



CHENNAI METRO RAIL LIMITED

CHENNAI METRO RAIL PROJECT PHASE 1 EXTENSION

BIDDING FOR CMRL-PS&OHE-04-2018

DESIGN, MANUFACTURE, VERIFICATION, DELIVERY, INSTALLATION, TESTING, COMMISSIONING AND TECHNICAL / MAINTENANCE SUPPORT INCLUDING TRAINING OF PERSONNEL FOR A COMPLETE, INTEGRATED POWER SUPPLY SYSTEM AND OVERHEAD EQUIPMENT FOR CMRL PHASE 1 EXTENSION BETWEEN WASHERMANPET TO WIMCO NAGAR INCLUDING DEPOT AT WIMCO NAGAR.

Addendum - II

**Chennai Metro Rail Limited
Chennai Metro rail Admin Building
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India**

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PS&OHE-04-2018

Page.No	Old	New
VI-ER 2.3.1 ER 199- page no 323 of 894	2.3.1 Refer to Volume1 Appendixes 3, CMR Project Phase 1 Extension – General Overview. Metro is running with 25kV Overhead catenaries, Standard gauge track and 2.9m car width.	Deleted: "Refer to Volume1 Appendixes 3, CMR Project Phase 1 Extension – General Overview"
VI-ER 4.15 Pg.no 340 of 894	4.1.5 The system shall meet or exceed the requirements of CENELEC Standards EN50126 or equivalent international standards for Reliability, Availability, Maintainability and Safety of electronic equipment	Delete : "Refer to the appendix D in present PS volume for requirements "
VI-ER 7.1.12 Pg.no 391 of 894	7.1.12 Site supervision and safety issues	delete: Details of Health and Safety requirements at Site are described in Volume1 General Specifications.
VI-ER 9.1.1 Pg.no 407 of 894	9.1.1 Contractor shall provide spare parts in accordance with the requirements of section 13 of the volume1 and this section 9 of the volume 2. All spare parts for which the contractor has been authorised to provide through a written instruction by the employer shall be provided 6 weeks before commencement of revenue service.	<p>"8.2.3.1 The comprehensive maintenance shall cover the taking in charge of the comprehensive maintenance for the level 0 to 4 (defined as per international standard, see below) of all the sub-systems and equipment part of the contract's scope from the issuance of the Completion Certificate for Stage1 up to the Stage 2 beginning of DLP.</p> <p>8.2.3.2 During the comprehensive maintenance period the Contractor shall ensure full compliance with reliability, availability, safety and performance requirement as stipulated in the contract for each and every equipment / sub-systems part of the contract's scope.</p> <p>8.2.3.3 The staff provided for maintenance shall have adequate qualifications and experience in the relevant discipline in the line-side maintenance depots and workshops of existing metro type undertakings.</p> <p>8.2.3.4 The Contractor's responsibilities during the comprehensive maintenance period shall include the following:</p> <ul style="list-style-type: none"> i. All scheduled and unscheduled maintenance; ii. Routine inspections; iii. Preventive maintenance work; iv. Service overhauls; v. Investigation of all failures, major failures, repetitive failures and design defects; feedback on failure investigation shall occur within a maximum period of 10 days. vi. On fault occurrence, undertaking all necessary corrective actions; vii. Repair and correction of all defects occurring under any circumstances (accidental, third parties damage, vandalism...). This is complementing the obligations of the contractor during DLP. viii. Investigation of interference problems between the Contractors

General

		<p>equipment and the equipment provided by interfacing Contractors or equipment located external to the railway;</p> <p>ix. Maintenance planning;</p> <p>x. Manpower planning and resource allocation;</p> <p>xi. Documenting all maintenance activities including details of the corrective action taken, relevant specifications, drawings, design/specification change.</p> <p>8.2.3.5 Handing over of all revised maintenance documentation to the Employer's representative at the end of the contracted maintenance period or as otherwise required by the Employer's representative; The contractor is authorized to use Contract Spares in order to ensure the works related to this option. If the Contract Spares falls below the level required to achieve the RAM requirements, then the Contractor shall warn the Employer so that the Employer can replenish the stock of Contract Spares to the level required to achieve the RAM requirements. The Employer will replenish the stock of Contract Spares in accordance with Cost Center C5"</p>
<p>VI-ER 2.2.1 Pg.no 323 of 894</p>	<p>CMRL phase 1 extension comprises of 9km which constitutes approximately km of Underground section and km of elevated section with a elevated depot at Wimco Nagar.This 9km stretch is extension of corridor 1 of Phase 1 project which runs between Chennai Airport to Washermanpet . Key data about the project is as below.</p> <p><input type="checkbox"/><input type="checkbox"/>No of UG station: 2</p> <p><input type="checkbox"/><input type="checkbox"/>No of elevated station: 7</p>	<p>No of Elevated Station: 7 is corrected as 6</p>
<p>VI-ER 1.5.5 Pg.no 321 of 894</p>	<p>1.5.5 Notwithstanding the precedence specified in § 1.6.2, 1.6.3, and 1.6.6 the Contractor shall always immediately seek advice from the Employer in the event of conflicts between Specifications</p>	<p>1.5.5 Notwithstanding the precedence specified in § 1.5.2, 1.5.3, and 1.5.6 the Contractor shall always immediately seek advice from the Employer in the event of conflicts between Specifications.</p>
<p>VI-ER 3.1.1 Pg.no 327 of 894</p>	<p>The Power supply and Overhead Equipment for Phase 1 Extension from Washermanpet to Wimco nagar and Wimco Nagar Depot is to Design, Manufacture, Supply, Installation, Testing and Commissioning by the Contractor under this Contract and shall meet all performance, functions, design/ technical requirements as defined in this Specification.</p>	<p>The Scope of Power supply and Overhead Equipment contract for Phase 1 Extension from Washermanpet to Wimco nagar and Wimco Nagar Depot is to Design,....</p>
<p>VI-ER 3.4.4</p>	<p>Wimco Nagar Depot: The Washing plant is available on the Down Ramp . The elevated Depot OHE is approximately 8</p>	<p>The Washing plant is available on the Depot Entry</p>

General

Pg.no 329 of 894	km.	
VI-ER 3.7.2 Pg.no 331 of 894	3.7.2 Details of the interfaces of Power supply system and OHE Contractor with the other contractors are in the Interface Specifications in Appendix A.	Details of the interfaces of Power supply system and OHE Contractor with the other contractors are in the Interface Specifications in Appendix I.
4.11.m	Add the sub clause after 4.11.l	m. For any major overhaul/breakdown, the manufacturer shall be capable to provide support in time span of 24Hrs from request raised. i.e Manufacturer shall have established service support in Chennai or capable of delivering support within INDIA within 24Hrs
ER VI 4.18 Pg.no 341 of 894	In order to analyse afterwards a sequence of events with an acceptable accuracy the number of data samples must be sufficient. Therefore, every alarm or event is dated with a precision of 0.001s i.e. 1 (one) ms (day and time: hours, minutes, seconds, tenths of second) by the RTU that receives it from an equipment, or by the computer that generates it if no RTU is involved in this alarm or event: this date is called the « origin » date of the alarm or event. Each alarm or event potentially existing in the whole system is designed to be sent to the OCC	In order to analyse afterwards a sequence of events with an acceptable accuracy the number of data samples must be sufficient. Therefore, every alarm or event is dated with a precision of 0.001s i.e. 1 (one) ms (day and time: hours, minutes, seconds, tenths of second) by the Relay/RTU that receives it from an equipment, or by the computer that generates it if no Relay/RTU is involved in this alarm or event: this date is called the « origin » date of the alarm or event. Each alarm or event potentially existing in the whole system is designed to be sent to the OCC. Time stamping shall be done at Relay/IED/BCU level . If a data is received by RTU directly then time stamping shall be done at RTU. All Relay/IED/BCU, Relay servers shall be time synched with master clock shared by telecom
VI-ER 5.2.1 Pg.no 344 of 894	The SCADA software shall be designed with necessary process display screen to provide a graphical depiction of the power supply network for the Metro Rail Phase 1 Extension section. This shall Auxiliary Substation, Traction Substation, sectioning and sub-sectioning posts and Local Auxiliary power distribution for Main Line and Depot. Two separate views for complete Traction Line & Auxiliary Line should also be designed. In addition to it necessary facilities shall be provided for integrating Phase 1 Extension SCADA System with the existing Chennai Metro rail Phase 1 SCADA System."	"The SCADA software shall be designed with necessary process display screen to provide a graphical depiction of the power supply network for the Metro Rail Phase 1 Extension section in line with the one already being used in phase 1 and shall be appended with existing phase 1 SCADA display. This shall contain separate view of Traction line in mainline with switching station/isolator, Traction line in Depot with switching station/Isolator, Auxiliary network, separate view of each Auxiliary substation & switching stations. System alarms page, overall map of the corridor, the details given here is just short description and detailed design may be done during design stage. The event Logging System of SCADA System shall support the following features and options:"
VI-ER 6.1 Pg.no 355 of 894	This section is dealing with Power Supply system and overhead equipment design requirement. Regarding all transformer supply for this contract, power losses are a real concern. As long 33kv cable network is the running throughout the entire line of the Phase 1 Extension under contract The Power factors and harmonics aspect shall also be taken care during construction phase/idle charging condition.	This section is dealing with Power Supply system and overhead equipment design and technical requirement.....In Traction system Reliability & design part on wind speed and train speed is concerned.
VI-ER 6.3.4.1	Sub Sectioning and Paralleling Posts (SSP) At strategic intervals the OHE is Sub Sectioned by means of an insulated	Add "(Type 1 @ SWA)" in heading

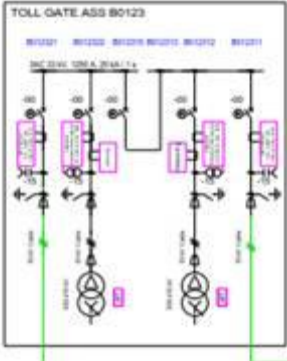
General

Pg.no 356 of 894	overlap, which is normally bridged by an interrupter. In addition, the Up and Dn track OHE's are paralleled at these SSP's by means of Interrupter. The SSP provides a Sectioning facility and also helps to improve the voltage regulation because of paralleling.	
VI-ER 6.3.4.2 Pg.no 356 of 894	Sub Sectioning Switching Station (SS) With a view to limiting the length of any section of OHE, which can be affected by a fault or an electrical isolation for maintenance, the OHE is further Sub Sectioned, so that generally not more than 3 or 4 Metro Stations fall in one Sub-section. No paralleling facility is provided at these Sub-Sectioning Stations	Add "(Type 2 & STG)" in heading
VI-ER 6.3.4.3 Pg.no 356 of 894	Sub Sectioning and Paralleling Posts (SSP) With Depot Feed .SSP always feed to Depot OHE	Add (Type 3 @ SWN) in heading
VI-ER 6.5.14.4 Pg.no 358 of 894	position earth switch shall be provided between Bus and Interrupter/Circuit breaker to enable grounding the cables for maintenance.	"Three position earth switch shall ..."
VI-ER 6.6.8.3 Pg.no 364 of 894	"6.6.8.3 MFM meters shall have following minimum functions with 0.2s Class accuracy	6.6.8.3 MFM meters shall have following minimum functions with 0.2 Class accuracy "
VI-ER 6.9.6.2 Pg.no 370 of 894	. The short circuit level at secondary side shall be 17.5kA	"Percentage impedance for transformers upto 1MVA shall be 4% while above 1 MVA shall be 6%"
VI-ER 6.9.8.1 Pg.no 370 of 894	The contractor shall confirm the following characteristics for each power transformer: i. - Short-circuit voltage, j. - No-load losses, k. - Full-load copper losses l. - Efficiency at different load conditions: m.- 1/4 - load: power factor = 1 (Minimum: 98,95%) power factor = 0,8(Minimum: 98,7 n. - 1/2 - load: power factor = 1 (Minimum: 98,87%) power factor = 0,8 (Minimum: 98,59%) o. - 3/4 - load: power factor = 1 (Minimum: 98,67%) power factor = 0,8 (Minimum: 98,34%) p. - Full load: power factor = 1 (Minimum: 98,4%) power factor = 0,8 (Minimum: 98,%)	delete "l. - Efficiency at different load conditions: m. - 1/4 - load: power factor = 1 (Minimum: 98,95%) power factor = 0,8(Minimum: 98,7 n. - 1/2 - load: power factor = 1 (Minimum: 98,87%) power factor = 0,8 (Minimum: 98,59%) o. - 3/4 - load: power factor = 1 (Minimum: 98,67%) power factor = 0,8 (Minimum: 98,34%) p. - Full load: power factor = 1 (Minimum: 98,4%) power factor = 0,8 (Minimum: 98,%)"

Clarification to Bidder Query

CMRL-PS&OHE-04-2018 Queries on Addendum 1			
S no	page no 1/ clause/ volume	Query	Reply
1	Volume 6 Appendix E	<i>Access Date 3b1</i> AD 3b should be of Korukkupet. Please confirm	Confirmed
2	Volume 6 Appendix E	<i>Access Dates and Key Dates</i> The gap between the following :- i) ASS's access available (AD) & ASS's commissioning (KD) ii) Via duct available (AD) & Traction energisation (KD) It is observed that the gap between the AD & KD for ASS's is very less & time period also overlapping. Thus duration is not only less but parallel working on ASS's is required to be done. Either the AD's need to be advanced or KD's shifted back. Please confirm.	Refer attachment 1
3	Volume 6 Appendix E	<i>Under Ground corridor general Alignment Drawing</i> The chainages of Washermanpet, Sir Thegaraya College and Korukkupet are not clear & thus we are not able to map the access dates with the corresponding key dates for these stations. Kindly clarify.	Refer point no 90 of addendum 1
4	Section-VI Employer's Requirement, Appendix A – Bid Drawings Drg. No. CMRL-PS&OHE04-BID-PS-180001, pg no. 636	<i>Depot Lines</i> Length of Depot lines. CMRL may indicate the preferred location for FOCS – ROCS transition at Depot.	Transition shall be preferable between Depot Takeoff and Washing plant in line with washing plant and shall be in between Infeed and depot takeoff.
5	Section-VI Employer's Requirement Clause no. 11.6,	<i>Source code for the software shall be made available with employer so as to enable the employer to add/delete few features/fields.</i>	Accepted. Provided Provisions shall be incorporate additional features as well as assets i.e, shall be possible to incorporate more number of route length and new features like

Clarification to Bidder Query

	pg no. 378	We request CMRL to delete this point as source code for the software cannot be shared.	introducing new alarms, reminders, job cards, work permits etc without an requirement of additional licensing
6	Section-VI Employer's Requirement, Appendix A – Bid Drawings Drg. No. CMRL-PS&OHE04-BID-PS-180001, pg no. 636	 <p>In GIS, Cable side earth switch is not separate. Earthing shall be done with the help of 3P switch. This is standard feature of 33kV GIS. We request you to change the SLD accordingly</p>	Correction issued in addendum 1
7	Section-VI Employer's Requirement, Appendix C – Test Sheets 1.3, pg no. 693	<p><i>* For this type test, the Contractor could provide a report of less than 5 years on similar equipment and If the type test is done freshly The tested Transformer shall not be supplied to CMRL</i></p> <p><i>**For this type test, the Contractor could provide a report of less than 5 years on similar Equipment</i></p> <p>We presume that Short Circuit Test on higher rating (2000kVA) Transformer of similar type is acceptable. Please confirm.</p>	Accepted type test on highest rating shall be provided. Mathematical calculation with support of type test of similar transformer as spelt in standard IEC 76 for lower ratings.
8	CMRL-PS&OHE-04-2018 719/894 APPENDIX G	<p>2. RTU Configuration :</p> <p>Please confirm the IED relay and MFM meter communication protocol with RTU. Because IEC61850 protocol won't work in Ring connection.</p>	Relay communication to RTU/SCADA shall be of IEC61850 protocol, Contractor is free to choose the protocol for MFM meter with RTU/SCADA.
9	CMRL-PS&OHE-04-2018 364/894 6.6.8.4	<p><i>MFM meter shall communicate all above mentioned data with the SCADA system through Station RTUs with the same protocol as used by numerical Relay.</i></p> <p>RTU configuration architecture shows IEC61850 communication for IED communication.</p> <p>As per 6.6.8.4 MFM won't support for IEC61850 .kindly confirm the protocol for MFM communication with RTU.</p>	Accepted. Contractor is free to choose protocol of MFM meter communication with RTU/SCADA.
10	CMRL-PS&OHE-04-2018 407/894 9.2.4	<p>SCADA spare Part List</p> <p>1. Fiber optic i/o Card of Each type total 20 qty</p> <p>Being extension project please confirm whether you need I/O cards of each type as spares.</p>	Yes, I/O cards spare is required.

Clarification to Bidder Query

11	CMRL-PS&OHE-04-2018 329/894 3.3.3	<p><i>Equipment shall be provided at the OCC, and other locations as required to enable the remote control and monitoring of In-feed, traction and auxiliary power supply systems at Universal Workstations located in the Operation Control Centre Equipment shall be provided at the OCC, stations and other locations as required to enable the remote control and monitoring of safety critical systems at Universal workstations located in the Operation Control Centre, and Station Control Rooms (SCR).</i></p> <p>Please confirm whether we have to provide SCADA system (workstation) at each Station control Room for monitor and controlling PS equipment</p>	No, new servers are not required, Servers already provided shall be utilised.
12	Addendum -1. Page 427 of 432 Appendix -A	<p><i>In the Addendum -1 issued, bidders are advised to submit bid total price summary in revised format .</i></p> <p>The revised format provided with addendum 1 does not permit to quote Basic Customs Duty, IGST and GST in foreign currency. Please permit us to provide the price in respective foreign currency.</p>	Taxes shall be in INR only
13	PS&OHE04-2018, Section VI Employer's Requirements, Subsection 3, Scope of Works, Page no. 329 3.4 Overhead Equipment, 3.4.4 Wimco Nagar Depot	<p><i>Wimco Nagar Depot:</i></p> <p><i>The Overhead Equipment for Depot shall be of Rigid overhead contact system .It consists of stabling line: 12 nos, Inspection bay line: 3 nos and One Emergency Repair Bay. The Washing plant is available on the Down Ramp. The elevated Depot OHE is approximately 8km.</i></p> <p>6.1.16 Feeding and Sectioning: Chennai Central Traction Sub Station will be feeding the entire 18 TKM of OHE of the Phase 1 Extension and 5 km of Depot OHE. In case of emergency 25 kV, 50 HZ. Ac supply will be extended from Alandur Traction sub-station. Both the Traction substation are Existing Traction Substation of Phase 1 of Chennai Metro rail Project.</p> <p>In the clause 3.4.4 it is mentioned that the depot is approx. 8km length however in clause 6.1.16 it is mentioned 5km length of depot. Please confirm the correct length of ROCS and FOCS in Depot.</p>	<p>Refer point no 4 of this addendum.</p> <p>Entire depot is ROCS type. . it is confirmed that Depot is approx. 8km length</p>

Clarification to Bidder Query

14	PS&OHE04-2018, Section VI Employer's Requirements, Particular Requirements, Subsection 6, Design/Technical Requirement, Page no. 374 6.15.4	<p>6.15.4 In underground section, anchor bolts shall be designed and provided by the PS&OHE contractor.</p> <p>1. Should the anchor bolts for the underground stations be Stainless Steel or Galvanised Iron?</p> <p>2. As Installation method should the bolts be installed chemically (with mortar) or should they be installed mechanically?</p>	<p>1. Bolt shall be only of stainless steel</p> <p>2. Chemical or mechanical method shall be used life and loading factor cannot be compromise</p>
15	Page 637 of 894	<p><i>Wimconagar Depot</i></p> <p>1. Two Feeders from Wimco Nagar SSP needs to be connected in Depot area. Please confirm the connection to be either in OHE or SSP.</p> <p>2. Please provide the Single Line Diagram of Depot Area SSP (If applicable) so that it indicates the connectivity of SSP with various stabilising lines and inspection lines (i.e. no. of outgoings of SSP).</p> <p>3. Please indicate the location of Depot ASS Room & SSP Room (If applicable) in the Depot architectural layout in order to quantify the cables.</p> <p>If Depot SSP needs to be provided, then please specify whether the Switchgear should be GIS or AIS type.</p>	<p>1. No separate SSP for depot. Wimco Nagar SSP shall be referred for feeders for depot feed.</p> <p>2. No SSP for stabilising line. Only isolating arrangement with manual operated isolators with earthing heal are required.</p> <p>3. Location of depot ASS is shown in Depot architectural Drawing</p>
16	Page 371 of 894 Clause 6.11	<p><i>Battery & Battery Charger</i></p> <p>We are considering 2 sets of Float cum boost charger rated each with 100% capacity along with 1 set of Battery rated with 100% capacity. Please confirm our understanding.</p>	One set of battery charger is suffecient
17	Page 351 of 894 Clause 5.2.8	<p><i>The ETS switches are installed in OCC and at each RSS</i></p> <p>Schedule B of Bidding forms (Cost center B9) mentions supply, erection, testing and commissioning of Emergency Trip system, where as in clause 5.2.8 of Technical Specification ETS should be installed in OCC and RSS only.</p> <p>Both the statements are contradicting. Please clarify the scope of ETS is in this contract. If yes, please specify whether it needs to be installed in all stations or only under ground stations.</p>	<p>Emergency trip system shall be provided as OCC & RSS only where the operator (TPC) shall be located. No ETS is required in stations.</p> <p>ETS of mainline (elevated and UG section) shall be already covered on phase 1 as phase 1 ext shares the same TSS feeders.</p> <p>ETS for Wimco Nagar Depot shall be provided in OCC at Koyambedu, 3 RSS (Alandur, Koyambedu and</p>

Clarification to Bidder Query

			Chennai Central), DCC for Wimco Nagar Depot.
18	General Query	Please provide the Chainage of Depot ASS to be considered	Location of Depot ASS is given in Architectural drawing of Depot
19	PS&OHE04-2018, Section VI Employer's Requirements, Subsection 6, Design/Technical Requirement, Page no. ER 254\ Clause 6.16.1.11 Jumpers	<p><i>All Jumpers to be used at various locations shall be of 95 sq mm Copper jumper with 259 no of strands</i></p> <ol style="list-style-type: none"> 1. It is mentioned in clause No. 6.16.1.11 that for FOCS only 95 Sqmm copper jumper wires will be used. However the jumper typical arrangement drawings (e.g. Drawing No. 180008) show that different size jumpers will be used (i.e. Small and large). Could you kindly clarify what sizes and types of Jumpers are permitted to be used? For such a project we would usually use: <ol style="list-style-type: none"> a. 105 sqmm large jumper wire (un-insulated overlap) b. 50 sqmm small jumper wire (Insulated overlap) c. 164 sqmm feeder jumper (from interruptor/isolator to OHE) 2. If the FOCS section of the elevated Wimco Nagar depot is to be tramway type OHE then usually 35 sqmm copper bridle wire will be used for keeping the tension in the contact wire in absence of the messenger wire. Will it be required in this case? 	<p>1 95 sq.mm of two runs shall be uniformly adopted in UIOL and Feeder jumpers (interrupter & isolator). While, 95 sq.mm of one run shall be used insulated overlap (anti theft jumper)</p> <p>2. Refer point no 4 of this addendum.</p>
20	PS&OHE04-2018, Section VI Employer's Requirements, Subsection 3, Scope of Works, Page no. 329 3.4 Overhead Equipment 3.4.4 Wimco Nagar Depot	<p><i>Wimco Nagar Depot:</i></p> <p><i>The Overhead Equipment for Depot shall be of Rigid overhead contact system .It consists of stabling line: 12 nos, Inspection bay line: 3 nos and One Emergency Repair Bay. The Washing plant is available on the Down Ramp. The elevated Depot OHE is approximately 8 km.</i></p> <ol style="list-style-type: none"> 1. It is mentioned in the clause that the overhead equipment for the Wimco Nagar Depot will be rigid overhead contact system, however it is not clear whether the entire 8 TKM of depot (from the take of point from mainline) will be ROCS or if only the covered shed area will be ROCS 2. If only the covered area is to be equipped with ROCS in such case the balance depot lines shall be designed with tramway equipment 	Refer point no 4 of this addendum.
21	PS&OHE04-2018, Section VI Employer's Requirements, Subsection 6,	<p><i>Hot dip galvanized steel structures of overhead equipment support: the contractor shall ensure zinc coatings of various type of mast, tubes and fittings including fabricated mast and SPS as per IS 209, ETI/OHE/13 latest version and shall not be less than 1000 g/m sq.</i></p> <p>As per clause 6.16.1.2 it is stated that masts and SPS shall be galvanized as per IS 209, ETI/OHE/13 to 1000 g/m sq. Does this only apply for masts and SPS or will this also apply for</p>	Shall apply for Masts (including DA) and SPS. Tubes and fitting shall be of aluminium

Clarification to Bidder Query

	Design/Technical Requirement, Page no. ER 252 Clause 6.16.1.2	tubes and fittings?																																			
22	Addendum 1 4.4.1.2	<div><p><i>Safety, health & environmental resources shall be provided by the Contractor as per the Contract value in table 1</i></p><table><thead><tr><th>Resource Title</th><th>Required Qty</th></tr></thead><tbody><tr><td>Chief OSH&E Manager</td><td>01</td></tr><tr><td>Senior OSH&E Manager</td><td>01</td></tr><tr><td>Junior OSH&E Manager</td><td>01</td></tr><tr><td>Safety Steward</td><td>01</td></tr><tr><td>Sr. Electrical Engineer</td><td>01</td></tr><tr><td>Jr.Electrical Engineer</td><td>01</td></tr><tr><td>Occupational Health officer with necessary Nursing Staff</td><td>02</td></tr><tr><td>Environmental Manager</td><td>01</td></tr><tr><td>Senior OSH&E (Traffic) Engineer</td><td>01</td></tr><tr><td>Housekeeping & Barricade</td><td>01</td></tr></tbody></table></div>	Resource Title	Required Qty	Chief OSH&E Manager	01	Senior OSH&E Manager	01	Junior OSH&E Manager	01	Safety Steward	01	Sr. Electrical Engineer	01	Jr.Electrical Engineer	01	Occupational Health officer with necessary Nursing Staff	02	Environmental Manager	01	Senior OSH&E (Traffic) Engineer	01	Housekeeping & Barricade	01	<div><p>Accepted,</p><table><thead><tr><th>Resource Title</th><th>Required Qty</th></tr></thead><tbody><tr><td>Chief OSH&E Manager</td><td>01</td></tr><tr><td>Junior OSH&E Manager</td><td>01</td></tr><tr><td>Safety Steward OHE</td><td>02</td></tr><tr><td>Safety Steward PS</td><td>02</td></tr><tr><td>Labour Welfare Officer</td><td>01</td></tr></tbody></table><p>Above figures are minimum requirements</p></div>	Resource Title	Required Qty	Chief OSH&E Manager	01	Junior OSH&E Manager	01	Safety Steward OHE	02	Safety Steward PS	02	Labour Welfare Officer	01
Resource Title	Required Qty																																				
Chief OSH&E Manager	01																																				
Senior OSH&E Manager	01																																				
Junior OSH&E Manager	01																																				
Safety Steward	01																																				
Sr. Electrical Engineer	01																																				
Jr.Electrical Engineer	01																																				
Occupational Health officer with necessary Nursing Staff	02																																				
Environmental Manager	01																																				
Senior OSH&E (Traffic) Engineer	01																																				
Housekeeping & Barricade	01																																				
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Clarification to Bidder Query

		<table><tr><td>Maintenance Squad</td><td></td></tr><tr><td>Labour Welfare Officer</td><td>01</td></tr><tr><td>Total</td><td>12</td></tr></table> <p>1) The requirement of EHS manpower is enormous. We request customer to allow contractor to provide efficient EHS manpower requirement as per project requirement. However the proposed EHS manpower will not comprise the tender requirement on OSH & E.</p> <p>2) Further Chennai Metro being Urban city with sufficient Hospitals and Clinic, we propose the have tie-ups with nearby Hospitals in place of Occupational Health Officer with necessary Nursing staff and Ambulance requirement. Please confirm.</p>	Maintenance Squad		Labour Welfare Officer	01	Total	12	
Maintenance Squad									
Labour Welfare Officer	01								
Total	12								
23	Addendum 1, Attachment 6 – Earthing and Bonding policy 3.1.1	<p><i>Earthing, bonding, lightning and corrosion protection has to be in accordance with current standards applicable Requirements applicable to the Metro system for the purposes of this Earthing Policy shall be assumed to be no less onerous than the relevant requirements of the following:</i></p> <p><i>a. European Standard EN50122-1 - 'Railway Applications Fixed Installations Protective provisions relating to electrical safety and earthing'.</i></p> <p><i>b. European Standard EN50122-1 - 'Railway Applications Fixed Installations Protective provisions relating to electrical safety and earthing'.</i></p> <p><i>c. European Standard EN50122-1 - 'Railway Applications Fixed Installations Protective provisions relating to electrical safety and earthing'.</i></p> <p><i>d.</i></p> <p><i>e. BS 7671 - Requirements for Electrical Installations</i></p> <p><i>f. IEC 60364 - Electrical Installations of Buildings</i></p> <p><i>g. IEC 61312 - Protection Against Lightning</i></p> <p>As per our understanding, EN 50122-2 is to be followed for DC traction system. IEC 61312 has been replaced with IEC 62305. Kindly remove and replace with respective standards.</p>	agreed						
24	Addendum 1, Attachment 6 – Earthing and Bonding policy 4.2.3	<p><i>Lightning interception facilities shall be provided along the sides of the viaduct which shall be securely bonded to the structure earth of the viaduct. These shall be provided by the civil contractor to a design provided by the power supply contractor</i></p> <p>As per our understanding, for lightning protection design on viaduct, we will provide AEW (aerial earth wire) which will act as lightning protection for Viaduct. Connection of AEW with Structure Earth will be established by us. Please confirm our understanding</p>	Agreed						

Clarification to Bidder Query

25	Addendum 1, Attachment 6 – Earthing and Bonding policy 5.2.2.1	<p><i>Each services Substation will be provided with an earth farm, of resistance less than 1 ohm, and connected to the substation earthing system through two 'Principal Connection' links by means of stranded insulated copper cables with a cross section area calculated for the worst case conditions of earth current.</i></p> <p>As per our understanding, Earth Mat for ASS (Auxiliary Sub-station), design and construction will be in the scope of E&M contractor. Our scope of work will be limited to connection of equipment to the Earth riser provided by E&M in the ASS room. Please confirm our understanding.</p>	Agreed
26	Addendum 1, Attachment 6 – Earthing and Bonding policy 5.3.5.1	<p><i>The 110V supplies are obtained from 240/110V transformers. Each 110V winding of these transformers is to be fitted with a centre tap which is to be solidly</i></p> <p>As per our understanding, there is no requirement of 110V AC supplies. So transformer converting 240V/110V will not applicable for us. Kindly confirm our understanding.</p>	Agreed . All voltage sources other than 415V/230V AC is required shall be derived by the contractor himself
27	Addendum 1, Attachment 6 – Earthing and Bonding policy 5.4.1	<p><i>This section refers to the treatment of metal enclosures or supporting metalwork for the equipment associated with the power supply systems covered in Section 4.3 above, with the exception of the trackside equipment which is covered in Section 5.5 below</i></p> <p>Earthing and Bonding policy to be provided by the contractor will mention the bonding requirement to be provided for metal enclosures or supporting metal works, but the supply and execution of bonding will be performed by respective equipment owners. (POS, E&M or signaling)</p>	Agreed. All equipments provided by PS&OHE-04 Contractor shall be earthed (Bonding) by PS&OHE-04 contractor
28	Addendum 1, Attachment 6 – Earthing and Bonding policy 5.5.1.1	<p><i>The track rails, where used for traction return purposes in main line and Depot areas, have to be regularly bonded to the Buried Earth Cable. Maximum distance between two bondings should not exceed 500 m. In Track circuited areas, the bonding will be through appropriate track circuit device</i></p> <p>As per original contract it was mentioned bonding to be performed at every 1000 m. Kindly confirm</p>	It is confirmed that Maximum distance between two bondings should not exceed 500 m.
29	Addendum 1, Attachment 6 – Earthing and Bonding policy 5.5.1.8	<p><i>Track rails, Buried Earth Cables, Aerial Earth cables, Earth pits will be connected together via Integral Transverse Bonds provided: - with a maximum 500 meter spacing - at mechanical joints.</i></p> <p><i>Spacing will be determined in contractor EMI study.</i></p> <p>As per our understanding, the bonding between rails and BEC will be done by us. The distance</p>	Accepted but maximum distance between two bondings should not exceed 500 m.

Clarification to Bidder Query

		<p>of bonding as specified in the original contract document was 1000m.</p> <p>The distance of connection needs to be verified by the Signaling contractor along with the supply and connection of ITB with rails. The study concerned with this needs to be conducted by signaling as clarified in per query number 122.</p> <p>Please confirm.</p>	
30	Addendum 1, Attachment 6 – Earthing and Bonding policy 5.5.2.1	<p><i>Any exposed, non live, conductive part (metallic structure or other equipment), which is closer than 2.0 m from vehicle static envelope shall be earthed to the Buried Earth Cable. If already part of an earthing system, the conductive part should be connected to the buried earth cable via voltage limiting device</i></p> <p>We will be connecting exposed conductive part within 2 m from vehicle static envelope to return circuit directly as mentioned in EN 50122-1 clause 6.2.1. As per general practice direct connection can be established with return circuit no additional requirement of Voltage limiting Device is envisaged. No Voltage Limiting device will be provided for connection of conductive part which is already part of earthing system, please confirm</p>	agreed
31	Addendum 1, Attachment 6 – Earthing and Bonding policy 7.1.5	<p><i>Earth pits shall be provided at each stations and their spacing should not exceed 300 m on viaducts and in depot. Earth pits earthing value shall not exceed 1 Ohm.</i></p> <p>As per our understanding, earth pits along with earth bar/strip till the top along the viaduct, depot and stations will be provided by the civil contractors. Our scope of work will be to connect the earth strip/bar with BEC. Kindly confirm our understanding.</p>	Yes, earth pit is in scope of E&M contractor. But Contractor shall interface and measure the earth pit values and ensure quality of earth pit
32	Section VI, Employer Requirements, GS, Sub section 3, Page 154 of 894 3.10 3.10.1	<p><i>3.10.1 The Contractor shall prepare and submit for Notice of No Objection by the Employer an EMC Management Plan which shall, based upon a top-down approach, define the EMC philosophy, activities, means of control for the design processes and EMC submissions to be supplied to demonstrate compliance with the Particular Specification and this GENERAL SPECIFICATION 3.10.2 The EMC Management Plan shall identify a comprehensive list of specifications, standards, method statements and procedures to be submitted to the Employer for Notice of No Objection . The EMC Management Plan shall also include a programme that shall identify the dates for EMC submissions.</i></p> <p>As per your response to query number 119 raised earlier, we need to interface with other contractors. As per our understanding, signaling will be lead contractor to undertake the EMC testing and study.</p> <p>We will extend our support by witnessing the tests conducted along the section, site survey and testing of substations conducted by other contractor. Further plans developed by the other contractor will be reviewed and checked whether they are in synchronization with our requirements.</p>	Contractor (PS&OHE04) is lead contractor

Clarification to Bidder Query

33	NIT BDS Invitation for Bids – Point 6 BDS ITB 21.1	Kindly confirm our understanding. <i>Bid security of Rs. 1,87,00,000 (USD 290,037”</i> <i>“Bid security shall be Rs. 18,606,105 (USD 288,208)</i> We would request you to clarify the bid security amount and correct the discrepancy.	Bid security shall be INR 1,87,00,000 (USD 290,037)
34	Part 2- Section VI/Employers’ Requirements/Section-B PS/Sub-section-4/ Performance Requirements Pg 335/894 Clause no. 4.2- RAM Requirements Addendum 1 point no 48	<i>“Operability is the ability to keep equipment, a system in a safe and reliable functioning condition, according to pre-defined operational requirements.</i> <i>Operable conditions are to be given by contractor in Design Built project”</i> As per contractor experience and understanding the Safety activities, safety documents, safety analysis methods, safety studies and safety approach shall be performed to keep the system in safe and reliable condition as per CENELEC standards for RAMS. Please confirm our understanding.	Agreed
35	Part 2- Section VI/Employers’ Requirements/Section-B/ PS/Sub-section-4/ Performance Requirements Pg 338/894 Clause No. 4.9-	<i>“If the process in defined in the specification it has to be demonstrated.”</i> Actually the process is not defined in the specification. Thus, bidder would like to request for the CLAUSE No. in Specification where the Availability demonstration process in defined. Please share with us on request.	Agreed. Availability shall be demonstrated by simulation

Clarification to Bidder Query

	Availability Requirements Addendum 1 point no 55		
36	Part 2- Section VI/Employers' Requirements/Section-B /PS/Sub-section-4/ Performance Requirements Pg 338/894 Clause No. 4.11- Maintainability Requirements Addendum 1 point no 57	<p><i>Yes, It refers to MTTR. Estimated value shall be given by contractor</i></p> <p>Contractor can provide the Estimated value of MTTR for each LRU as asked in the first sentence as per their experience and benchmarks. But could not able to understand "how" The 90% of these MTTR shall be lower than its estimated value? Please explain.</p>	The MTTR achieved shall be within the estimated value in 90% of events.
37	Part 2- Section VI/Employers' Requirements/Section-B /PS/Sub-section-4/ Performance Requirements Pg 339/894 Clause No. 4.12- Mean Time to Restore Addendum 1 point no 59	<p><i>"Redundancy is built-in in the system. Hence the MTTR is practical"</i></p> <p>Yes the Redundancy is built-in in the system which will be demonstrating the availability of the system. But for Maintainability, the MTTR (Mean Time to Restore) for all ASS equipment too stringent. Please reconcile the bidder request for "240 minutes for ASS equipment". As well as, bidder would like to request to share some practical samples for the same as well.</p>	Here MTTR refers to the system rather than equipment

Clarification to Bidder Query

39	<p>Part 2- Section VI/Employers' Requirements/Section-B /PS/Sub-section-4/ Performance Requirements</p> <p>Pg 339/894</p> <p>Clause No. 4.12- Mean Time to Restore</p> <p>Addendum 1 point no 60</p>	<p><i>"Redundancy is built-in in the system. Hence the MTTR is practical"</i></p> <p>Yes the Redundancy is built-in in the system which will be demonstrating the availability of the system. But for Maintainability, the MTTR (Mean Time to Restore) for Low Voltage equipment too stringent. Please reconcile the bidder request for "180 minutes for Low Voltage equipment", As well as, bidder would like to request to share some practical samples for the same as well.</p>	<p>Here MTTR refers to the system rather than equipment</p>
40	<p>Part 2- Section VI/Employers' Requirements/Section-B /PS/Sub-section-4/ Performance Requirements</p> <p>Pg 339/894</p> <p>Clause No. 4.12- Mean Time to Restore</p> <p>Addendum 1 point no 61</p>	<p><i>"Redundancy is built-in in the system. Hence the MTTR is practical"</i></p> <p>Yes the Redundancy is built-in in the system which will be demonstrating the availability of the system. But for Maintainability, the MTTR (Mean Time to Restore) for equipment located in equipment rooms or control rooms or on the platform stringent. Please reconcile the bidder request for "180 minutes for equipment located in control rooms" As well as, bidder would like to request to share some practical samples for the same as well.</p>	<p>Here MTTR refers to the system rather than equipment</p>
41	<p>General</p>	<p><i>We did not find the format for joint agreement. A format of joint agreement along with associated documents such as format of power of attorney for JV etc. may be provided please.</i></p>	<p>As such there is no specific format tameable format generally used in industry shall be adopted</p>

APPENDIX E

SCHEDULE OF KEY DATES AND COMPLETION DATES

Effective Date : (Tentative)

Key Date Ref.	Description	Key Date
KD1	Commissioning of ASS's at Sir Theagaraya College Metro Station	AD8+ 40
KD2	Commissioning of ASS's at Korukkupet Station	AD8+ 40
KD3	Commissioning of ASS's at Tondiarpet Station	AD5a+ 40
KD4	Commissioning of ASS's at Toll Gate Station	AD5b+ 40
KD5	Commissioning of ASS's at Thangal Station	AD5c+ 60
KD6	Commissioning of ASS's at Gowri Ashram station	AD7a+ 60
KD7	Commissioning of ASS's at Thiruvottiyur metro station	AD7b+ 70
KD8	Commissioning of ASS's at Wimco Nagar station	AD7c+ 70
KD9	Commissioning of ASS's at Wimco Nagar Depot	AD13+ 40
KD10	Commissioning of SSP at Washermanpet station	AD1+ 90
KD11	Commissioning of SS's at Toll gate	AD5b+ 40
KD 12	Commissioning of SSP and depot 25kV feeder at Wimco Nagar station	AD7c+ 40
KD13	Commissioning of 25kV cable between Washermanpet SSP to Wimco Nagar SSP	AD10+ 30
KD14	Traction energisation for Underground section (ROCS) from Theagaraya college Station and ramp between Korukkupet -Tondiarpet station	AD8+ 60

KD15	Traction energisation for elevated section (FOCS) from ramp between Korukupet -Tondiarpet station and Toll Gate SS	AD09+ 90
KD16	Traction energisation for elevated section (FOCS) from Toll Gate SS to Wimco Nagar shunting neck.	AD10+ 90
KD17	Traction energisation for elevated depot section (ROCS) at Wimco Nagar.	AD12+ 120
KD18	Testing and Commissioning of SCADA system for Under Ground stations	AD8+ 60
KD19	Testing and Commissioning of SCADA system for Elevated stations Tondiarpet, Toll gate & Thangal	(AD5a, AD5b, AD5c) +60
KD20	Testing and Commissioning of SCADA system for Elevated stations Gowri Ashram, Thiruvotriyur & Wimco nagar	(AD7a, AD7b, AD7c) +60
KD21	Testing and Commissioning of SCADA system for Depot 25kV equipments including Depot ASS	AD12+ 140
KD22	Acceptance of Integrated Testing and Commissioning for Phase 1 Extension Revenue Service	KD 21 + 30
KD23	Issue of Completion Certificate for Phase 1 Extension Revenue Service	KD 22 + 28
KD24	Achieve Operational Acceptance for Phase 1 Extension Revenue Service	KD 23 + 366

Notes on Key Dates:

1. The achievement of a Key Date shall be subject to the issuing of a notice of no objection from the Employer's Representative
2. The achievement of a Key Date shall require completion of all the works specified for achievement of the Key Date.
3. The achievement of Key Dates shall be read in conjunction with the Interface Specifications to establish access requirements for Interfacing Contractors.
4. The access and order for completion of the Works shall be coordinated among the Interfacing Contractors in the development of the Track Related Installation Programme (TRIP) and Coordinated Installation Programme.

ACHIEVEMENT OF COMPLETION**KD1 to KD9 : Commissioning of Station ASS and power on**

Achievement : Commissioning of station ASS includes the energisation of all equipment of the substation including SCADA equipment with all permanent arrangement duly obtaining the necessary statutory clearance.

KD10- KD12 : Commissioning of SS's & SSP

Achievement : Commissioning of 25kV switching station in all respect duly getting necessary statutory clearance and interfaced with the SCADA device (PLC/RTU) in respective station.

KD13: Commissioning of 25kV cable between Washermanpet SSP to Wimco Nagar SSP

Achievement : Commissioning of 25kV cables in all respect duly getting necessary statutory clearance

KD14 to KD16: Traction energisation for elevated (FOCS) and underground (ROCS) section

Achievement : Energising 25kV traction on overhead equipment after completing all OHE installation, earthing and bonding, buried earth cables, number plate fixing, stencilling, safety works and all other connected works, testing for tracks in respective section duly proving the performance by current collection test (including turnout / crossover beyond end stations) as well as on intermediate tracks and depot access viaduct to the elevated section.

KD17 Traction energisation for Elevated depot (ROCS) section

Achievement : Energising 25kV traction on overhead equipment after completing all OHE installation, earthing and bonding, buried earth cables, number plate fixing, stencilling, safety works and all other connected works, testing for tracks in respective section duly proving the performance by current collection test (including turnout / crossover beyond end stations) as well as on intermediate tracks and depot access viaduct to the elevated section

KD18 to KD21: Commissioning of SCADA systems

Achievement : Commissioning of SCADA system of All field equipment 33kv, 25kV, and other auxiliary equipment with control and monitoring of system from Operation Control Center.

KD22 : Acceptance of Integrated Testing and Commissioning for Phase 1 Extension Revenue Service

Achievement: Completion of integrated testing and commissioning prior to Service Trial for Phase 1 Extension service.

KD23 : Issue of Completion Certificate for Phase 1 Extension service.

Achievement : Satisfactory completion of all the Works and Service Trial for Phase 1 Extension Revenue Service.

KD24 : Achieve Operational Acceptance for Phase 1 Extension Revenue Service

Achievement : Satisfactory completion of the Regular Service Verification for Phase 1 Extension Revenue Service.

List of the interfaces Contractors

Sl no	CONTRACT A	CONTRACT B	DESCRIPTION
1.	Power supply system and OHE: CMRL-PS&OHE-04	DDC 101- Detailed Design Contractor	Interface requirements between the OHE and Power supply system and Detailed Design Contractor
2.	Power supply system and OHE: CMRL-PS&OHE-04	ECV-101 Elevated Viaduct & Station contractors	Interface requirements between the OHE and Power supply system and Elevated Viaduct & Station contractors
3.	Power supply system and OHE: : CMRL-PS&OHE-04	ECV-102 Elevated Viaduct & Station contractors	Interface requirements between the OHE and Power supply system and Elevated station contractors
4.	Power supply system and OHE: : CMRL-PS&OHE-04	ECV-103 Elevated viaduct pier contractor	Interface requirements between the OHE and Power supply system and Elevated viaduct pier contractor
5.	Power supply system and OHE: CMRL-PS&OHE-04	ADC-03 Wimco Nagar Depot Contractor	Interface requirements between the OHE and Power supply system and Koyambedu Depot
6.	Power supply system and OHE: CMRL-PS&OHE-04	UAA-08 UG tunnel contractor	Interface requirements between the OHE and Power supply system and UG – Station and tunnel-Washermanpet
7.	Power supply system and OHE: CMRL-PS&OHE-04	UAA-09 UG station contractor	Interface requirements between the OHE and Power supply system and UG – Station and tunnel
8.	Power supply system and OHE: CMRL-PS&OHE-04	ASA-01 S&T contractor	Interface requirements between the OHE and Power supply system and Signaling and telecom

9.	Power supply system and OHE: CMRL-PS&OHE-04	ARE-01- Rolling Stock contractor	Interface requirements between the OHE and Power supply system and Rolling Stock
10.	Power supply system and OHE: CMRL-PS&OHE-04	ATW07- Track Contractor	Interface requirements between the OHE and Power supply system and Track (Permanent Way)
11.	Power supply system and OHE: CMRL-PS&OHE-04	UA-M&E-08- UG E&M contractor	Interface requirements between the OHE and Power supply system and Underground Electrical & Mechanical systems
12.	Power supply system and OHE: CMRL-PS&OHE-04	ECV-M&E-10- Elevated –E&M contractor	Interface requirements between the OHE and Power supply system and Elevated Electrical & Mechanical systems
13.	Power supply system and OHE: CMRL-PS&OHE-04	ADC-M&E-12- Depot AE&M contractor	Interface requirements between the OHE and Power supply system and Depot Electrical & Mechanical systems
14.	Power supply system and OHE: CMRL-PS&OHE-04	UA-VAC & TVS-09-TV & VAC contractor	Interface requirements between the OHE and Power supply system and TVS , Ventilation & air conditioning

Types of interface

S no	Name	Description	Design	Construction	T&C
1	PS-01	Cable routing			
2	PS-02	Equipment & Room layout			
3	PS-03	Earthing arrangement			

4	PS-04	Transformer secondary termination			
5	PS-05	Relay co-ordination & interlocks			
7	PS-06	LT supply			
8	PS-07	Active filter			
8	PS-08	SCADA			
9	PS-09	Fire Fighting			
10	PS-10	Ventilation in power rooms			
11	PS-11	Communication network			
12	PS-12	Backbone port			
13	OHE-01	OHE Design			
14	OHE-02	Earthing and Bonding			
15	ROCS-01	Tunnel OHE support			
16	ROCS-02	UG Station OHE support			
17	ROCS-03	Sectioning in UG section			
18	ROCS-04	Electrical Clearance in tunnel			
19	FOCS-01	OHE mast location in viaduct			
20	FOCS-02	OHE support in station Area			
21	FOCS-03	Sectioning in elevated section			
22	FOCS-05	Electrical Clearance in Elevated section			
23	DEP-01	OHE mast location Open Depot Area			
24	DEP-02	OHE support in roofed Depot Area			
25	DEP-03	Depot Sectioning			
26	DEP-04	Electrical Clearance in Depot			
27	DEP-05	Interlock			

Detailed interface matrix

	DDC101			ECV101			ECV102			ECV103			ECV-M&E-10			ADC-03			ADC-M&E-12			UAA-08			UAA-09			UA-M&E-08			UA-VAC&TVS-09			ASA-01			ARE-01			ATW07		
	D	C	T	D	C	T	D	C	T	D	C	T	D	C	T	D	C	T	D	C	T	D	C	T	D	C	T	D	C	T	D	C	T	D	C	T	D	C	T			
PS-01	X				X	X		X	X		X	X		X	X		X	X		X	X		X	X		X	X			X	X	X										
PS-02	X				X	X		X	X		X	X		X	X		X	X		X	X		X	X		X	X															
PS-03	X											X	X					X	X								X	X														
PS-04	X											X	X					X	X								X	X														
PS-05	X											X	X					X	X								X	X														
PS-06	X											X	X					X	X								X	X														
PS-07	X											X	X					X	X								X	X														
PS-08	X											X	X					X	X								X	X														
PS-09	X											X	X					X	X								X	X														
PS-10	X											X	X					X	X								X	X														
PS-11																																										
PS-12																																										
OHE-01	X																																									
OHE-02	X				X	X		X	X		X	X		X	X		X	X		X	X		X	X		X	X		X	X												
ROCS-01	X																																									
ROCS-02	X																																									
ROCS-03	X																																									
ROCS-04	X																																									
FOCS-01	X				X	X		X	X																																	
FOCS-02	X				X	X		X	X																																	
FOCS-03	X				X	X		X	X																																	
FOCS-04	X				X	X		X	X				X	X																												
DEP-01	X																	X	X																							
DEP-02	X																	X	X																							
DEP-03	X																	X	X																							
DEP-04	X																	X	X																							
DEP-05	X																	X	X																							

*D= Design Phase, C=Construction Phase, T= testing commissioning Phase