1 to 7 or Latest Version	25 kV Lightning Arrester
ETI/OHE/16(1/94) as per to latest version	25 kV Switchgears
ETI/PSI/98 (08/92) with all latest amendments	For Booster transformers
TI/SPC/OHE/SNS/0000	Location for SNS (SP)
ETI-C-0068	horizontal or vertical awnings for mechanical protection
ETI/OHE/33 A (12/97) Rev.-7	Number Plate, caution boards/Notice such as caution board on mast, caution board at neutral section etc.

RDSO Drawing/Standard/Specification No.	Title/ (Applicable for)
ETI/OHE/P/7503 or Latest Specification	for retro reflective number plates

Note: -

1. All the required drawings like General Power supply arrangement, sectioning diagram, wiring diagram, LOP, Cross Sectioning diagram, SED, Location plan, Pegging Plan, OHE arrangement on bridges drawing with emergency provision, Bridges Mast drawing, Switching Post diagram etc as per Railway Electrification practice being followed by Indian Railways shall be prepared by the contractor and shall submit for approval of Engineer. Indicative drawings for GPS cum sectioning arrangement are attached at Appendix 15C for reference.
2. The High Rise OHE foundations shall be Conventional Block type or Cylindrical type as per approval of Engineer
3. All the required machines & Equipment's like Tower Wagon, Diesel Loco, BRN wagon, Conventional Coach, BRN mounted 5 MT Rail Crane, Rail cum Road Vehicle etc. shall be arranged by contractor.
4. The Contractor shall make his own arrangements at his cost for all Tools & Plants and Machinery required for casting of foundations, erection/dismantling of steel structures, portals, booms and equipment's, wiring, droppering & clipping, cube testing, earthing arrangements, cabling/trenching works etc. and execution, completion and maintenance of all items of work included in his scope of work to the complete satisfaction of the Engineer. No extra payment shall be made to the contractor in this regard. The cost of maintenance / repair of machine's damage during working shall be borne by the contractor
5. All materials used in the work shall be procured from RDSO/ CORE approved sources only and of the best quality and of the class suited for the purpose specified.
6. The contractor shall be solely responsible for the correctness of the position, levels and dimensions of the works according to approved drawings, notwithstanding that he may have been assisted by the Engineer or his men in setting out the same.
7. The contractor is bound to follow IR ACTM and IR SOD Up to latest correction slip in design, installation and other electrification work.
8. Notwithstanding anything given anywhere else all work execution shall be as per latest design and drawing of RDSO/CORE and latest guideline issue by Railway Board.
9. The contractor should follow all the clearances as per latest CEA regulation.
10. Meet the Project Safety and Environment requirements as per "Project Safety and Environment Manuals".
11. Meet the all protective provisions relating to electrical safety.
12. Above Note shall be applicable to the complete work in this tender.

7.6 TECHNICAL SPECIFICATION OF GENERAL SERVICES: -

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
1.	Wiring for light/ceiling fan/exhaust fan/call bell etc. points including circuit wiring, sub-main wiring with Fire Retardant (FR), PVC insulated, multistranded, copper conductor, single core cable on surface/in recessed PVC conduits, distribution boards, sub distribution boards, earthing and suitable number of modular switch and socket.	1. The point/ circuit wiring is to be done by 03 x 1.5 sqmm insulated multi-strand copper wire for phase, neutral and earth inside pvc duct/ conduit 19/20 mm. 2. Wiring of sub-main with single core insulated, multi-stranded 3x2.5/3x4.0/3x6.0 sqmm PVC CU cable in PVC conduit ISI mark 19/20mm concealed in stone/ bricks masonry wall separate conduit & 2.5/4.0/6.0 sqmm PVC CU cable insulated multi-stranded for earth wire respectively. 3. Wire for phase, neutral and earth shall be laid/done in concealed with heavy duty ISI marked PVC conduit pipe, minimum 19/20 mm dia and thickness 1.5 mm along with bend / junction. 4. SITC of 5/6 and 15 Amp plug 5-pin 230V or above modular type switch socket of standard size on existing board and connection with 2.5sqmm and 4.0 sqmm PVC CU cable respectively. 5. Supply and fixing of PVC cable duct 40 x 60 (w x h) 1 M STD slot greenish grey. 6. SITC of Double Pole MCB of 32 Amp, 10 kA C series is to be provided in the metal enclosure. 7. SITC of 02/04/08/12 Module modular Plate MS Box (GI) for fixing of switches and sheet metal box of thickness 2/3 mm, of good quality and standard size. 8. SITC of Double Door MCB DB SP 12 way (10+ 2 module), neutral and earth link and suitable IP protection, with one no DP MCB 40amp, one no	i. IS: 694-2010 for PVC conductor. ii. IS: 3854/1997 for switches iii. IS: 1293/2005 For Plugs & socket iv. IS: 371/1999 for celling rose. v. IS: 8828/1996 for MCB vi. IS 13947 (Part -1) 1993 for MCCB vii. IS:9537/2000 for PVC conduit The Electricity Act- 2003 or Latest. All CPWD Norms for electrical wiring	PVC CU conductor- Finolex / Polycab / KEI / Havells or similar as approved by Engineer. i. Modular switch/ socket – Anchor /Roma / Schneider / Legrand / Havells or similar as approved by Engineer. ii. MCCB/RCCB/ MCB/DB – Legrand, ABB, Schneider and similar. iii. PVC conduit – BEC / AKG / Polypack or similar as approved by Engineer.

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		DP RCCB 40 amp 30 mA and eight no SP MCB 32/25/16/10/6 amp. 'C' series. 9. SITC of Double Door MCB TPN DB 8 modules 4 row, neutral and earth link, and suitable IP protection with one no 4 pole MCB 40 amp, one no FP RCCB 40 amp 30 mA and twenty-four no SP MCB 40/32/25/16/10/6 amp. Min 02 Nos of DB should be installed at each floor of station building or as per requirement.		
2	Supply, installation, testing and commissioning of pre-wired 22 watt energy efficient Tube light fitting(4 feet) on wall bracket connections from junction box/light point etc. to luminary with 1.5 sq.mm FRLS PVC insulated multistranded copper conductor single core/three cable as instructed & earthing etc.	1.SITC of LED tube light (22 Watt) suitable for IP-20 for indoor application operating voltage (140-270) V minimum 2000 Lumens, Colour temperature 6500ºK, CRI>65, CRCA steel sheet type enclosure. **2.** SITC of rechargeable batten type Emergency light 60 LEDs, 4 watt or higher with one-hour minimum backup. Minimum 40 Nos in overall C-2 Package area.	CEE Spec No:CEE/NR/121-Elect/PS/2019(REV-04) Dated-04.11.2019 or latest for LED light.	Bajaj, Philips, Crompton or similar as approved by Engineer.

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
3	Supply, installation, testing and commissioning of 230V A.C. ceiling fan (1200/1400MM)/Exhaust fan and fan Regulator.	1. SITC OF ceiling fan 230V A.C. 1200/1400 mm ISI mark 5-star energy rating issued by BEE. 2. SITC of heavy duty exhaust fan 300mm sweep with louver shutter. 3. SITC of modular type electronic fan regulator, 5 step type on existing board.	i. IS: 374/1979 for ceiling fan ii. 2312/1967 for Exhaust fan. iii. IS:11037/1984	i. Crompton Greaves / Usha / Bajaj /Havells / Schneider or similar as approved by Engineer. ii. Anchor /Roma / North-West / Schneider / Legrand / Havells Crabtree or similar as approved by Engineer for fan regulator.
4	Provision of Bus Trunking System (Rising Main structure) In Manesar station building (G+3) as per requirement and specification.	1. SITC of sandwich type rising main 800 Amp straight runner (Rising Main -1) for use on 3 phase 4 wire 415 Volt 50 Hz AC supply temp. rise As per requirement with enclosure having IP 54 rating after fixing the tape of boxes and all accessories made of GI/Aluminium sheet enclosure IP 54 duly power coated in convenient sections complete with 4 nos. copper Bus bar having current density of 1.6 Sqmm per Amp at nominal current rating, necessary joint & expansion joints, Fire barrier at each floor, provision of taping at every meter, continuous earthing with 2 nos copper strip of suitable size (1 on each side) including all accessories for fixing. 2. SITC of 800 A capacity End feed unit for the existing sandwich type rising mains for use on 3 phase 4 wire 415 Volt 50 Hz AC supply made with GI/Aluminium sheet enclosure (IP 54) duly power coated with provision of MCCB complete with necessary fitting accessories. 3. SITC of sandwich type rising main 250 Amp straight runner (Rising Main –II) for use on 3 phase 4 wire 415 Volt 50 Hz AC supply temp. rise as per requirement with enclosure having IP	i. IEC-61439 ii. IEC 60439-1 and IEC 60439-2	Any reputed make of ISI mark

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		54 rating after fixing the tape of boxes and all accessories made of GI/Aluminium sheet enclosure IP 54 duly power coated in convenient sections complete with 4 nos. copper Bus bar having current density of 1.6 Sqmm per Amp at nominal current rating, necessary joint & expansion joints, Fire barrier at each floor, provision of taping at every meter, continuous earthing with 2 no's copper strip of suitable size (1 on each side) including all fitting accessories. 4. SITC of 125 A plug IN/Tap off box on the existing sandwich type rising mains for use on 3 phase 4 wire 415 Volt 50 Hz AC supply made with 1.6 mm thick sheet steel enclosure IP 54 duly power coated with provision of MCCB complete etc. as required. "Danger" warning signs of an approved type shall be provided at the front panel of all tap-off units. 5. Bus duct joints shall be of removable type with clamping bolts that can be checked for tightness without de-energizing the whole bus duct length and The cross-sectional area (CSA) of copper conductors shall be 270Sqmm.		
5	Provision of High Mast Tower (16 Mtrs) with LED Flood Light fitting (200 Watt) complete in all respect and as per requirement. Minimum 06 Nos of LED light fitting at each HMT.	**1.** SITC of hot dipped galvanised (inside & outside), 16m high mast system (in two sections), complete with accessories, foundation bolts with nuts, washers, anchor plates & templates etc. manufactured from special steel, head frame, 2-point suspension system with steel wire rope 6mm dia (7/19 construction), double drum winch, galvanised lantern carriage arrangement suitable for required luminaries symmetrically arranged & control gear boxes and	i. IS:875(Part-3)/1987 for High Mast Structure, ii. BSTN-10025/1993 for High Mast Shaft, iii. IS:2026 for other component IS: 2629 / 1985, BSEN ISO-1461 for Galvanization	Bajaj, Philips, Crompton or similar

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		lighting finial etc. The mast shall have integral type power tool at the base compartment for its raising and lowering operation, twin dome LED aviation obstruction lights. construction of foundation as per recommendation of manufacturer and approved drawing and its fixing arrangements etc. 2. SITC of Control Panel consist of - (a) 1X63 A TPN MCB for incoming supply (b) 3X32 A SPN MCB for outgoing (50% lighting, 100% lighting, motor) (c) Automatic timer with Power contactor for controlling above lights of suitable capacity. (d) 1 no multi plug socket 16A 3. High mast shall be provided with fencing panel of size 2Mx2Mx1.5M in square shape (If required by Engineer) for protection of erected high mast tower wherever required as directed by Engineer. **4.** SITC of LED flood light fitting (200 Watt) pre die cast aluminium, IP-66 protection, with high power LED lamp complete with all accessories. 5. Provision of Pipe Earthing system of each HMT. (Minimum 02 earth is required for each high mast tower).	CEE Spec No:CEE/NR/121-Elect/PS/2019(REV-04) Dated-04.11.2019 or latest for LED light.	
6	Provision of Octagonal poles (5 metres) with street light fitting (40 Watt) and 70-30% arrangement with complete accessories.	1. SITC of 5 mtrs. long octagonal pole made with 3 mm thick GI sheet, Top Dia 70 mm, Bottom dia 130 mm with single /double arm hot dip galvanized steel octagonal Poles with galvanized base plate of 220 x 220x 12 mm (as per IS 2062) and GI bolt size M20 X 600mm X4 no in position including excavation of pit and filling the same	i. IS:2629/1985, BESN ISO-1461 for Galvanization. ii. CEE Spec No:CEE/NR/121-Elect/PS/2019(REV-04) Dated-04.11.2019 or latest for LED light.	Bajaj, Philips, Crompton or similar as approved by Engineer.

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		with concrete M-20 including supply of material as required or recommended by pole manufacturer. 2. SITC of 40-Watt LED Energy efficient LED based street light fitting with pressure die cast aluminium housing with driver &suitable fixing arrangement, IP-65 for outdoor application, operating voltage (140-270) V, System efficacy more than 100 lm/W, colour temperature 6500K, CRI>65. Complete with all accessories. 3. SITC of modular digital timer for automatic operation of platform, circulating area, street light etc. complete with required power contractor, digital timer and MCB etc. in enclosure of suitable size and power Contractor.		
7	Provision of Passenger Lifts (13 Passengers, 884 Kg) (G+1) with complete accessories at Manesar and New Patli Staion.	1. Supply ,installation , testing and commissioning of passenger Lifts (13 Passanger,884 Kg) gearless machine room less, single landing(GF&FF), Minimum load 13 persons speed 1m/s to 1.5 m/s, Automatic door with two side opening, microprocessor base variable frequency, variable voltage derive controller with ARD, Stainless Steel Hairline Finish Car and Car Door, 1.00 MPS. Simplex Collective, Selective Control, Emergency Light, Fireman's switch, Alarm Button, Phase Failure & Phase Reversal Protection, Automatic Rescue Device, Vacuum fluorescent display in Car and other safety device with minimum guarantee/ warranty of 02 years. 2. Contractor should provide all the safety parameters/ License/ Insurance certificate and other required clearness issued by state authorities.	i. IS-14665/2000 for Lift ii. RDSO/2013/EM/SPEC/0016Rev (0) for Lift iii. All CPWD Norms for installation of Lifts.	OTIS, KONE, Mitsubishi, Jonson or similar as approved by Engineer.

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		3. During Warranty period contractor will ensure all Preventive and Schedule maintenance/checks will be done by OEM only with in time interval as decided by Engineer. 4. During warranty period all the Breakdowns like defective/ broken of lifts Light, Fan, Batteries ARD and various electronic cards with in 3 hrs otherwise penalty may be imposed as per decision of Engineer. (Detail Technical specification of LIFT is also given at Para 7.7 for reference only)		
8.	Supply, Installation, Testing and Commissioning of Sub-Station (11/0.440 KV) including CSS-1 and CSS-2. Each CSS Shall be consisting of 11KV Compact VCB/SF6 CB panel (1 incoming isolator + 2 outgoing VCB/SF6 CB with air insulated BUS PT metering module) + DRY type Transformer (500 kVA) Capacity + L.T. Switchgear with all HT & LT inter- connections, accessories, fittings & auxiliary equipment inside GI Enclosure as per technical specification. CSS also include 1 RMU 11kVA	1. Each CSS comprising of 11 kV compact substation suitable for outdoor installation with natural cooling, having type tested equipment comprising of dry-type (CRT) distribution transformer and SF-6 insulated compact switchgear enclosed in robotically sealed stainless steel tank, low – voltage switchboard, interconnection between HT switchgear and transformer using cables and transformer to LT-switchgear using aluminium bus bars, factory built ready for connection type, internal GI earthing provided complete with other associated equipment etc. complete as required as regards to design, manufacturing, type-testing, route-testing, pedestrian and operator safety (IAC AB 21ka/1-sec). The enclosure shall have modular construction using G.I. Sheet and shall be power-coated from exterior. The transformer compartment will have IP-54 protection.	IEC 62271-202	ABB/Raychem/Voltamp/Schneider/Siemens/CG or similar as approved by Engineer.

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
	630 Amp 21 KA, LT panel as per spec., APFC panel 200 kVAR MPP type heavy duty, all HT and LT cable with proper termination arrangement of suitable size and length, Suitable H-pole arrangement with GO/DO switch (if required) supply, fixing and commissioning of silent type 160 kVA DG set with AMF panel, Provision of Copper Plate earthing as per requirement and CT/PT for Metering system as per technical specification and supply & fixing of all safety items required for 11/0.440 substation as per rules.	2. HT SWITCHGEAR shall comprise of 03-Way Ring Main Unit having 01nos. Fixed-Type VCBs feeding to transformer in CSS, all enclosed in common tank, made of robotically welded non-magnetic/non-ferritin Stainless Steel Sheets, and filled with SF6 gas acting as insulating medium to suitable pressure, the tank design meeting IP-67 criteria with SF6 gas leakage rate less than 0.1% per annum, whereas it shall be Arc-Proof design with internal Arc classification IAC 20ka/1-sec individually. The complete Ring Main Unit should be a front-accessible design with associated Capacitive Voltage LED Indicators for each arc-proof cable box, along with associated Terminal Protector boots and front-facia semaphore mechanical indication for isolator/breaker ON/OFF/EARTH. The breaker will have provided with integrated Self-Powered 30C +1EF relay with low and high set for over current and earth fault. Relay should have facility to display the maximum loaded phase current also. Relay shall record minimum 5 fault records with time stamping, and shall be actuated via Resin cast Ring Core Protection CTs of suitable ratio and burden installed in the cable box. 3. 01no. 500 KVA 11KV/433V Dyn11 Dry Type Distribution transformer having cast resin design Bushings for HT and LT with Off load tap switch of rating +5% to -5% @2.5% and WTI scanner.		

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		Temp Rise – 115 deg C, Class 'H' insulation, Losses = 2.2 kW (NLL/7.25KW(FLL) (Subject to IS Tol.), Impedance 5% (Subject to IS Tol.) and 01no. WTI Alarm/Trip Scheme and Surge arrestor in the HV side. 4. LV-PANEL shall be a totally enclosed, floor/Wall mounted, dead-front access, min IP2X protected panel which has a type tested design, aluminium busbars, suitable switchgear configuration and indication scheme as describe below 01no. 433V, 800 Amp, Aluminium Busbar Arrangement with suitable colour coding scheme for identification for each phase.01no. 800A, 433V, 50Ka, 4P Fixed, Manual ACB with microprocessor based over current, short circuit and earth fault release acting as IC-OG arrangement 01set. LED based ON/OFF/TRIP Indication for mains ACB. 01no. Multifunction Meter for measurement of various parameters like Voltage, Amp, kVA, kw, PF etc. of reputed make for mains ACB. (along with associated CT where applicable) 5.OUTDOOR ENCLOSURE shall comprise of having construction of Galvanised Sheet Steel of thickness at least 1.5mm. The Enclosure shall have IP54 degree of protection for HT & LT switchgear compartment & IP23 degree of protection for Transformer compartment. The enclosure shall be Power coated. Each compartment will be provided with the door and pad locking arrangement. The compartment illumination lamp with the door operated switch shall be provided for HV and LV compartment.		

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		6.LT Panel: - One additional LT panel (technical specification same as S. No-18) will be installed at Substation for further LT power supply distribution CSS, HT Switchgear, transformer and LT switchgear should be of same make. The successful tenderer shall submit the arrangement GTP and other relevant drawings for approval as per standard make prior to supply and execution of work. Note: -1. Indicative drawings of Sub-station are attached at page No- 118 and 119 of this chapter. 1. The technical specification for New Patli Sub-Station will remain same, only it's parameters will be as per rated capacity (250kVA).		
9.	Provision of Inverter type Split AC (1.5 Ton, Heavy duty, 5 Star Rating with Stabilizer) and other accessories as per site requirement	1. SITC of 1.5 Ton heavy duty, 5-star inverter type split air conditioner with required suitable size nuts, bolts, fasteners, cu pipe & petty hard ware in all respect. Top up the required refrigerant & maintain the pressure (If required) as per company recommendation or latest Eco-friendly refrigerant. 2. SITC of Metal Clad Plug Socket 20A single phase with 32A MCB 10kA ,c series including fixing and sheet metal enclosure box with one 20A plug top (Ray roll type) to be supplied with board for each AC.	IS:1391/1992 for Air conditioning	Voltas, Blue Star, Carrier, Hitachi, O - General, Mitsubishi or similar as approved by Engineer.
10.	Provision of LED Signage Board & LED Station Name Board (Single Sided/Double	1. Design, SITC of LED back lit single & double-sided signage boards with IP-65 CRCA housing, vinyl print on acrylic sheet which is back lit with high grade, high brightness LED modules inbuilt SMPS driver, without battery backup. Operating	IS:16101-2012 and 16102-2012 part 1 and 2.	PHILIPS, NICHIA, OSRAM and SEOUL or similar as approved by Engineer.

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
	Sided) with all accessories	voltage 80-270VAC. LED with L70 life of minimum 50,000 hours, LPM technology, including fabrication and supply of clamping arrangements as desired. 2. The pictogram and letter of desired colour and size made by translucent vinyl sheet cut through computerized machine shall be pasted on acrylic sheet. Acrylic sheet with pictogram shall be fixed on CRCA/GI sheet powder coated box with suitable arrangement. Subject matter and pictogram can be seen in the standard book of signage available in office. 3. Depth of box shall be approximately 3.5 inches (for single sided) 5.5 inches (for double sided) and made by 0.8 mm thick CRCA/GI sheet with powder coated having louvers for ventilation on two sides having suitable gaskets for protection against water and vermin ingress.		
11	Supply and laying of different sizes 1.1 kV grade LT XLPE insulated armoured, aluminium conductor cable, in trench/ air/ HDPE pipe. making good the damages, end terminations with aluminium crimping sockets/lugs, provision of cable route markers, etc.	1. Supply of 1.1 KV grade 4x16/4x35,4x50,4x70,4x95,4x120 and 4x185 sqmm LT XLPE insulated armoured aluminium conductor cable, making good the damages, end terminations with aluminium crimping sockets/lugs, gland, testing and meggering etc. as per required Technical specifications. Note: -The contractor shall arrange inspection of cable at manufacture's works before dispatch at his own cost if required by the Engineer. 2. Supply & laying of HDPE pipe in already excavated trench under road/ground/floor/railway track etc. as per site requirement size 75/80 and 50 mm Dia wall thickness 3mm PN-4 conforming to	i. IS: 7098 Part-II-1985 for cable ii. IS: 8130-1984 for cable iii. IEC-502 standards with latest amendment. iv. IS 4984:1995 or latest for HDPE pipe	i. KEI, Finolex, Havells and Universal or similar as approved by Engineer for cable. ii. Duraline/Godavari/Rex Polyextrusion/ Eflex or similar as approved by Engineer for HDPE pipe. iii. Comet / Dowells / Lapp Kabel/Hummel or similar as approved by Engineer for Lugs and glands.

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		IS 4984:1995 or latest as per site requirement. Pipe should be laid in trench such that It shall be possible to withdraw the cables for repair or replacement without disturbing the work. 3. Supply & laying of HDPE pipe in already excavated trench under road/ground/floor/railway track etc. with technical specification 160 mm dia (OD), wall thickness between 6.2 mm to 7.1 mm, material grade PE-80 and class of pipe should be PN-4. 4. Laying of underground cable under the road/Railway track, recessing in platform /wall along with Railway Track. in laid HDPE /GI pipe as required 1.1 KV grade LT XLPE insulated armoured, aluminium conductor cable including making chase & plastering after laying of cable/digging of cable trench, sand cushioning, protective covering with second class bricks, provision of cable route marker (200x150x3mm thick M.S. Plate and welded to MS rod of min 5 mm dia including bending and fixing) as per tech. spec. 5. Excavation & Refilling of 0.5 Mtr Width 1.20 Mtr Deep trench in all kinds of soil for laying of HDPE/GI pipe for underground cable crossing. Contractor will clear all metallic parts & stones etc. in trench. 6. Drilling of horizontal bore below Rly track by pushing method for laying of HDPE/SPUN/DWC/CI/GI pipe up to 450 mm by pushing method. Horizontal boring will be done at minimum 1.5 Mtr. Below or as per site requirement from ground level.		

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		7. SITC of LT heat shrinkable straight through joint with required accessories complete in all respect suitable for LT XLPE 4 core cable as per site requirement. Note: Indicative Drawing of Cabling arrangement of any station is attached at page No 120 of this chapter.		
12	Provision of Water Cooler (150 Ltrs) capacity with MS Cage & suitable protection arrangement as per site requirement.	1. SITC of self-contained drinking water cooler 150 litres capacity (cooling capacity 150 Lts. per hour), ISI marked, min 3 star rated, suitable for operation on 230 volts+/-10%, 50Hz, AC supply system complete with all connected standard fittings, accessories etc. and 5KVA, wall mounted, I.C. controlled electronic auto-voltage corrector.	i. IS:1475/2005 ii. IS: 1475 Part-1/2001	Blue Star, Kelvinator, Shriram, Voltas or similar as approved by Engineer.
13	Provision of Water Pumping Arrangement system with 10 HP Submersible Pump set,120 LPM or Above; Head range: 160M or above; Phase: 3 Phase; HP: 10 and 2 HP Monoblock submersible pumps with Suitable Starter , 3 core copper cable 10 Sq mm and other accessories as per site requirement.	1.SITC The pump set shall Energy Efficient Pumps (3 star or above) confirm to latest relevant IS and shall be guaranteed for the pump discharge range of head between +25% and - 10% of the specified head. The pump set shall be suitable for 8" dia bore well. Rotor dynamically balanced suitable for operation on 3-phase 50Cycles 415Volts -10% +5% AC Sup-ply. Motor squirrel cage induction type and shall be adequate capacity to provide the pump discharge within the range as specified. The Electric motor shall be water-cooled and water lubricated sealed against pollution from outside water. The thrust bearing shall be hydrodynamic Mitch well type preferably and provided with tilting thrust pads de-signed to make up all outward loads at the most unfavourable conditions. The motor shall be of ISI 410grade material; starter of motor should be impregnated with superior quality	i. IS:8034/2002 for submersible pump set. ii. IS: 9283/1995 for Motor of submersible pump set. iii. IS: 14220/1994 for open well submersible pump set. iv. IS 694 Part-I 1964 or latest for CU cable.	i. ABB / BBL / Crompton Greaves / Kirloskar or similar as approved by Engineer. ii. Finolex / Polycab / KEI / Havells / Lapp or similar as approved by Engineer for CU cable.

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		epoxy paint having type it thermal insulation as per IS5831-1970 or latest the rotor shall be dynamically balanced. All nut-bolts in contact with water of bore well should be of stainless steel. 2. Supply, fixing, testing and commissioning of single stage Mono-block open well submersible pump set with control panel rating 2HP/1.5KW, Head range (M) :26 meters and above, size (MM) suction X delivery 50X40, Discharge (LPM):180 or above at 26-meter head suitable for single phase 50Hz AC supply make as per ref list. 3. Supply and laying of flat submersible cable copper 3Cx10 sq.mm for pump set ISI mark as per requirement.		
14	Supply, Installation Testing and Commissioning of Earthing System	1. The earthing shall be done with 3 meters long 50 mm dia. 'B' class G.I. Pipe earth electrode with l2 mm dia. holes around the pipe at distance of 30 cm, down side tapered. Earth electrode to be put vertically 3-meter-deep with alternate layer of salt & charcoal approx. 50 kg charcoal and l0 kg salt. 8 SWG hot dip G.I. or 7/4 mm dia. galvanized steel stranded earth wire shall be connected from earth electrode top with l2 mm dia. G.l. nut bolt to main board / equipment with masonry / RCC earth enclosure of size 300x300x300 mm (ln side to inside) with I25 mm wall thickness & suitable size MS/RCC pull out cover. The G.l. wire shall run in l2 mm 'B'class G. I. Pipe along with wall / pole up to height of 1.5 meter. The depth of 8 SWG hot dip G. I. or 7/4 mm dia galvanized steel stranded earth wire including connections from earth pipe to	i. IS:1239 or latest IS: 3043 ii. RDSO specification No. iii. RDSO/PE/SPEC/PS/0109 (REV-0)-2008	1) TATA, Jindal, Prakash, Surya Sail or similar as approved by Engineer for MS pipe for earthing. 2) Erico / Indlec / Duvalmession or similar as approved by Engineer for maintenance free earth.

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		main board / equipment /H pole/Tower in ground shall be 30 cms. 2 Supply and providing of Maintenance Free Earthing with primary MS conductor 40 mm dia 3000 mm long and secondary MS Electrode 80 mm dia 3000 mm long includes digging pit of size 5ft.x5ft.x10ft. And using earth enhancement chemical compound minimum 75 kg. Per pit suitable for 40 KA current capacities. 3. supply of Copper earthing of size (600x600x3 mm) thick copper earth plate & suitable size of 40 X 5 mm copper strip. The price shall also cover erection including digging of earth pit in any kind of soil at the specified location. The work shall also cover the earth treated to obtain earth resistance of less than 1 ohm. Connection of earth electrode should be made by providing Copper clamps nuts, bolts.		
15	Supply and fixing of suitable size feeder pillars and Junction Box	1. Supply, erection, testing and commissioning of feeder pillar size 900x600x300 mm fabricated from 16 SWG MS sheet (tolerance as per IS permitted) hut shape suitable for outdoor installation, painted/ with red oxide and enamel/ powder coated complete enclosed type dust and vermin proof, with gland plate in bottom as required including connecting incoming & outgoing cables with aluminum lugs and brass glands, with 63 amp MCCB and 4 nos. aluminum bus bars suitable for 200A, complete with locking arrangement with MS angle stand 2 feet height angle size 40 x40 x6 mm Grouted in cement concrete mixture 1:3:6.	Relevant IS code	Popular make of ISI mark

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		2. Supply and fixing of junction box size 390x305x170mm comprising of SMP/FRP material with rubber gasket, padlock arrangement, zinc pas- sivated earth bolt, etc. similar to Sintex model no. GSJB 3525 or similar with 4 no. aluminums bus bar cap 200 Amp. Suitable for 415-volt supply requirement. The box shall be fixed robustly with clamps at pole/ wall as per requirement.		
16	Supply and fixing of CLS panel suitable for 25 kVA/10 KVA capacity AT supply with complete accessories and protection system as per RDSO specification	1.SITC of CLS panel including automatic changeover complete as per connections as required.	RDSO specification No.TI/SPC/PSI/CLS/0020 (12/02) with A&C slips No. 1 to 4 or latest,	RDSO approved make.
17	Supply and fixing of Phase selector of size (610x450x190mm) with I/P MCCB- 100/ 63 amp and O/P MCCB- 63 Amp	1. SITC of 1.6 mm thick CRCA power coated box of size 610 x 450 x 190 mm approximate with Din rail. The distribution board shall be indoor type dust vermin proof Knock out/glands plates as applicable shall be provided in the box for incoming and outgoing cables. Earth terminals shall be provided. Danger notice shall be provided at appropriate place. The complete internal wiring for each phase selector is to be done with copper wire of size 10 sqmm. 2. It consists of 01 no. 100 amp TPN MCCB as incomer,01 no. 100/63 amp (as per requirement) SPN MCCB as outgoing, 04 nos. integrated LED	Relevant IS code	

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
		pilot lamp (3 incoming+1 outgoing),01 no. 63-amp selector switch (phase selector switch) without OFF Three pole three ways (Three phase incoming & only one phase outgoing.		
18	Design, supply, testing Erection and commission of Indoor type LT panel with one incoming MCCB of suitable rating and Min 6 Nos of Output MCCB of suitable rating.	1. SITC of 1.5 mm CRCA sheet steel fabricated, cubicle, having outdoor type LT panel distribution board, having suitable IP protection, floor mounted front operated, mounted on MS base channel of suitable size, with top / bottom removable cable gland plate as required, earth bus, hinged and lockable doors, dust and vermin proof, complete with all inter connections, small wiring by min 2.5 sq mm copper wires. The panel should consist of(A) incoming 2x250 amp 4 pole MCCB's with changeover provision (if required) with microprocessor release having integral overload, short circuit, earth fault and neutral protection and breaking capacity 60 KA (Ics=100%Icu). (B)outgoing 2x125 amps, 2x100 amps and 2x63 amp 4 poles MCCB's with adjustable overload and adjustable short trip unit and breaking capacity 36KA (Ics=100%Icu). the panel is to be provided with over voltage protection with suitable relay. The bus bar shall be insulated by heat shrinkable sleeves. The instrument shall be of flush type ammeter, voltmeter, and selector switches with CTs, feeder name & danger board.	IS: 2147-1952 IS:2675-1966	Rittal / ABB / Schneider or similar as approved by Engineer.
19	Design, Supply &Installation of fire Detection & Alarm system (air aspiration) as per	1.SITC of Automatic fire detection & Suppression System (AFDSS) including heat detector, Smoke Detector, Aspiration type smoke detector for relay room, Alarm & Control Unit (ACU), Fire Extinguish	RDSO/SPN/NEW /2010.	RDSO approved make .

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
	requirement and standard railway practice.	System, Change over switch for switching extinguish system. 2. The AFDSS shall be self-checking & diagnostic type.		
20	Supply, fixing commissioning, installation and testing of 2 kVA pure sine wave 24-volt online inverter consist of intelligent battery charging mechanisms with adaptive battery charging and 150 AH tubular battery of voltage 12 volt suitable for heavy duty application. Warranty of invertors is 24 months and for Battery -36 months	1.SITC of 2 kVA, 24-volt pure sine wave Online UPS cum inverter. 2. SITC of 150 AH 12 volt heavy duty tubular Battery with 3 year warranty.	IS:13314/1992 for Inverter	Luminous, Microtek, Exide, Amaron or similar as approved by Engineer.
21	Supply, fixing, commissioning and installation of Perforated Cable Tray of size 150x50 mm made out of MS sheet and hot dip galvanized (85 microns) 1.6 mm thick with suitable fixing Arrangements.	SITC of 150x50 mm and 1.6 mm tick galvanised cable tray for laying of cable with all accessories.	Relevant IS code	Adarsh / Indiana / Mahesh Wari or similar as approved by Engineer.

S.No	Description of work	Work to be Done	Relevant IS Code/Standards	Reference Make
22	Provision of Solar Plants with 380 watt panels, hybrid type inverter, Galvanised structure, DCDB, ACDB, connectors, MCCB, earthing system, LA, Surge protector and complete wiring material.	1. SITC of 380 watt or above mono crystalline solar system. 2. Supply of hybrid type inverter suitable for solar system with all in built safety features. 3. Supply of galvanised iron solar structure suitable for panel installation. 4. Supply of DCDB and ACDB of including MCB of suitable rating and capacity. 5. SITC of net meter and metering CT suitable for solar plant. 6. SITC of different size of cu cable for connection of panel and other accessories.	i. IS: 12834/1989 ii. IEC 61215/2005 iii. IEC 60904-2006	TATA BP, REIL, CEL, BEL and BHEL or similar as approved by Engineer.

7.7 DETAILED SPECIFICATION FOR PASSANGER LIFTS (FOR 13 PERSONS)

1	Type of Lift	Passenger lift
2	Number of lift required	As per requirement
3	Load: no. of person	13 Person
4	Related speed	1.0 metre per second
6	Number of floor served	2
7	a) Inside size of lift well	Approx. size 2500 mm x 1900 mm deep or as Per site feasibility
	b) Pit depth	1600 mm or as per site feasibility
	c) Head room	4800 mm or as per site feasibility
8	Clear inside size of lift car	Approximate size : 2000x1100x2200(H) mm or as per site feasibility
9	Dimension of machine room	Not Applicable(No machine room is being provided)
10	Position of counter weight	At the back / side of the car
11	Position of machine room	Not applicable
12	a) Type of control	Microprocessor based AC variable voltage variable frequency
	b) Type of operation	Simplex selective – collective without attendant
	c) Potential free contacts	Yes potential free contacts for each floor position and up and down movement of the lift shall be provided in the controller which can be used for the building automation system at later
13	Car entrance door	
	a) Number	1 No. center/side opening stainless steel
	b) Size	Approx. size900x2000 mm high or as per site feasibility
	c) Type of doors	Horizontal sliding-center / side opening
	d) Car open in front only or open through	Open in front at ground floor and opposite / reverse opening at first floor
14	Construction design and finish of car body work	Stainless steel Hairline finish with stainless steel drop ceiling and led lights fittings for lightning inside the car and axial flow fan, 5 mm thick antiskid PVC flooring. All other item as per CPWD general specification for lifts 2003 with up to date amendments.
15	Type of signal system	(a) Digital floor position indicator in the car and all landings (to be provided above the car/ landing doors).
		(b) Travel direction indicator in the car and at all landings. (to be provided above the car/ landing doors).
		(c) Gongs & visual indication through directional arrows on all landings pre arrival of the car at all floors.
		(d) Over load warning audio & visual indica-tor , inside the car (lift should not start on overload)
		(e) Battery operated alarm bell and emergency light.
		(f) Car operating panel with fade proof luminous buttons in in the car and with intercom. Braille switches to be provided in the lift.
		(g) Luminous hall buttons at all landings with Braille switches.

		(h) Fireman's switch at ground floor.
		(i) Voice annunciation system. This will announce the position of the car landing in Hindi & English facilities for any other announcement to be made from the central control room / reception of the building.
		(j) Protection against over – voltage, under voltage and single phasing should be provided.
16	Landing entrance	
	a) Location of landing entrance in different floors	Front at ground floor and opposite / reverse at first floor
	b) Number	2 pairs
	c) Size	Approx. size 900 mm wide x 2000 mm high or as per site feasibility
	d) Type of doors	Horizontal sliding – canter / side opening
	e) Lift in use / lift out of order sign	Suitable box above the landings with LED illuminated bilingual (in English & Hindi) sign of "LIFT OUT OF ORDER" coming up simultaneously on all floors.
17	Electric supply	a) Power 415 V, AC, 50 Hz, 3 Phase, 4 Wire system.
		b) Lighting : 230 V, AC, 50 Hz, 1 Phase
18	Is neutral wire available for control circuits	Yes
19	Proposed date for commencement of site	-
20	Proposed date for completion	-
21	Environmental condition at site of installation	Summer condition Winter condition Monsoon condition Height above sea level
22	Storage space provided	_
23	Additional item, if any	
	a) Firemen's switch	Required for all lifts
	b) Emergency power supply	Available
	c) The firm's offer should include beam and all structural steel required for work	
	d) Automatic Rescue Device (ARD)	Provisions of automatic rescue device for the purpose of bringing the lift car to the nearest floor should be provided, one each for individual lift. ARD's are to be provided. The each shall consist of 1. Control panel with necessary interface /integration of device with main controller 2.Invertor of required capacity 3. Maintenance free batteries of Ampere –hours 4. Battery charging unit 5. "Rescue Operation On "indicator in the lift car.

S.NO.	**Particulars of detail**	
A	General	
1	Name of manufacture	As per CPWD approved 'A' category manufacture
2	Capacities (Persons/Weight)	13 Person/884 kg
3	Service	Passenger
4	Speed of travel	1.0 MPS
6	No. of floor served	02
7	No. of openings	02
8	Position of counterweight	At the back / side of the car or as per site feasibility
9	Type of levelling method	Automatic +/- 5 mm
B	**Machine**	
1	Position of machine	Top of lift shaft in hoist way / Machine room less
2	Motor	Permanent magnet synchronous Motor, Gear less machine
3	Electric supply particulars for which it is suitable for operation	3 PH 415 V 50 HZ 4 wire system
C	**Brake**	
1	Type	Electromagnetic brake
D	**Car & Doors**	**Horizontal sliding, centre / side opening**
1	Outside dimension of car	AS PER SITE CRITERIA
2	Inside clear dimension	Approximate size : 2000x1100x2200 (H) mm or as per site feasibility
3	Construction of car	Stainless steel Hairline finish with stainless steel drop ceiling and LED lights fittings for lighting inside the car and axial flow fan. 5 mm thick antiskid PVC flooring. All other item as per CPWD general specification for lifts 2003 with up to date amendments.

4	Design/ type of enclosure of car	Rectangular / as per site condition, stainless steel scratch proof (HAIR LINE FINISH)
5	Details of flooring	6 mm thick aluminium/5 mm SS Chequered plate
6	Attachment and fitting inside the car	Axial flow fan & LED light fittings with anti – theft arrangement (As per requirement)
7	Car doors	HORIZONTAL SLIDING, CENTRE/SIDE - OPENING
	a) Size	Approx. size 900mm x 2000 mm or as per site feasibility
	b) Operation	Power operated automatic door
	c) Construction, design & finish	Stainless steel scratch proof (HAIR LINE FINISH)
8	**Landing Doors**	
	a) size	Approx. size 900 mm x 2000 mm high or as per site feasibility
	b) operation	Power operated automatic door
	c) Construction, design & finish	Stainless steel scratch proof (HAIR LINE FINISH)
E	**SAFETY DEVICE**	
1	Car safety type	Progressive / instantaneous type
2	Counter weight safety- type	-
3	Door inter locks in car- type	Electrical type
4	Door locks in landing- type	Electromechanical type
F	**For physically challenged**	Note below
	Voice Response System.	Required in Hindi, English / local language if needed
	Luminous Push Button with Brail script.	Required
	Hand Rails	Stainless steel hair line finish, SS - 304

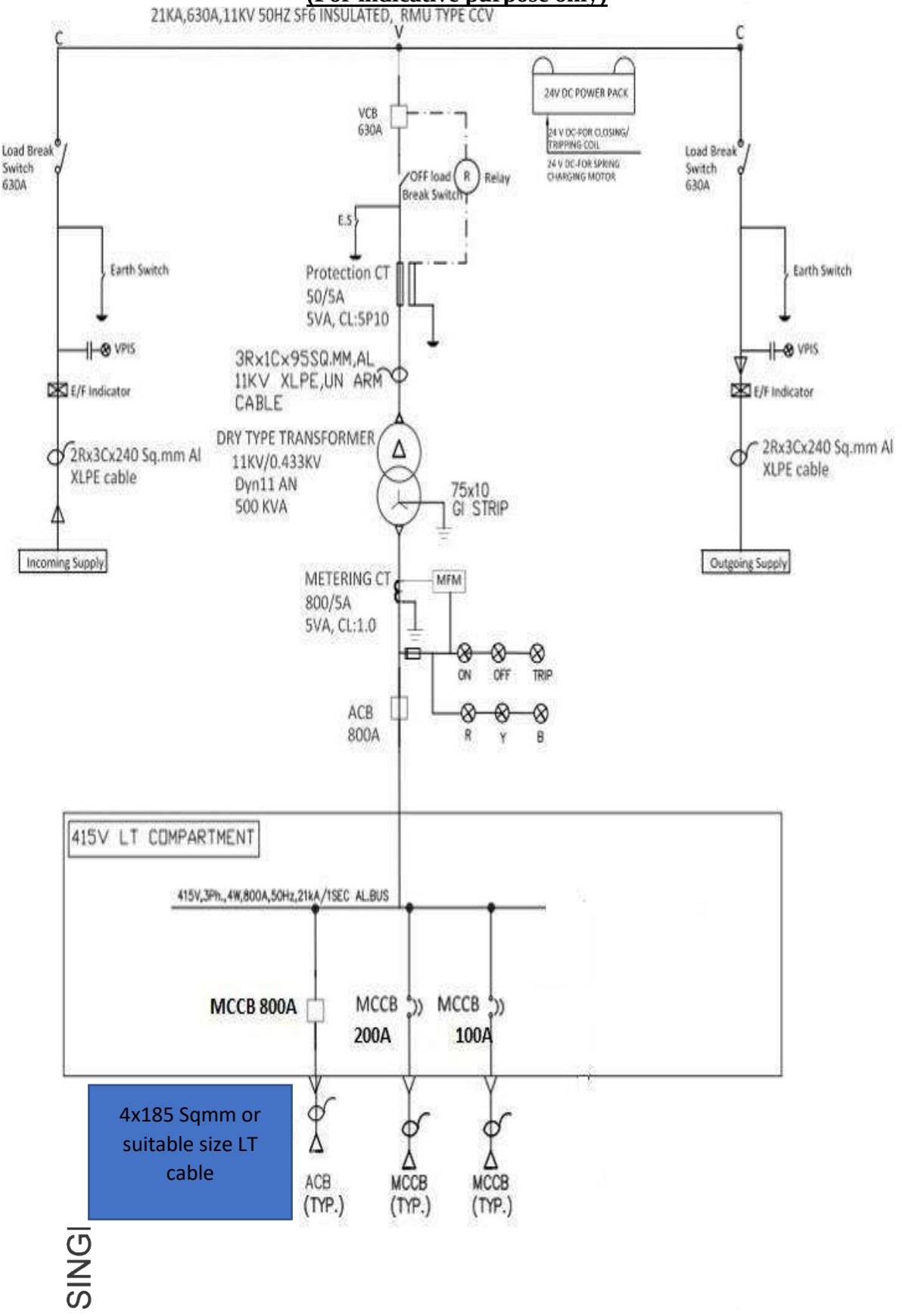
7.8 DESIGN LIFE OF ELECTRICAL ASSETS

All the equipment supplied and erected by contractor have to comply with the following Codal life standards.

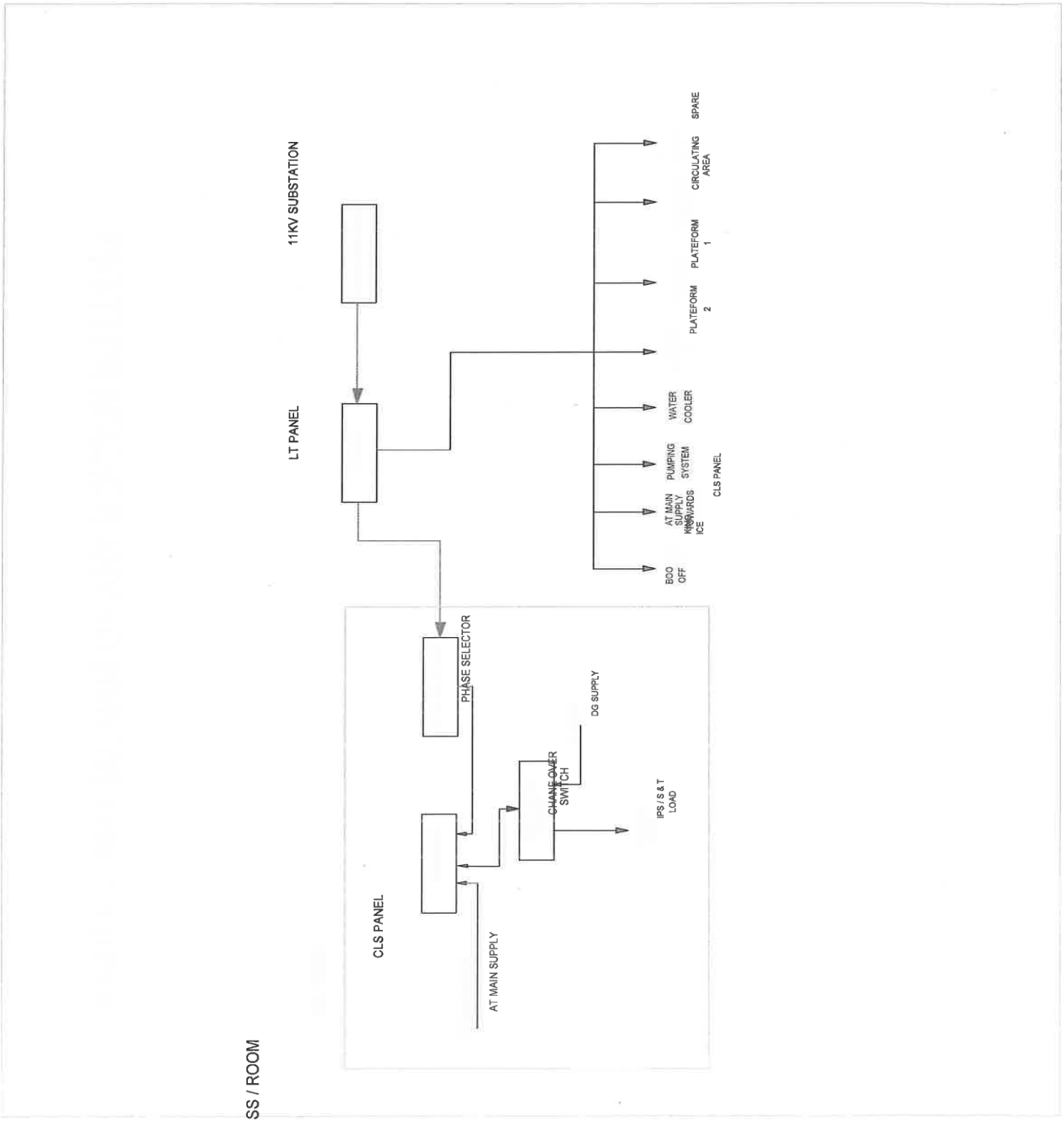
S.NO.	Class Of assets	Average life in years
1	Over Head Power Lines	40
2	Over Head Traction Line excluding contact wire	60
3	Electric underground Cables	30
4 (a)	Electric contact wire (Alm.)	25
4 (b)	Electric contact wire (Copper)	40
5	Electric Power Plant excluded oil engine driven	25
6	Electric Plant above 25 HP	25
7	Electric Power Plant oil engine driven (diesel)	15
8	Overhead traction lines contact wire	40
9	Electric Machinery others	30
10	Electric Sub Station Building	50
11	Water Cooler, Refrigeration, Air Conditioner, hospital and domestic appliance	5
12	Internal wiring of building	10
13	Switch Gear	25
14	Electric Pumps	20
15	Electric Lifts & Hoist	20
16	Ceiling Fans	20
17	Electric Battery charging set	15

18	Flood Light Projection	10
19	Battery lead Acid/VRLA	4

SINGLE LINE DIAGRAM OF 11 KV / 0.44 kVA COMPACT SUB STATION (For indicative purpose only)



(SINGLE LINE DIAGRAM OF ANY STATION BUILDING **(For indicative purpose only)**



Attachment 7
to
Corrigendum No. 5

Section VII: Employer's Requirements

Section VII-11: Tender Drawings and Documents

List of Charted utilities for Signalling at existing Patli station of IR

List of Charted utilities Signalling at existing Patli station of IR

For Phase 1 work

A) Full Location Boxes/Single Apparatus cases:
   1) L-12C,
   2) L-12A,
   3) B/Box,
   4) L-12,
   5) CH-2,
   6) CH-1,
   7) L-10,
   8) L-10D,
   9) B/Box,
   10) L-10A,
   11) L-7,
   12) B/Box,
   13) L-8,
   14) L-8A,
   15) L-8B,
   16) Axl (Old),
   17) L-3A,
   18) L-3

B) Half Location Boxes/Half Apparatus cases:
   1) L-12
   2) L-8C
   3) B/Box
   4) B/Box

For Phase-II work

A) Full Location Boxes/Single Apparatus cases:
   1) L-4
   2) L-5
   3) L-6 (Old)

B) Half Location Boxes/Half Apparatus cases:
   1) Axl (Old)
   2) 4TF Location box

Attachment 8
to
Corrigendum No. 5

Section VII: Employer's Requirements
Section VII-12: Appendices

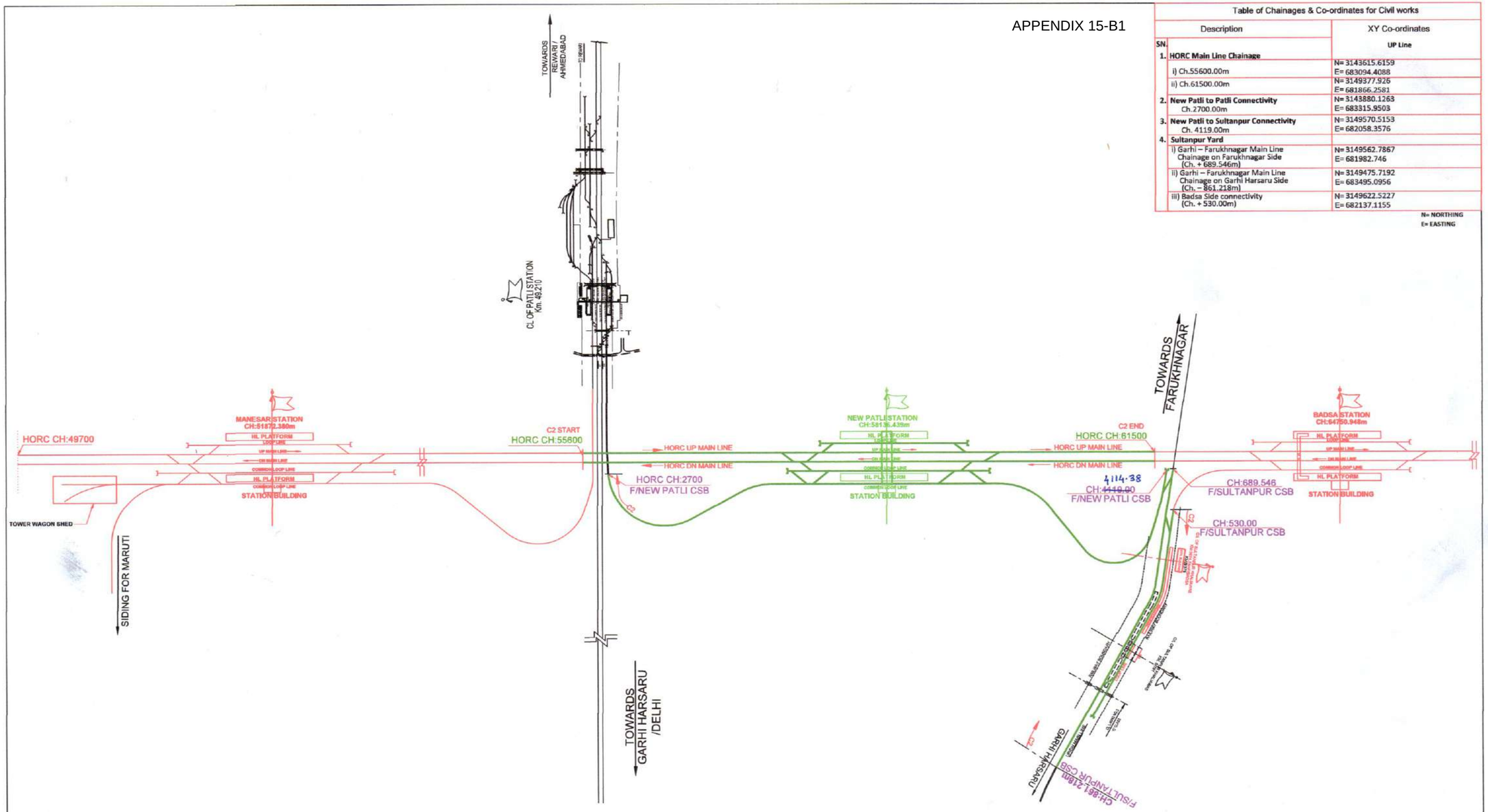
Appendix 15B (15B1, 15B2 and 15B3),

Appendix 15C
and
Appendix 15D

APPENDIX 15-B1

Table of Chainages & Co-ordinates for Civil works		
SN.	Description	XY Co-ordinates UP Line
1.	**HORC Main Line Chainage**	
	i) Ch.55600.00m	N= 3143615.6159 E= 683094.4088
	ii) Ch.61500.00m	N= 3149377.926 E= 681866.2581
2.	**New Patli to Patli Connectivity** Ch.2700.00m	N= 3143880.1263 E= 683315.9503
3.	**New Patli to Sultanpur Connectivity** Ch. 4119.00m	N= 3149570.5153 E= 682058.3576
4.	**Sultanpur Yard**	
	i) Garhi – Farukhnagar Main Line Chainage on Farukhnagar Side (Ch. + 689.546m)	N= 3149562.7867 E= 681982.746
	ii) Garhi – Farukhnagar Main Line Chainage on Garhi Harsaru Side (Ch. – 861.218m)	N= 3149475.7192 E= 683495.0956
	iii) Badsa Side connectivity (Ch. + 530.00m)	N= 3149622.5227 E= 682137.1155

N= NORTHING
E= EASTING



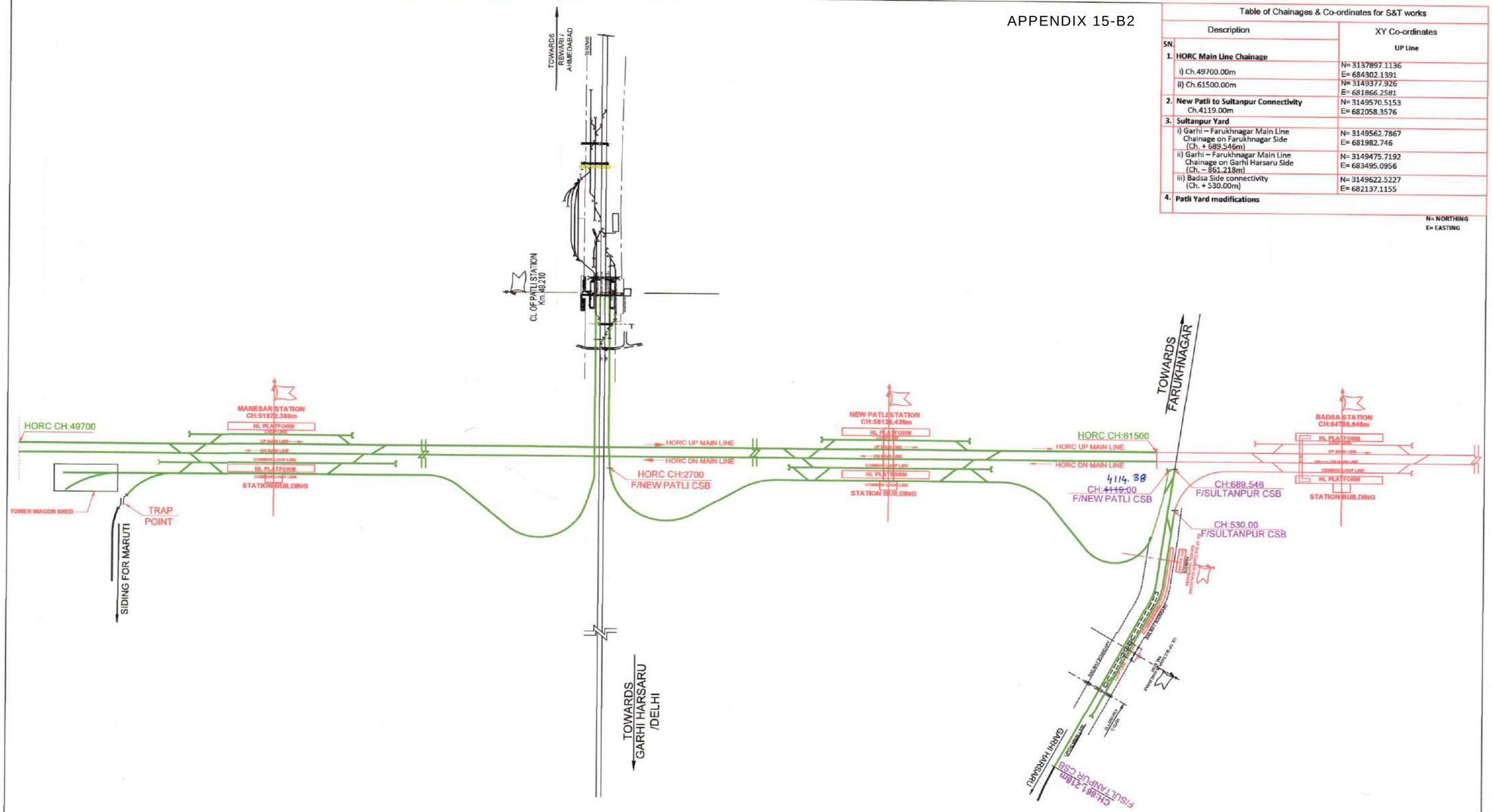
GC/HORC	HRIDC	TITLE: JURISDICTIONAL SKETCH FOR CIVIL WORKS C-2 PACKAGE
DPD/ CIVIL	CPM	LEGEND
CDE/ CIVIL	DGM/ CIVIL West	CIVIL WORKS TO BE DONE BY C2 PACKAGE CONTRACTOR
		Drawing No. GC-HRIDC-C2-SK-CIVIL-001_A0

NOTE:
1. **The through chainages mentioned can undergo some minor corrections, without any impact on the overall length/ scope of the work.The coordinates of the salient locations with the corresponding chainages are given in the table for correlating the ground points. It may be noted that coordinates are fixed & will generally not undergo any change.**
2. **The chainages of connecting line have been taken from Centre line of New Patli station as 0.00m.**
3. **The chainages of Sultanpur yard have been taken from Centre line of Sultanpur station as 0.00m.**

APPENDIX 15-B2

Table of Chainages & Co-ordinates for S&T works		
SN.	Description	XY Co-ordinates UP Line
1.	**HORC Main Line Chainage**	
	i) Ch.49700.00m	N= 3137897.1136 E= 684302.1391
	ii) Ch.61500.00m	N= 3149377.926 E= 681866.2581
2.	**New Patli to Sultanpur Connectivity** Ch.4119.00m	N= 3149570.5153 E= 682058.3576
3.	**Sultanpur Yard**	
	i) Garhi – Farukhnagar Main Line Chainage on Farukhnagar Side (Ch. + 689.546m)	N= 3149562.7867 E= 681982.746
	ii) Garhi – Farukhnagar Main Line Chainage on Garhi Harsaru Side (Ch. – 861.218m)	N= 3149475.7192 E= 683495.0956
	iii) Badsa Side connectivity (Ch. + 530.00m)	N= 3149622.5227 E= 682137.1155
4.	**Patli Yard modifications**	

N= NORTHING
E= EASTING



NOTE:

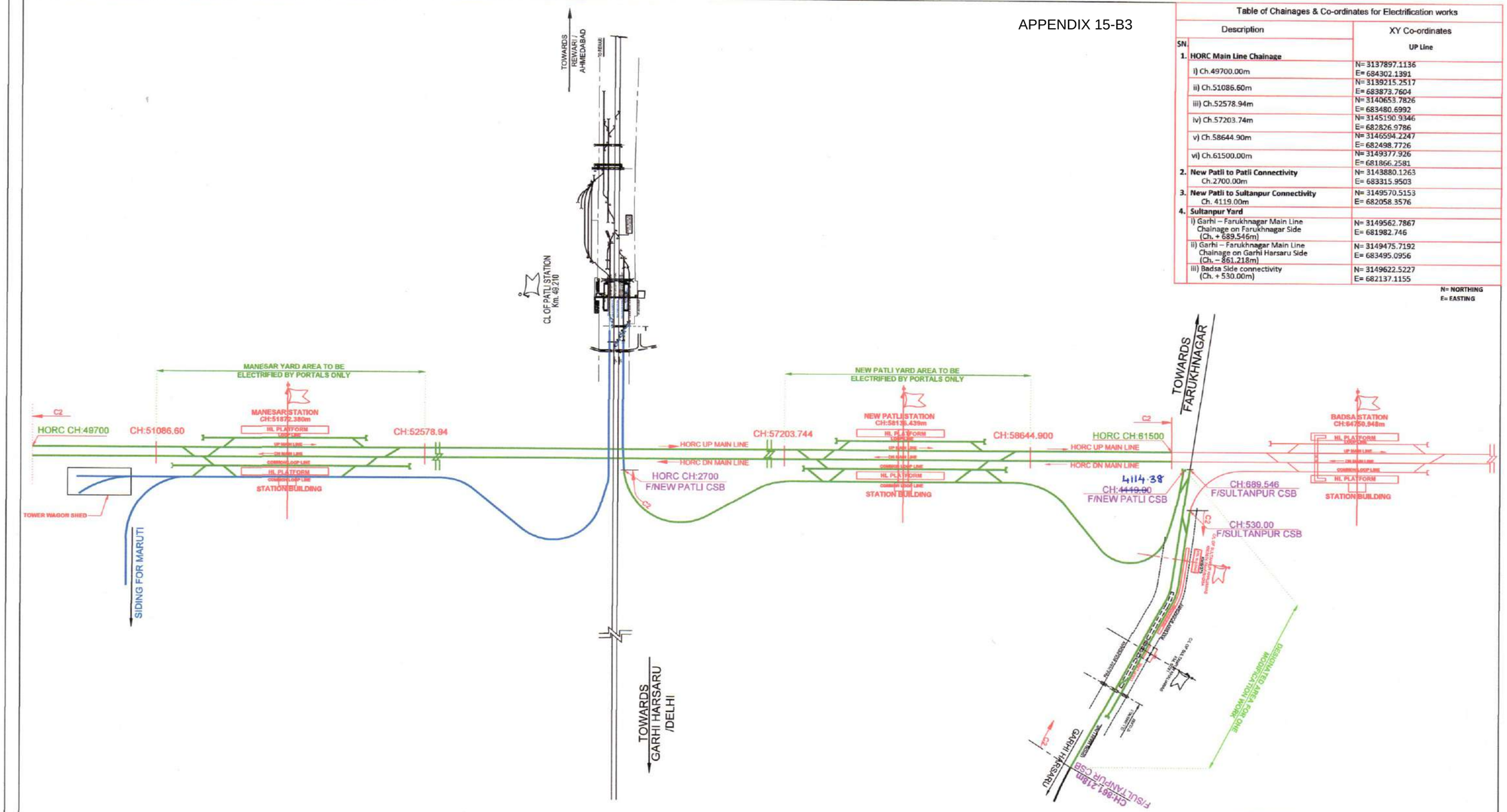
1. **The through chainages mentioned can undergo some minor corrections, without any impact on the overall length/ scope of the work.The coordinates of the salient locations with the corresponding chainages are given in the table for correlating the ground points. It may be noted that coordinates are fixed & will generally not undergo any change.**
2. **The chainages of connecting line have been taken from Centre line of New Patli station as 0.00m.**
3. **The chainages of Sultanpur yard have been taken from Centre line of Sultanpur station as 0.00m.**

GC/HORC	HRIDC	TITLE: JURISDICTIONAL SKETCH FOR S&T WORKS C-2 PACKAGE
DRD/ EST	CPM	LEGEND
CRE/ S&T	DGM/ S&T	S&T WORKS TO BE DONE BY C2 PACKAGE CONTRACTOR ———
		Drawing No. GC-HRIDC-C2-SK-S&T-001_A0

APPENDIX 15-B3

Table of Chainages & Co-ordinates for Electrification works		
SN.	Description	XY Co-ordinates UP Line
1.	**HORC Main Line Chainage**	
	i) Ch.49700.00m	N= 3137897.1136 E= 684302.1391
	ii) Ch.51086.60m	N= 3139215.2517 E= 683873.7604
	iii) Ch.52578.94m	N= 3140653.7826 E= 683480.6992
	iv) Ch.57203.74m	N= 3145190.9346 E= 682826.9786
	v) Ch.58644.90m	N= 3146594.2247 E= 682498.7726
	vi) Ch.61500.00m	N= 3149377.926 E= 681866.2581
2.	**New Patli to Patli Connectivity** Ch.2700.00m	N= 3143880.1263 E= 683315.9503
3.	**New Patli to Sultanpur Connectivity** Ch. 4119.00m	N= 3149570.5153 E= 682058.3576
4.	**Sultanpur Yard**	
	i) Garhi – Farukhnagar Main Line Chainage on Farukhnagar Side (Ch. + 689.546m)	N= 3149562.7867 E= 681982.746
	ii) Garhi – Farukhnagar Main Line Chainage on Garhi Harsaru Side (Ch. – 861.218m)	N= 3149475.7192 E= 683495.0956
	iii) Badsa Side connectivity (Ch. + 530.00m)	N= 3149622.5227 E= 682137.1155

N= NORTHING
E= EASTING



NOTE:

1. **The through chainages mentioned can undergo some minor corrections, without any impact on the overall length/ scope of the work.The coordinates of the salient locations with the corresponding chainages are given in the table for correlating the ground points. It may be noted that coordinates are fixed & will generally not undergo any change.**
2. **The chainages of connecting line have been taken from Centre line of New Patli station as 0.00m.**
3. **The chainages of Sultanpur yard have been taken from Centre line of Sultanpur station as 0.00m.**

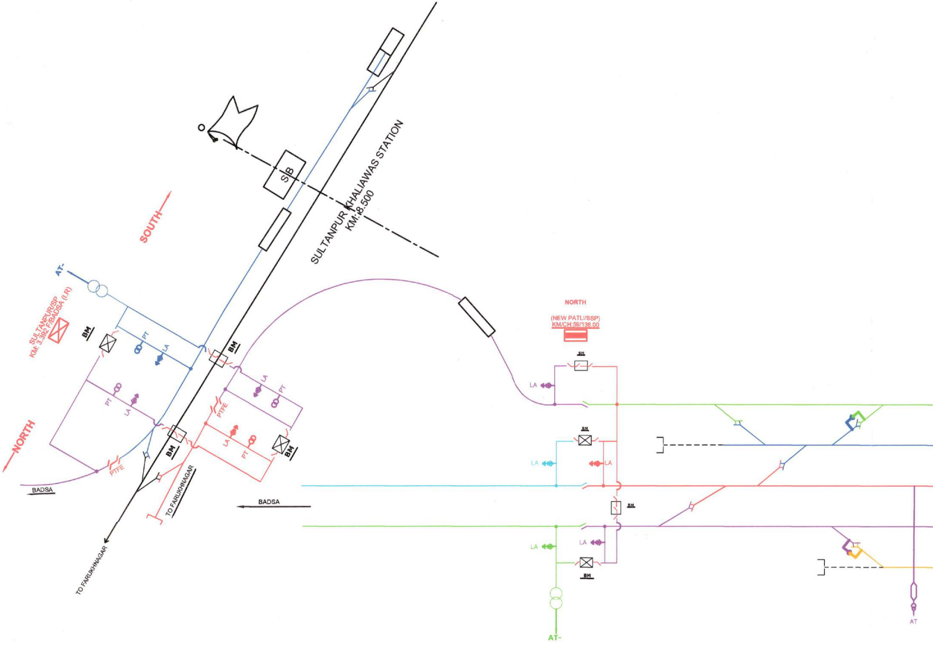
GC/HORC	HRIDC
DPD/ EST	CPM
SRE/ OHE&General	DGM/ Elec.

TITLE: JURISDICTIONAL SKETCH FOR ELECTRIFICATION WORKS OF C-2 PACKAGE

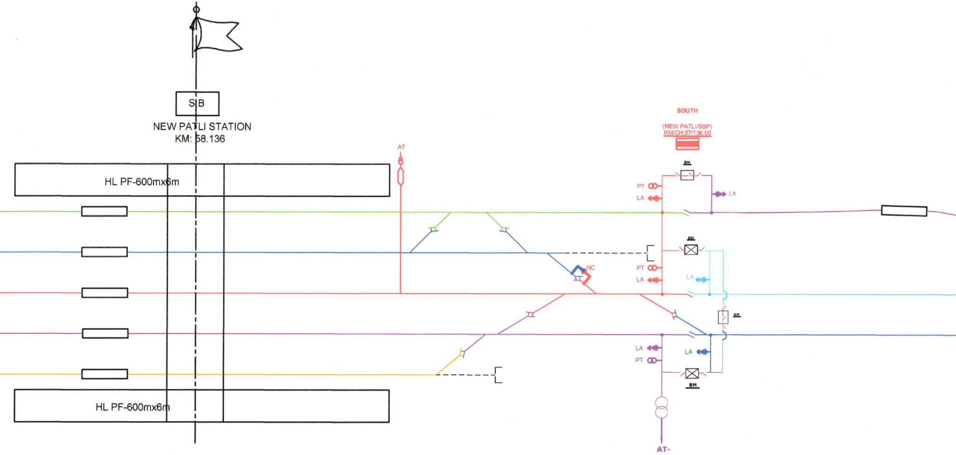
LEGEND

TO BE ELECTRIFIED BY C2 PACKAGE CONTRACTOR	
TO BE ELECTRIFIED BY MSIL CONTRACTOR	
EXISTING OHE LINE	

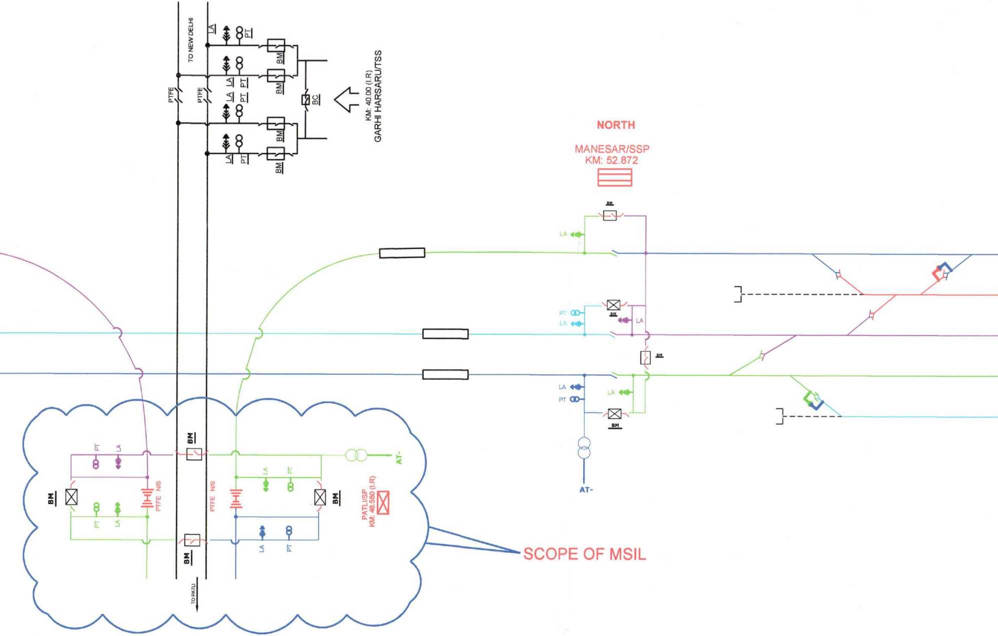
Drawing No. GC-HRIDC-C2-SK-OHE-001_A0


S/B
SULTANPUR KHALIAWAS STATION
KM: 8.500
SOUTH
AT-
SULTANPUR/SP
KM: 3.392 F/BADSA (I.R)
BM
PT
LA
BM
LA
PT
PT
LA
PTFE
NORTH
PTFE
BM
LA
PT
BM
BADSA
TO FARUKHNAGAR
BADSA
TO FARUKHNAGAR
NORTH
(NEW PATLI/SSP)
KM/CH:59/136.00
BM
LA
BM
LA
LA
BM
LA
LA
BM
AT-
AT

GENERAL POWER
NEW

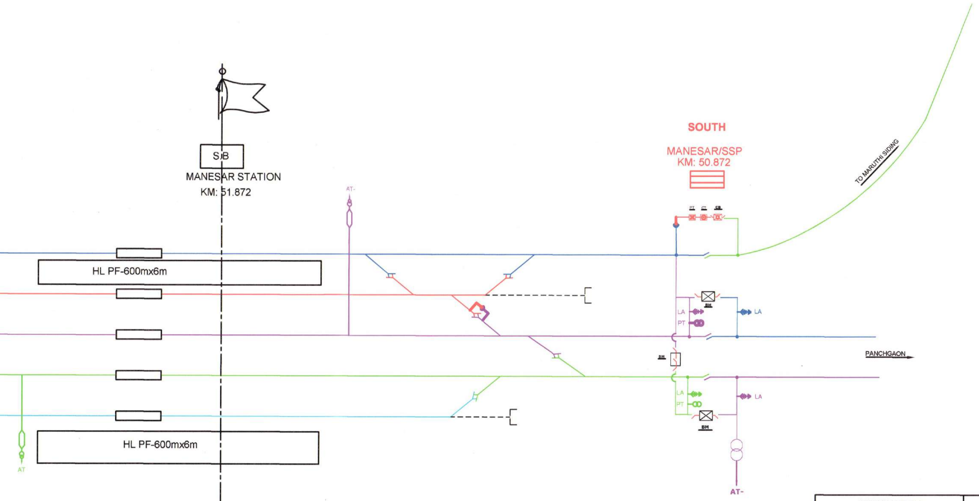

S|B
NEW PATLI STATION
KM: 58.136
HL PF-600mx6m
HL PF-600mx6m
AT
NC
SOUTH
(NEW PATLI/SSP)
KM/CH:57/136.00
BM
PT
LA
LA
BM
PT
LA
LA
BM
LA
PT
LA
BM
AT-

SUPPLY CUM SECTIONING DIAGRAM FOR
PATLI TO MANESAR SECTION


TO NEW DELHI
LA
PT
BM
PTFE
BC
KM: 40.00 (I.R)
GARHI HARSARU/TSS
NORTH
MANESAR/SSP
KM: 52.872
BM
LA
PT
AT-
PTFE N/S
PATLI/SP
KM: 48.580 (I.R)
TO PATLI

SCOPE OF MSIL

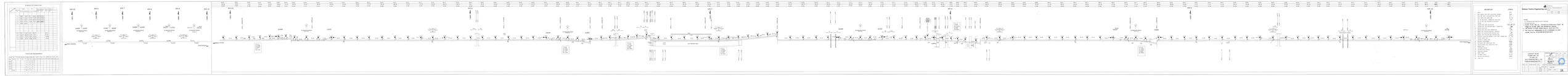
APPENDIX-15C


SJB
MANESAR STATION
KM: 51.872
AT-
HL PF-600mx6m
HL PF-600mx6m
AT
SOUTH
MANESAR/SSP
KM: 50.872
PT
CT
CB
TO MARUTHI SIDING
BM
LA
PT
LA
BM
PANCHGAON
LA
PT
BM
LA
AT-

DESIGNATION	SIGNATURE
SRE(OHE & Gen.)/GC	Stephen
DPD / EST/GC	
DGM/Elect./HRIDC	Jyoti

MODIFICATION	MODIFIED DATE	NATURE OF MODIFICATION	SIGNATURE	REMARKS

LEGEND

SYMBOLS	DISCRIPTION
EEEE	Ex.8 ELECTRIFIED OF B.G LINE
———	Ex.8 B.G LINE PROPOSED FOR ELECTRIFIED
—⬭→	L.T SUPPLY TRANSFORMER WITH D.O.FUSE
⧄	INSULATED OVERLAP
←≫—	42 KV LIGHTING ARRESTOR
OO—|	25KV / 11OV PT
—⊘—	DOUBLE POLE ISOLATOR WITH EARTHING HEEL
—o)—	25KV SINGLE POLE ISOLATOR
⊡—	25KV INTERRUPTOR
⊞	CAPACITOR BANK
—OO—	POWER TRANSFORMER
—⊘—	DOUBLE POLE ISOLATOR
OOO—|	COLOUR LIGHT SIGNAL
||H||	PTFE NEUTRAL SECTION
—⊡—	CIRCUIT BREAKER
ϕ	SERIES REACTOR
—⧄—	SECTION INSULATOR
▬	SUB SECTIONING & PARALLING POST
⊠	SECTIONING & PARALLING POST
⬆	TRACTION SUB STATION
⇔	LIGHT WEIGHT HIGH SPEED SECTION INSULATOR
———	WIRED TRACK
- - - - - -	UN-WIRED TRACK
—●——●—	TRAM WAY OHE

APPENDIX 15D