SN	Part	Section	Clause	Original Bid condition	Revised bid condition
1	Part 2	Particular Specifications	1.1	Coasting: An increase of inter-station runs time over the maximum Train performance time, usually by a specified constant percentage value.	Coasting: An increase of inter-station runs time over the maximum Train performance time, usually by a zero constant percentage value.
2	Part 2	Particular Specifications	1.1		Add Initial delay: The delay occured for the first train/or the train inside which the failure occured at the location owing to a signalling failure. This shall be computed as the {(Sum of Stoppage time and Time taken for recovering the mode and designed speed for the train for that section) minus the original time for the train to cover this distance without a failure as per schedule/design}.
3	Part 2	Particular Specifications	1.2	Delete RPS: Rear Projection system	Add VWS: Video Wall System SCC: Security Control Room
4	Part 2	PS-Appendix 2M	3.1	The system shall conform to IEEE 1474.1 (2004), IEEE 1474.2 (2003), A200 FRS, Functional Requirements Specification for ETCS (European Train Control System) in general.	The system shall conform to IEEE 1474.1 (2004), IEEE 1474.2 (2003), A200 FRS(Functional Requirements Specification for ETCS) in general.
5	Part 1	Bidding Forms	4.2	 7. Price Centre C: Stage 2: Corridor 5 – Section from CMBT to Sholinganallur (Section corresponds to Civil package C5-ECV02 & C5-ECV03). 14.0% 14.0%- GoTN 	 7. Price Centre C: Stage 2: Corridor 5 – Section from CMBT to Elcot (Section corresponds to Civil package C5-ECV02 & C5-ECV03). 13.5% 13.5% - GoTN. (Note to the bidder: For bidding purpose, the price bid excel file wll remain unchanged. Price center C will be 14% which includes the cost of newly formed Price center J3 (0.5%) also)
6	Part 1	Bidding Forms	4.2	 18. Price Centre K: Training and Operation & Maintenance manuals: (To be carry forwarded from BOQ 'K') 19. Price Centre L: Contract Spares, Special tools, Testing Equipments, Measuring Instruments and Furnitures, and Maintenance assistance. (To be carry forwarded from BOQ 'L') 20. Provisional Sum towards DB Expenses 	 Price Centre K: Training and Operation & Maintenance manuals: (To be carry forwarded from BOQ 'K') Price Centre L: Contract Spares, Special tools, Testing Equipments, Measuring Instruments and Furnitures, and Maintenance assistance. (To be carry forwarded from BOQ 'L') Provisional Sum towards DB Expenses
7	Part 1	Bidding Forms	4.2		 18. Price Centre J3: On-board Signalling Equipments – Catenary Maintenace Vehicles (3 nos): Supply of ATP/ATO on-board equipments, TWC equipments and Associated accessories; Supply of Driver's HMI equipments, Speedometer and Associated accessories; to CMV Contractor(s), Installation supervision at the CMV production factories, joint testing and certification on the test track as well as in main line and commissioning for Regular service. 0.5% 0.5%- GoTN (Note to the bidder: For bidding purpose, the price bid excel file wll remain unchanged. Price center C will be 14% which includes the cost of newly formed Price center J3 (0.5%)also)
8	Part 1	Bidding Forms	4.4	Corridor 5 – Section from CMBT to Sholinganallur (Section corresponds to Civil package C5-ECV02 & C5-ECV03).	Corridor 5 – Section from CMBT to Elcot (Section corresponds to Civil package C5-ECV02 & C5-ECV03).
9	Part 2	PS-Appendix 2P-10	5	STC contractor shall coordinate with Train Auto Wash Plant Contractor/s in order to achieve the functional and operational requirements of the system. The roles and activities of the Contractors shall broadly include minimum but not limited to those mentioned in table below. Apart from the below table, the contractors shall also adhere to all the Interface specifications (as above) and the GS and PS requirements.	STC contractor shall coordinate with Depot machines Contractor/s in order to achieve the functional and operational requirements of the system. The roles and activities of the Contractors shall broadly include minimum but not limited to those mentioned in table below. Apart from the below table, the contractors shall also adhere to all the Interface specifications (as above) and the GS and PS requirements.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
10	Part 2	PS-Appendix 2P-10	5		7. Wheel profile measuring device related Interface. STC contractor: Shall Interface and provide the information in the mutually agreed format. Wheel Profile measuring device contractor: Shall receive the information and incorporate the Rake number and associated information into the measurement reports.
11	Part 2	PS-Appendix 2P-10	5		 Boint test for the wheel profile measuring device Interface. Both contractors shall conduct the joint test on a mutually agreed format to demonstrate all the functionalities related to Interface.
12	Part 2	PS- Appendix 2M	5.1	The System shall conform to the reliability & safety standards of CENELEC Standards EN 50126, EN 50128 & EN 50129. The system shall conform to Safety Integrity Level-4 of the relevant CENELEC standards.	The System shall conform to the reliability & safety standards of CENELEC Standards EN 50126, EN 50128 & EN 50129. The system shall conform to Safety Integrity Level-4 of the relevant CENELEC standards. The contractor can propose equivalent IEC standards, with a Gap analysis duly certified by an independent safety assessor. The acceptance of the equivalant standards is subject to the Engineers satisfaction regarding the equivalance of the EN standard and the proposed standards, especially in the point of view of the safety parameters.
13	Part 2	PS-Appendix 2L	5.2	Control Terminal with VDU Display- SIL 4 Workstation	Control Terminal with VDU Display- SIL 2 functionality Workstation
14	Part 2	PS- Appendix 2M	6.6	No single component/card failure (viz input/output card DMI, odometer/Tachometer, Balise antenna, radio antenna, radio modem etc.) should cause the complete failure of the on-board or trackside ATP or ATO equipment. Both cabs shall have the independent ATC equipments. The Bi-directional Train to wayside radio communication network architecture should use radio-based communication system. Failure of single network element viz Radio access point, switch, media converter etc. shall not cause any deterioration in CBTC working.	No single component/card failure (viz input/output card DMI, odometer/Tachometer, Balise antenna, radio antenna, radio modem etc.) should cause the complete failure of the on-board or trackside ATP or ATO equipment. The Bi-directional Train to wayside radio communication network architecture should use radio-based communication system. Failure of single network element viz Radio access point, switch, media converter etc. shall not cause any deterioration in CBTC working.
15	Part 2	PS-Appendix 2J	8.1	Use of soldering in cable connections shall be minimized and it shall be used only for terminating conductors. Cables and wires shall be terminated by more flexible means such as WAGO terminals or similar.	Use of soldering in cable connections shall be minimized and it shall be used only for terminating conductors. Cables and wires shall be terminated by more industry pervalent means such as terminal blocks of reputed makes.
16	Part 2	GS- Appendix 2A	12		Refer the Revised Access Dates and Key dates attached

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
17	Part 2	Particular Specifications	13.7	Transfer of Technical know-how for Installation, Testing, Commissioning, Repair and Maintenance 13.7.1 Contractor shall submit the detailed plan of transfer of technical knowhow within 60 days of the commencement date of works. 13.7.2 As part of Transfer of Technical know-how, the contractor shall set up of a fully equipped LAB/Repair Centre at a suitable place provided by the Employer. All furniture and equipments needed for this shall be supplied by the Contractor. 13.7.3 The contractor shall provide Required Jigs and testing tools shall be provided in LAB/Repair Centre. 13.7.4 The contractor shall propose the furniture and the jigs, testing tools/instruments etc. for the NoNO of Engineer. 13.7.5 Lab/Repair Centre/training centre shall include a model training room comprising of minimum equipment for stations such as testing platform for CBI, ATC and ATS (as a part of maintenance simulator), Point Machine, Signals, Axle Counters, Radio network for CBTC and VMS etc. 13.7.6 This Facility can also be availed by the Contractor with prior permission of the Engineer or the Employer for repair and maintenance of any cards/parts concerning the project during its association with project. 13.7.7 The Employer will nominate some of his personnel for Transfer of Technical knowhow for various sub systems. These personnel's will be deployed at site under the administrative control of Employer. The Contractor shall involve these personnel in installation, testing and commissioning, repair, and maintenance, so that they may gain in depth knowledge of system installation, configuration, testing, fault finding and failure rectification.	Transfer of Technical know-how for Installation, Testing, Commissioning, Repair and Maintenance 13.7.1 Contractor shall submit the detailed plan of transfer of technical knowhow within 60 days of the commencement date of works. 13.7.2 As part of Transfer of Technical know-how, the contractor shall set up of a fully equipped LAB/Repair Centre at a suitable place provided by the Employer. All furniture and equipments needed for this shall be supplied by the Contractor. 13.7.3 The contractor shall provide Required Jigs and testing tools shall be provided in LAB/Repair Centre. 13.7.4 The contractor shall provide Required Jigs and testing tools shall be provided in LAB/Repair Centre. 13.7.5 Lab/Repair Centre can share the testing facility with the maintenance simulator (offline integration test platform). The Lab/Repair center shall have all provisions for the replacements of LLRUS for both indoor cabinets as well as out-door equipments The facility shall have provision for replacement of components of the point machines and test it for its parameters before deploying it in the site (eg: stroke, force parameters, current, insulation resistance etc etc). Rectification of components of PCBs is excluded from the scope of this lab. For all other LLRUS, the repair centre shall have the required test jigs and instruments/tools, to test the concerned equipment functionality for all requirements, before its re- commissioning in service. 13.7.6 This Facility can also be availed by the Contractor with prior permission of the Engineer or the Employer for repair and maintenance of any cards/parts concerning the project during its association with project. 13.7.7 The Employer will nominate some of his personnel for Transfer of Technical knowhow for various sub systems. These personnel's will be deployed at site under the administrative control of Employer. The Contractor shall involve these personnel in installation, testing and commissioning, repair, and maintenance, so that they may gain in depth knowledge of system insta
18	Part 2	Particular specifications	14.9	Comprehensive Maintenance for Rear Projection System. 14.9.1 The Signalling contractor shall get executed at his cost, a separate comprehensive maintenance contract between CMRL and RPS supplier for maintenance of RPS system at OCC and BOCC. 14.9.2 This maintenance contract shall remain valid from commissioning of the RPS system till the completion of DLP of the last stage. 14.9.3 This maintenance contract shall provide all-inclusive maintenance service of on- site periodic preventive maintenance and corrective maintenance of RPS system. This shall include troubleshooting, repair, replacement of modules etc. under contractor's cost. 14.9.4 The performance requirements under this maintenance contract for Corrective maintenance shall be same as that required during DLP of this contract. 14.9.5 Prior approval of Employer shall be taken regarding the terms and conditions in the maintenance contract before it is executed.	Comprehensive Maintenance for Video Wall System. 14.9.1 The Signalling contractor shall get executed at his cost, a separate comprehensive maintenance contract between CMRL and VWS supplier for maintenance of VWS system installed in OCC,BOCC,SCC,DCC etc. 14.9.2 This maintenance contract shall remain valid from commissioning of the VWS system till the completion of DLP of the last stage. 14.9.3 This maintenance contract shall provide all-inclusive maintenance service of on-site periodic preventive maintenance and corrective maintenance of VWS system including telephonic support in working hours. This shall include troubleshooting, repair, replacement of modules etc. under contractor's cost. 14.9.4 The performance requirements under this maintenance contract for Corrective maintenance shall be same as that required during DLP of this contract. 14.9.5 Prior approval of Employer shall be taken regarding the terms and conditions in the maintenance contract before it is executed.
19	Part 2	Safety Manual	33.5	A qualified Doctor, Nurse and assistant Nurse shall be in attendance at the first aid base during all times when work is being undertaken on the site.	A qualified Male Nurse shall be in attendance at the first aid base during all times when work is being undertaken on the site and contractor shall make necessary arrangements for the availability of Qualified Doctor by making tie arrangements with near by hopspital as and when required during the contract period.
20	Part 2	Safety Manual	33.6	A fully equipped ambulance and driver shall be provided at the first aid base during all working hours. The ambulance shall be equipped with the articles specified in Schedule-IV of TBOCWR 2006.	The contractor shall make necessary arrangements for the availability of Ambulance by making tie up with near by hoapital as and when required during the contract period.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
21	Part 1	BDS	37.1	The date for the exchange rate shall be: 28 days prior to the stipulated date of submission of the Bid.	The date for the exchange rate shall be: 28 days before Last date for submission of Bid.
22	Part 2	Safety Manual	56	The Contractor shall implement a surveillance CCTV system in Administrative areas, Construction areas (general indoor, general outdoor, tunnel and general underground work areas, mucking and scaling), Maintenance / Operating areas, Mechanical/electrical equipment rooms, Warehouses and storage rooms/area, Casting yard, Labour Colony, Health Centres and First aid stations and infirmaries, Parking areas, Visitor areas and Laboratories , with cameras strategically positioned at high-risk areas for purpose of monitoring site conditions and deterring unsafe work practices. The number and location of cameras installation shall be subjected to the acceptance of the Employer /Engineer. The contractor shall submit the CCTVinstallation and monitoring plan to Employer /Engineer	The Contractor shall implement a surveillance CCTV system in Administrative areas, storage rooms/area, Labour Colony, First aid stations, Parking areas, Visitor areas and Laboratories, with cameras strategically positioned at high-risk areas for purpose of monitoring site conditions and deterring unsafe work practices. The number and location of cameras installation shall be subjected to the acceptance of the Employer /Engineer. The contractor shall submit the CCTV installation and monitoring plan to Employer /Engineer.
23	Part 1	Particular conditions	56	(v) Each party shall choose any one member from the panel. The two members so nominated shall recommend a third member from the same panel and the Parties shall agree upon the same, who shall then act as Chairman of the DB.	(v) Each party shall choose any one member from the panel. The two members so nominated shall recommend a third member from the same panel and the Parties shall agree upon the same, who shall then act as Chairman of the DB. In case the two nominated members fail to agree for Chairman of the DB, parties shall agree for a Chairman from the same panel.
24	Part 2	PS-Appendix 2P-6	1.1 INTERFACE- Division of Responsibility	Item: Rear Projection Large Screen display system STC contractor: To provide the display system at OCC and BOCC PS/OHE contracotrs: To provide the feed to Signalling contractor.	Item: Video Wall display system STC contractor: To provide the display system at OCC, BOCC PS/OHE contracotrs: To provide the feed to Signalling contractor in the format compatiable with the displays,as specified by the signalling contractor
25	Part 2	PS-Appendix 2P-10	1.1.1	This specification covers the interface requirements between Signalling & Train Control Contract ASA-04 and Train Auto wash plant system Contract(s).	This specification covers the interface requirements between Signalling & Train Control Contract ASA-04 and Depot machines Contract(s).
26	Part 2	PS-Appendix 2K	1.20.	Use of soldering in cable connections shall be minimized and it shall be used only for terminating conductors. Cables and wires shall be terminated by more flexible means such as WAGO terminals or similar.	Use of soldering in cable connections shall be minimized and it shall be used only for terminating conductors. Cables and wires shall be terminated by more industry prvalent means such as terminal blocks of reputed makes.
27	Part 2	Particular specifications	1.5.6	The order of preference with Particular specification having highest priority is: • The Particular Specification of the Contract and its appendices • The General Specification of the Contract and its appendices • International standards referred in contract. • Indian Railway Standards • Chennai Metro Rail Signal Engineering Manual • Other International standards.	The order of preference with Particular specification having highest priority is: • The Particular Specification of the Contract and its appendices • The General Specification of the Contract and its appendices • International standards referred in contract. • Indian Railway Standards • Other International standards.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
28	Part 2	Particular Specifications	10.6.2		Prototype Installation assistance and supervision shall be undertaken by the OEM of that particular equipment. This is especially applicable for equipments like Point machine, secondary drives, Axle counter etc. The Contractors installation staff shall be trained and provided competency by the OEM staff for further installation. The list of equipments which require prototype installation supervision by OEM shall be submitted by the contractor to the Engineer for NoNO.
29	Part 2	Particular Specifications	10.6.6.4		The bottom most part of all junnction boxes and distribution boxes of signalling shall be a minimum of 300mm high from the rail level installed in tunnels and Depots. For viaduct the minimum height shall be 100mm from the deck slab. The location of the junction boxes shall be planned clear of the schedule of dimension requirements.
30	Part 2	Particular Specifications	10.8.2.5	All Line Side assets such as Signals, Point Machines, Wayside Radio Equipment, Multi- Section Digital Axle Counter, location Boxes and all other field equipment shall be identified.	All Line Side assets such as Signals, Point Machines, Wayside Radio Equipment, Multi-Section Digital Axle Counter, location Boxes and all other field equipment shall be identified electronically and manually. For electronic identification unique QR codes (conveying the asset number, location etc) shall be printed on all weather resistant stickers and pasted on the assets.
31	Part 2	Particular Specifications	11.14.5		The failues which are of higher category which may not be able to be demonstrated within the DNP duration of the stage, the employer has the right to observe the performance in respect of that category of failure for an extended period (till the last stage of DLP, as required). Failure to demonstrate the acheivement of failure rate of those failure categories, within the extended period will have an impact on the release of Performance Bank guarantee.
32	Part 2	Particular Specifications	12.8.3	The furniture for the SMR of crossover stations shall be provided with one table, one chair with castor wheels, 5 chairs, two steel shelfs, Box locker (4x3). Depot maintainer room shall be provided with two tables, two chairs with castor wheels and 10 chairs apart from four steel shelfs and box lockers (4x6).	The furniture for the SMR of crossover stations (or approximately every fifth station) shall be provided with one table, one chair with castor wheels, 5 chairs, two steel shelfs, Box locker (4x3). Depot maintainer room shall be provided with two tables, two chairs with castor wheels and 10 chairs apart from four steel shelfs and box lockers (4x6). The OCC and BOCC maintainer room hall be provided with one table, two chairs with castor wheels and 6 chairs apart from three steel shelfs and box lockers (4x6)
33	Part 2	Particular Specifications	12.8.4	The contractor shall provide table and chair for all workstations in all other designated rooms. For SCR, furniture will be provided by Civil contractor.	The contractor shall provide consoles and chairs in OCC, BOCC, Depot control centres, Security control rooms for all controllers. Table and chair for rooms where Signalling or VMS workstations are installed except Station control room for which furniture will be provided by Civil contractor.
34	Part 2	Particular Specifications	13.4.8	The Contractor shall, as a minimum, in the maintenance training shall provide the following:	The Contractor shall, as a minimum, in the maintenance training shall provide the following (For equipments/systems from suppliers where the contractor is not the OEM, the supplier representative shall assist in the training) :
35	Part 2	General Specifications	13.8.3	The Engineer response to the submission will normally be made within 30 calendar days of receipt of the submission. The Engineer may extend the Notice of No Objection period depending on the amount of documentation accompanying the submission.	The Engineer response to the submission will normally be made within 21 calendar days of receipt of the submission, The Engineer may extend the Notice of No Objection period depending on the amount of documentation accompanying the submission.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
36	Part 2	Particular Specifications	14.5.1.8		The contractor shall ensure that transfer of technology to an Indian company is carried out before the commencement of the DLP of stage 1 to undertake the rectification of snags, modification of functionalities, refining the paramets etc for the ATO and ATS sub-system software. The Indian company shall undertake the modifications in the software of these systems in the commissioning stage and DLP periods. The service shall be available from this Indian company beyond completion of project, on payment basis, if the employer desires so.
37	Part 2	Particular Specifications	14.5.9.1		Software source files and documentation and tools for design, development and modification. 14.5.9.1 Within 14 days of the delivery of the Certificate of Operational Acceptance of stage 7, the Contractor shall proceed to a deposit in escrow two backup copies of the software, which shall include, without limitation: a) all source and executable codes; b) all design documentation relating to the software development,process and procedures ; and c) any specified development tools required for maintenance of the software, including, but not limited to, editors, compilers and linkers.
38	Part 2	Particular Specifications	14.5.9.2		Software source files and documentation and tools for design, development and modification 14.5.9.2 Any software item delivered in escrow pursuant to Paragraph above shall not be translated or modified by the Employer without the prior consent of the Contractor unless: a) The owner of the software becomes insolvent or has a receiving order made against them or makes anarrangement or assignment or composition with or in favour of its creditors (including the appointment of acommittee of inspection) or goes into liquidation or commences to be wound up or has a receiver, liquidator, trustee or similar officer appointed over all or any part of its undertaking or assets or if distress, execution or attachment is levied on, or if another party takes possession of, any of its assets or any proceeding or step is taken which has an effect comparable to the foregoing in any relevant jurisdiction; or b) The owner of the software ceases to trade; or c) The owner of the software ceases to trade; or c) The owner of the software assigns copyright in the software and the Contractor fails within 60 days of such assignment to procure in favour of the Employer, a licence from the new owner in the same terms as that required by the Contract; or d) The Contractor is in breach of any of his obligations under the Contract.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
39	Part 2	Particular Specifications	14.6.1 to 14.6.4	Hardware support for COTS product 14.6.1.1 The contractor shall obtain the license and ownership for all commercially off the shelf Hardware (e.g.: Network Switches, Servers, Data storage devices etc.) in the name of the Employer as the user. 14.6.1.2 All the legal, IP related, copyright related, application related compliances shall be ensured by the contractor in the procurement, design and usage of these hardware for various sub systems. 14.6.1.3 All the licenses, purchase agreements and legal documentation shall be handed over to the Employer. 14.6.1.4 The purchase of these Hardware by the contractor for the employer shall be such a way that the Indian arm of the supplier shall be able to extend AMC support for these equipments directly to the employer if employer desires to do so. The contractor shall facilitate the employer to obtain AMC from the supplier directly.	Hardware support 14.6.1 The contractor shall ensure that spare parts compatible is available for replacing any equipment till the end of design life of the Signalling and VMS system. 14.6.2 The contractor shall furnish an undertaking that he has no objection whatsoever to and shall not in any way deter or obstruct the employer, its licensee or its representative from dealing directly with the contractor's vendors for the purchase of the spares or any hardware support for that equipments supplied by that vendor. 14.6.3 Contractor shall obtain an undertaking from vendors, OEMs etc, at detail design submission stage that they are willing to deal directly with the employer for supply of spares, equipments or sub systems, if the employer desires so. 14.6.4 The contractor shall provide the employer all documentation which includes by not limited to the ownership rights, licences etc in the name of the employer for the usage as per the contractors design.
40	Part 2	Particular Specifications	14.6.5		Hardware support 14.6.5 For commercially of the shelf items: 14.6.5.1 The contractor shall obtain the license and ownership for all commercially off the shelf Hardware (e.g.: Network Switches, Servers, Data storage devices etc.) in the name of the Employer as the user. 14.6.5.2 All the legal, IP related, copyright related, application related compliances shall be ensured by the contractor in the procurement, design and usage of these hardware for various sub systems. 14.6.5.3 All the licenses, purchase agreements and legal documentation shall be handed over to the Employer. 14.6.5.4 The purchase of these Hardware by the contractor for the employer shall be such a way that the Indian arm of the supplier shall be able to extend AMC support for these equipments directly to the employer if employer desires to do so. The contractor shall facilitate the employer to obtain AMC from the supplier directly.
41	Part 1	Bidding Forms	2. Schedule of adjustment Data Table A	(d) Value as on 28 days prior to date of bid submission	(d) Value as on 28 days before Last date for submission of Bid.
42	Part 1	Bidding Forms	2. Schedule of adjustment Data Table B1	(d) Value as on 28 days prior to date of bid submission	(d) Value as on 28 days before Last date for submission of Bid.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
43	Part 1	Bidding Forms	2. Schedule of adjustment Data Table B2	(d) Value as on 28 days prior to date of bid submission	(d) Value as on 28 days before Last date for submission of Bid.
44	Part 1	Bidding Forms	2. Schedule of adjustment Data Table B3	(d) Value as on 28 days prior to date of bid submission	(d) Value as on 28 days before Last date for submission of Bid.
45	Part 2	PS- Appendix 2P-1	2.12.1	Regarding electromagnetic interference, STC Contractors shall provide a list of working frequencies and other sensitive requirements to the RS Contractor, to enable RS Contractor to avoid such frequency bands in design, and to provide devices to isolate the source of emission wherever required. STC Contractor will have first right of use for radio frequency 2.4GHz/5.8 GHz for CBTC application.	Regarding electromagnetic interference, STC Contractors shall provide a list of working frequencies and other sensitive requirements to the RS Contractor, to enable RS Contractor to avoid such frequency bands in design, and to provide devices to isolate the source of emission wherever required. STC Contractor will have first right of use for radio frequency bands in 2.4GHz and 5 GHz for CBTC application.
46	Part 2	PS-Appendix 2P-1	2.13 INTERFACE- Division of Responsibility		Item: Display of RTR-DMS feed in Video wall system at OCC/BOCC/DCC STC contractor: Shall connect the feed and arrange for the display of RTR-DMS information RS contractors: Shall extend the RTR-DMS feed in a format compatible with the displays, as specified by the Signaling Contractor.
47	Part 1	EQC	2.3.1	In Case of JV: All Parties Combined: N/A Each Member: Must meet requirement Lead Member: N/A	In Case of JV: All Parties Combined: N/A Each Member: Must meet requirement # Lead Member: N/A # - In case the JV member is a wholly owned Indian Subsidiary of the Lead member, apart from fulfilling the criteria for Lead member, the JV as a whole (All parties combined) has to fulfill the full requirements. In such a scenario, the criteria for each member requirement for the wholly owned Indian subsidiary will not be applicable, provided that they are part of JV.
48	Part 2	PS Appendix 2P-1	2.3.11.g	In By-pass/ Cut-out Mode or any other mode, external indication light shall flash or occult which will be finalized during design stage.	In By-pass/ Cut-out Mode, immobilization mode or any other mode, external indication light shall flash or occult (in distinct and distinguishable manner) . Details shall be finalized during design stage.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
49	Part 1	EQC	2.3.2	In Case of JV: All Parties Combined: Must meet requirement Each Member: Must meet minimum 25% of the requirement Lead Member: Must meet minimum 40% of the requirement	In Case of JV: All Parties Combined: Must meet requirement Each Member: Must meet minimum 25% of the requirement # Lead Member: Must meet minimum 40% of the requirement # - In case the JV member is a wholly owned Indian Subsidiary of the Lead member, apart from fulfilling the criteria for Lead member, the JV as a whole (All parties combined) has to fulfill the full requirements. In such a scenario, the criteria for each member requirement for the wholly owned Indian subsidiary will not be applicable, provided that they are part of JV.
50	Part 1	EQC	2.3.3	In Case of JV: All Parties Combined: Must meet requirement Each Member: Must meet minimum 25% of the requirement Lead Member: Must meet minimum 40% of the requirement	In Case of JV: All Parties Combined: Must meet requirement Each Member: Must meet minimum 25% of the requirement # Lead Member: Must meet minimum 40% of the requirement # - In case the JV member is a wholly owned Indian Subsidiary of the Lead member, apart from fulfilling the criteria for Lead member, the JV as a whole (All parties combined) has to fulfill the full requirements. In such a scenario, the criteria for each member requirement for the wholly owned Indian subsidiary will not be applicable, provided that they are part of JV.
51	Part 2	PS- Appendix 2P-1	2.3.8 c)	In Restricted Manual Mode the train operator shall be able to control Train's doors when the Train is stopped within the station stopping limits	In RM mode, When the Train Operator uses the Permissive Door Button (PDB), the PSD also shall Open and close along with train doors using the direct communication path designed for PSD Open/close commands from train borne signalling in a safe manner.
52	Part 2	PS-Appendix 2P-1	2.3.9	a) By-pass Mode shall be provided for use in the event of failure of the ATP system. In this mode, the train speed shall be controlled entirely by the train operator, to a limit speed as 25 kmph inside the Depot as "Low speed Cut-Out" and 40 kmph in Mainline as "High Speed Cut-Out". RS Contractor shall provide equipment and means to ensure that the maximum train speed remains within the above mentioned limits when the Cut-out Mode is in effect, under all circumstances. This shall be considered as Low speed cut out (25 Kmph & within depots) and High speed cut out (40 Kmph in mainline).	a) By-pass Mode shall be provided for use in the event of failure of the ATP system. In this mode, the train speed shall be controlled entirely by the train operator, to a limit speed as 25 kmph as "Low speed Cut-Out" and 40 kmph as "High Speed Cut-Out". RS Contractor shall provide equipment and means to ensure that the maximum train speed remains within the above mentioned limits when the Cut-out Mode is in effect, under all circumstances. This shall be considered as Low speed cut out (25 Kmph) and High speed cut out (40 Kmph).
53	Part 2	PS-Appendix 2P-1	2.3.9	b) The ATP Cut-out (By-pass) Mode shall be initiated by the train operator operating a sealed Safety Cut-out Switch (SCS) and simultaneously breaking its seal. The operation shall be recorded by the on-board digital counter and TCMS, OCC/BCC & DCC. The SCS shall be provided by RS Contractor. The on-board digital counter shall be provided by the STC Contractor.	b) The ATP Cut-out (By-pass) Mode shall be initiated by the train operator operating a sealed Safety Cut-out Switch (SCS) and simultaneously breaking its seal. The operation shall be recorded by the on-board digital counter and TCMS, OCC/BCC & DCC. The SCS shall be provided by RS Contractor. The on-board digital counter,seperate for high speed cutout and seperate for Low speed cutout, shall be provided by the STC Contractor.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
54	Part 2	PS- Appendix 2P-1	2.4.10 c)	There shall be no relays or contacts between the negative return connection and the battery terminals.	For the power supply distribution from the battery of RS systems for the STC systems, the detailed interface wiring diagram needs to be agreed between the STC & RS Contractors.
55	Part 2	PS- Appendix 2P-1	2.4.12	It shall also be noted that changes in the interface specifications such as key alarms, remote commands, interface signals and GUI specifications etc., are to be expected throughout the project execution stage and shall extend even after commencement of UTO operation based on operational and passenger requirements.	It shall also be noted that changes in the interface specifications such as key alarms, remote commands, interface signals and GUI specifications etc., are to be expected throughout the project execution stage and shall extend even after commencement of UTO operation based on operational and passenger requirements. Requirements identified in the Testing & Commissioning phase of various stages of train borne system needs to be factored in as a part of the contract. Likewise, in respect of UTO Operation only, the changes required from an operational perspective, need to be carried out as part of the Contractual obligations, if notified before the completion of DLP of the last stage.Beyond these periods, change request with reasonable EoT and Cost compensation will be considered. However, this is not applicable to rectification of snags identified during the DNP period of various stages, in respect of compliance with Performance & RAMS requirements of the Contract.
56	Part 2	PS- Appendix 2P-1	2.4.18	For compatibility, Rolling Stock and the train detection system (CBTC antennae/track circuits/axle counters), shall conform to EN 50238.	For compatibility, Rolling Stock and the train detection system (track circuits/axle counters), shall conform to EN 50238.
57	Part 2	PS-Appendix 2P-1	2.4.45	The integrated CCTV system shall support transmission of video streams (from multiple cameras/NVR live or recorded) from train and shall support for changing the video frame rate and resolution for good image quality and in limited bandwidth available for CCTV transmission. Recording of CCTV footages in train's NVR shall be at minimum 1920x1080 and minimum 30 frames per second Live Streaming : Dynamically allocated based on the viewing requirement from OCC SW	The integrated CCTV system shall support transmission of video streams (from multiple cameras/NVR live or recorded) from train and shall support for changing the video frame rate and resolution for good image quality and in limited bandwidth available for CCTV transmission.(80 to 95 mbps approximate) Recording of CCTV footages in train's NVR shall be at minimum 1920x1080 and minimum 30 frames per second Live Streaming : Dynamically allocated based on the viewing requirement from OCC SW
58	Part 2	PS- Appendix 2P-1	2.4.52	In UTO mode, if train gets delocalized, the STC system should use memorized location so that train can move with less speed until next beacon. Once train passes the next beacon, train shall be localized and get normal speed authorization.	Not used.
59	Part 2	PS- Appendix 2P-1	2.4.58	PSD & train Door control – Both the Signalling and Rolling Stock Contractor shall submit a full list of all control and monitoring functions, operations and fault data that shall be required between the PSD and Train Door interface. This control shall include as a minimum, door inhibition of PSD/RS because of faulty RS/PSD door, Door obstruction synchronization.	PSD & train Door control – Both the Signalling and Rolling Stock Contractor shall submit a full list of all control and monitoring functions, operations and fault data that shall be required between the PSD and Train Door interface. This control shall include as a minimum, door inhibition of PSD/RS because of faulty RS/PSD door.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
60	Part 2	PS- Appendix 2P-1	2.4.64	If any door or emergency exit door on a Train is detected to be unlocked while the Train is in UTO/ATO/ATP/Signaling RM mode in motion, on-board signalling system shall apply emergency brake to stop the train	If any door or emergency exit door on a Train is detected to be unlocked while the Train is in UTO/DTO/ATO/ATP/Signaling RM mode in motion, on-board signalling system shall apply emergency brake to stop the train
61	Part 2	PS- Appendix 2P-1	2.4.65		The non-passenger trains shall have automatic preconfigured methods to reduce the auxiliary energy, controlled by ATR/ATS. E.g. controlling the HVAC, Saloon announcement system, Saloon lighting system etc. This configuration shall be capable of being amended by operator based on the special needs. STC and RS contractor shall identify the stategies for auxillary power saving without affecting other requireemnts and implement the same.
62	Part 2	PS-Appendix 2P-1	2.4.7	There shall be 3 separate radio systems for communication between Train and wayside. The system will broadly cater to Train Radio (TETRA), CBTC Radio and CCTV Radio	There shall be 3 separate radio systems for communication between Train and wayside. The system will broadly cater to Train Radio (TETRA), CBTC Radio and CCTV Radio (Non-CBTC Radio)
63	Part 2	PS- Appendix 2P-1	2.8.1	The STC HMI equipment on driver's console used for UTO/ATO/ATP/RM/ROS modes shall be ergonomically placed. This HMI shall be provided by STC contractor per cabin side of each train.	The STC HMI equipment on driver's console used for UTO/DTO/ATO/ATP/RM/ROS modes shall be ergonomically placed. This HMI shall be provided by STC contractor per cabin side of each train.
64	Part 2	PS- Appendix 2P-1	2.9.1.b	xxvii. Brake Pressure	xxvii. Not used.
65	Part 2	PS-Appendix 2Q	3.1.1	The design shall be based on a theoretical headway of 90 secs in order to permit trains to operate on a sustained headway of 100 secs under normal operations as described in the Particular Specification.	The design shall be based on a un-iterfered headway of 90 secs as described in the Particular Specification.
66	Part 2	PS-Appendix 2P-10	3.1.2	Train Auto wash plant contractor will be the participating contractor. The Participating Contractors shall collaborate fully with the Lead Contractor in the development and finalization of the interface design, joint production of the interface documents and interface progress reports.	The Depot Machines contractor will be the participating contractor. The Participating Contractors shall collaborate fully with the Lead Contractor in the development and finalization of the interface design, joint production of the interface documents and interface progress reports.
67	Part 2	Particular Specifications	3.1.3	Contractor shall comply to follow latest standards / functionality that would be published at design stage, Decision of Employer's Engineer shall be final for both S&TC and VMS system	Not used.
68	Part 2	PS-Appendix 2P-10	3.1.7	STC Contractor and the Train Auto wash plant contractor shall prepare a joint compliance matrix for this interface specification and relevant clauses of the Metro Railway General Rules 2020, especially that of UTO operation (GoA 4 operation) related and submit to CMRL for review.	STC Contractor and the Depot Machines contractor shall prepare a joint compliance matrix for this interface specification and relevant clauses of the Metro Railway General Rules 2020, especially that of UTO operation (GoA 4 operation) related and submit to CMRL for review.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
69	Part 2	PS- Appendix 2Q	3.2.1.1	Allowed running speed of trains will be 85 kmph (if not limited as a part of Interface input).	Allowed running speed of trains will be 80 kmph (if not limited as a part of Interface input).
70	Part 2	PS-Appendix 2Q	3.2.1.1	Allowed running speed of trains will be 85 kmph (if not limited as a part of Interface.	Allowed running speed of trains will be 80 kmph (if not limited as a part of Interface.
71	Part 2	Particular specifications	3.2.1.2.1	Control equipment, including: • Servers, Workstations including LAN, routers/switches and Optical Fiber Cable Links, Input output devices at OCC, BCC, stations, depots and other locations. • RPS for Signalling, VMS (CCTV videos of Train-borne), Power SCADA and CCTV system (CCTV videos of stations/tracks/depot) at OCC and other locations.	Control equipment, including: • Servers, Workstations including LAN, routers/switches and Optical Fiber Cable Links, Input output devices at OCC, BCC, stations, depots and other locations. • LCD video wall for Signalling, VMS (CCTV videos of Train-borne), Power SCADA and CCTV system (CCTV videos of stations/tracks/depot) at OCC, BOCC and other locations.
72	Part 2	Particular specifications	3.2.1.2.19	Power Supply Distribution panel, Circuit-Breakers, Earth Leakage Detectors, and Isolators for the AC and DC for the Signalling system, Data communication systems, RPS systems, other equipments supplied as a part of this package.	Power Supply Distribution panel, Circuit-Breakers, Earth Leakage Detectors, and Isolators for the AC and DC for the Signalling system, Data communication systems, Video wall systems, other equipments supplied as a part of this package.
73	Part 2	Particular Specifications	3.2.1.2.27	Consoles and chairs for OCC theatre, BOCC, furniture for SER of all station, SMR of stations with points and crossing, DCC, LAB/Repair Centre, Operational Planning Room in OCC and BOCC buildings, Signalling Maintenance Management Room in OCC and BOCC buildings and other rooms where Signal workstations/equipments are proposed to be supplied by Contractor.	Consoles and chairs for OCC theatre, BOCC theatre, Security control centres, Depot control centres, furniture for SER of all station, SMR of stations with maintenance and diagnostic computer, LAB/Repair Centre, Operational Planning Room in OCC and BOCC buildings, Signalling Maintenance Management Room in OCC and BOCC buildings and other rooms where Signal workstations/equipments are proposed to be supplied by Contractor.
74	Part 2	Particular Specifications	3.2.2.1.18	Ergonomic Study for entire OCC, BOCC, DCC taking inputs from other designated contractors and submit the report.	Ergonomic Study for entire OCC, BOCC, DCCs,SCCs taking inputs from other designated contractors and submit the report.
75	Part 2	Particular specifications	3.2.2.1.7	Assistance to Maintenance, Comprehensive maintenance of RPS.	Assistance to Maintenance, Comprehensive maintenance of Video wall systems.
76	Part 2	PS- Appendix 2M	3.4.1	b) ATP, ATO, UTO Mode.	b) ATP, ATO, DTO, UTO Mode.
77	Part 2	Particular Specifications	3.6.10		The VMS system shall be designed for 3 car trains currently. The software and assosiated system shall be expandable for 6 car in future

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
78	Part 2	Particular Specifications	3.6.11		The unused equipemnts, I/O points etc, which are planned for 6 car operation, which will not be put into initial use shall be inhibited in software or in hardware manner for the timebeing. These unused equipments shall not intiate any alarms or failures and doesnt warrant any attention otherthan the general scheduled maintenace for all equipments.
79	Part 2	Particular Specifications	3.6.2	All the interfacing communication telegrams between various sub-systems of signalling and between other interfacing systems shall be designed for 6 car requirement initially itself.	All the interfacing communication telegrams between various sub-systems of signalling and between other interfacing systems shall be designed for 6 car requirement initially itself. This shall cater for 3 car operation currently.
80	Part 2	Particular Specifications	3.6.6		All indoor equipments, which requires an augmentation for supporting 6 car operation shall be installed and commissioned
81	Part 2	Particular Specifications	3.6.7		All outdoor equipments, which doesn't require a replacement/reposition/augmentation at the time of 6 car introduction shall be designed for 3 car
82	Part 2	Particular Specifications	3.6.8		The Data communication system (DCS): telegrams, bandwidth calculation etc shall be designed for catering 6 car consist also.
83	Part 2	Particular Specifications	3.6.9		The supply installation and commissioning of additional outdoor equipments, and its cabling, required for a 6 car operation, which can be installed and commissioned without affecting 3 car operation is excluded from the scope of this contract. However the space proofing of the same shall be part of the design within the contract.
84	Part 2	Particular Specifications	3.7.3.1	The Contractor will be provided with suitable space at a suitable place for constructing site office and storage facilities for contractor as well as for Employer's Engineer (At 2 depots). The Contractor shall construct the site office and storage facility within 4 months of possession of land given by Employer. The space will be available to the Contractor till end of DLP for whole of works of ASA-04 Contract. The details of the space allotted in various places is as under. Poonamallee Depot premises 2500 sq m Madhavaram Depot premises 2500 sq m Near to Nehru Nagar – SIPCOT section (C3-elevated) Contractor shall make his own arrangements at his own cost	The Contractor will be provided with suitable space,rent free, at a suitable place for constructing site office and storage facilities for contractor as well as for Employer's Engineer (At 2 depots) for appropriate duration of the project. The Contractor shall construct the site office and storage facility within 4 months of possession of land given by Employer. The space will be available to the Contractor till end of DLP for whole of works of ASA-04 Contract. The details of the space allotted in various places is as under. Poonamallee Depot premises 2500 sq m Madhavaram Depot premises 2500 sq m

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85	Part 2	Particular Specifications	3.7.3.3	The Contractor shall provide facilities and resources necessary for the Engineer and the Employer in the site office as per GS Appendix 10.	The Contractor shall provide facilities and resources necessary for the Engineer and the Employer in the site office as per GS Appendix 10. The details of the Main office and sectional office for the Enginner, which needs to be provided by the contractor is as under Poonamalle Depot Premises: Main office (Approximatly from Depot pre-installation works till end of project) For complete project duration Madhavaram Depot premises: Sectional Office (Approximately from Depot pre-installation works till end of last Rolling stock commissioning in the depot) Near Shollinganallur: Sectional office (Approximately from stage 2 pre-installation works till commissioning of stage 3) Near Thirumayilai: Sectional office (Approximatelyfrom stage 4 pre-installation works till commissioning of Stage 7). the detail time line for opening and closing shall be deicded in the execution stage of the project and subject to the NoNO of the Engineer.
86	Part 2	Particular specifications	3.8.1	Interlocking system shall be based on Entrance-Exit Principle. Locking shall be provided in accordance with best industry practices and Signal Engineering manual of CMRL. The locking principles shall be decided in the detail design phase with a NoNO from the Engineer.	Interlocking system shall be based on Entrance-Exit Principle. Locking shall be provided in accordance with best industry practices. The locking principles shall be decided in the detail design phase with a NoNO from the Engineer.
87	Part 2	PS- Appendix 2M	3.8.2.22	Starting Trains in ATP/ATO/ATB/UTO mode after Turn back operation.	Starting Trains in ATP/DTO/ATO/ATB/UTO mode after Turn back operation.
88	Part 2	Particular Specifications	3.9.1 to 3.9.5		 3.9 Headway simulation 3.9.1 The Signalling contractor shall undertake software-based simulation to identify the maximum capacity of the system, i.e., to identify the minimum un-interfered headway which can be achieved in the corridors in the normal direction of traffic. 3.9.2 The headway simulation shall be performed with the calculated MSS identified from the Civil speed data provided by the track contractors and the precise rolling stock characteristics obtained from the rolling stock contractors 3.9.3 The headway simulation report shall confirm the contractual requirement of 90 second signalling uninterfered headway to be achieved in all corridors. 3.9.4 The simulation shall be performed to identify the capacity headways of all intermediate turn backs 3.9.5 The headway simulation shall be performed with all three types of rolling stocks in 3-car as well as 6 car configurations. 3.9.6 The headway simulation shall be conducted separately for "one train in a tunnel restriction" functionality ON and functionality OFF (OFF denotes maximum two trains in a tunnel) and identify the capacity of the system with "one train in a tunnel restriction" ON. The bottle necks shall also be identified.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
89	Part 2	Particular Specifications	3.9.6 to 3.9.9		 3.9 Headway simulation 3.9.7 The headway simulation report shall be updated whenever the track alignment undergoes changes till the as build track alignment. 3.9.8 The headway simulation shall also provide location-based speed data (V max and V min for each location), which enables the track designers to refine the track parameters for each section. The speed data shall be obtained in the following scenarios (Total 24 scenarios). a. All three rolling stock types separate, each in 3 car and 6 car configurations in normal direction with stoppage in stations with run time reserve as zero. b. All three rolling stock types separate, each in 3 car and 6 car configurations in normal direction with stoppage in stations with run time reserve as ten percentage. c. All three rolling stock types separate, each in 3 car and 6 car configurations in reverse direction with stoppage in stations with run time reserve as zero. d. All three rolling stock types separate, each in 3 car and 6 car configurations in reverse direction with stoppage in stations with run time reserve as zero. d. All three rolling stock types separate, each in 3 car and 6 car configurations in reverse direction with stoppage in stations with run time reserve as zero. d. All three rolling stock types separate, each in 3 car and 6 car configurations in reverse direction with stoppage in stations with run time reserve as zero. d. All three rolling stock types separate, each in 3 car and 6 car configurations in reverse direction with stoppage in stations with run time reserve as zero. d. All three rolling stock types separate, each in 3 car and 6 car configurations in reverse direction with stoppage in stations with run time reserve as ten percentage. 3.9.9 The speed values, run time values, the headway possible etc as an outcome of the headway simulation document shall be validated as a part of the headway test in the Testing and commissioning stage.
90	Part 2	Particular Specifications	419.10.1	The Contractor shall ensure that all the Train control & Signalling equipment are designed and constructed in accordance with the latest issues or versions of internationally recognized EMC standards, including but not limited to EN50081,EN50082, EN50121,EN50123, IEC571, EN50155, IEC 61000 to ensure proper functioning.	The Contractor shall ensure that all the Train control & Signalling equipment are designed and constructed in accordance with the latest issues or versions of internationally recognized EMC standards, including but not limited to EN 50121-1 to 4, IEC-61000-6-1 to 4 & IEC 61000-4-2 to 4-6, 4-8, 4-9,9,IEC 61000-4-11 to ensure proper functioning.
91	Part 2	Particular Specifications	419.8.3	The following specific EMC requirements shall be met by the design of the Train Control and Signalling System: (i) Radiated Emissions As a minimum requirement, the maximum levels of radiated electro-magnetic interference (EMI) of the installation shall not exceed the levels specified in EN50081- 2; (ii) Conducted EMI The maximum levels of conducted EMI of the installation shall not exceed the levels specified in EN50081-2; and (iii) Induced EMI The Contractor shall ensure that any cables supplied under this Contract other than power cables used by the System are properly screened, earthed and terminated to prevent noise and/or electric shock from exceeding the levels defined by the International Telegraph and Telephone Consultative (CCITT).	The following specific EMC requirements shall be met by the design of the Train Control and Signalling System: (i) Radiated Emissions As a minimum requirement, the maximum levels of radiated electro-magnetic interference (EMI) of the installation shall not exceed the levels specified in IEC 61000-6-4 (ii) Conducted EMI The maximum levels of conducted EMI of the installation shall not exceed the levels specified in IEC 61000-6-4; and (iii) Induced EMI The Contractor shall ensure that any cables supplied under this Contract other than power cables used by the System are properly screened, earthed and terminated to prevent noise and/or electric shock from exceeding the levels defined in IEC 61000-6-4

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92	Part 2	Particular Specifications	419.8.6	Conducted Immunity Levels The equipment supplied shall continue to operate correctly with no degradation in performance, when subject to the levels of conducted interference set out in the European Standard EN50082-2 in the frequency range of 150 kHz to 30 MHz	Conducted Immunity Levels The equipment supplied shall continue to operate correctly with no degradation in performance, when subject to the levels of conducted interference set out in the EN61000-6-2 and EN 61000-4-6
93	Part 2	Particular Specifications	419.8.7	Electrostatic Discharge (ESD) Any equipment, which contains sensitive electronic components and is likely to be handled or touched by personnel or customers shall be protected against electrostatic discharge and shall be tested to 6 kV with contact discharge or 8 kV with air discharge as defined in IEC61000-4-2. Fast Transient Burst In regard of fast transient burst, equipment supplied shall be tested to 2 kV peak in accordance with IEC61000-4-4. Power Surge In regard of power surge, equipment supplied shall be tested to 2 kV (common mode) and 1 kV (differential mode) in accordance with IEC61000-4-5.	Electrostatic Discharge (ESD) Applicable immunity standards, EN 50121-3-2, EN50121-4,EN 61000-62 & EN 61000-6-1 shall be applicable depending upon the zoning/position/location of the equipment. Fast Transient Burst In regard of fast transient burst, equipment supplied shall be tested to 2 kV peak in accordance with IEC61000-4-4. Power Surge In regard of power surge, equipment supplied shall be tested to 2 kV (common mode) and 1 kV (differential mode) in accordance with IEC61000-4-5.
94	Part 1	Bidding Forms	4.1.17	xvii) Comprehensive maintenance of the RPS system including its spares, consumables till the end of the DNP of Stage 7; as described in Part 2 – Employer's Requirements.	xvii) Comprehensive maintenance of the Video Wall system including its spares, consumables till the end of the DNP of Stage 7; as described in Part 2 – Employer's Requirements.
95	Part 1	Bidding Forms	4.1.3	The Price Centre 'J1' and 'J2' – "On-board Signalling Equipments", comprises of all those obligations and ongoing activities which includes but not limited to the following: (i) Supply of on-board ATP/ATO and TWC equipment and associated accessories to respective Rolling stock Contractors at their factories for the respective train sets of Phase II. (ii) Supply of on-board Driver's HMI equipment, speedometer and associated accessories to respective Rolling stock Contractors at their factories for the respective train sets of Phase II. (iii) Supply of on Installation at the Rolling stock Manufacturers' factories, joint testing and certification on the test track as well as in main line and commissioning for Revenue service.	The Price Centre 'J1', 'J2' and 'J3' – "On-board Signalling Equipments", comprises of all those obligations and ongoing activities which includes but not limited to the following: (i) Supply of on-board ATP/ATO and TWC equipment and associated accessories to respective Rolling stock/CMV Contractors at their factories for the respective train sets of Phase II. (ii) Supply of on-board Driver's HMI equipment, speedometer and associated accessories to respective Rolling stock/CMV Contractors at their factories for the respective train sets of Phase II. (iii) Supply of on-board Driver's HMI equipment, speedometer and associated accessories to respective Rolling stock/CMV Contractors at their factories for the respective train sets of Phase II. (iii) Supervision of Installation at the Rolling stock/CMV Manufacturers' factories, joint testing and certification on the test track as well as in main line and commissioning for Revenue service.
96	Part 2	PS-Appendix 2P-2	4.1.49	Signalling system shall ensure that PSD related commands in ATP, ATO, DTO and UTO mode shall be transferred between On-board ATC or Interlocking to PSD directly or by faster route so that response time from instance of giving command from on-board ATC to reach the PSD system shall be less than 300 milli seconds.	Signalling system shall ensure that PSD related commands in ATP, ATO, DTO, UTO and RM mode shall be transferred between On-board ATC to PSD directly or by faster route so that response time from instance of giving command from on-board ATC to reach the PSD system shall be less than 1000 milli seconds.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
97	Part 2	PS-Appendix 2P-2	4.1.50	The PSD system shall ensure that once the command from the Signalling is received, the PSD door opening shall start within 200 milli seconds.	The PSD system shall ensure that once the command from the Signalling is received, the PSD door opening shall start within 500 milli seconds.
98	Part 2	PS-Appendix 2P-2	4.1.51	PSD system shall ensure that once the PSD doors are closed and locked, the All Doors Closed and Locked Signal shall be provided to Signalling within 300 milli seconds.	PSD system shall ensure that once the PSD doors are closed and locked, the All Doors Closed and Locked Signal shall be provided to Signalling within 500 milli seconds.
99	Part 2	PS-Appendix 2P-2	4.1.52	Once the All Doors closed and locked signal is received from the PSD system, the Signalling shall not take more than 300 milli second to initiate the command for the movement of the train, if all other departure conditions are met.	Once the All Doors closed and locked signal is received from the PSD system, the Signalling shall not take more than 500 milli second to initiate the command for the movement of the train, if all other departure conditions are met.
100	Part 2	PS-Appendix 2P-10	4.1.7		The STC contractor and the wheel profile measuring device contractor shall agree on the precise location of the wheel profile measuring device on the Depot track and its operation.
101	Part 2	PS-Appendix 2P-10	4.1.8		The STC contractor shall provide the information about the Rake number of the train which is scheduled to pass over the wheel profile measurement equipment along with the direction of the travel (active cabin ID). The wheel profile measurement device contractor shall use this data to record the wheel measurement data along with the rake number. The details shall be finalised as a part of the Interface forum to meet the requirement.
102	Part 2	PS-Appendix 2P-6	4.1.8.j		The PS/OHE contractor shall estimate the induced voltage on the cables installed in viaducts, tunnels and Depots.STC contractor shall use the input from PS/OHE contractor to design STC system to meet the requirements of maximum induced voltage
103	Part 2	PS-Appendix 2P-10	4.1.9		The STC contractor shall provide network port at DCC. The wheel profile measurement device contractor shall connect his equipment into this network port. The Protocol for communication, communication information telegram structure etc shall be mutually agreed upon. All the communication shall be real time, with proper time stamp and with proper hand shaking.
104	Part 2	Particular Specifications	4.10.5	The time necessary to the initialization of a sub-system (trackside ATC, train borne ATC, interlocking, track to train transmission, train detection) shall be as short as possible and no greater than 40 seconds.	The time necessary to the initialization of a sub-system (trackside ATC, train borne ATC, interlocking, track to train transmission, train detection) shall be as short as possible and no greater than 60 seconds.
105	Part 2	Particular Specifications	4.13.5	Once awake, these trains shall retain the door opening authorization so that the train doors and PSDs can be opened after wakeup in a scheduled manner or remotely from the OCC.	Once awake, the train borne signalling system shall retain the door opening authorization so that the train doors and PSDs can be opened after wakeup in a scheduled manner or remotely from the OCC.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
106	Part 2	Particular specifications	4.15.1	The Signalling and Train Control Systems shall provide for bi-directional running under all operating modes throughout the entire infrastructure of the Project. The Signalling and Train Control System shall provide full protection of ATP in ATP/ATO/UTO mode of the train running. The ATS functions like ARS, Timetable, Passenger information system interface etc shall work in bi-directional running also.	The Signalling and Train Control Systems shall provide for bi-directional running under all operating modes throughout the entire infrastructure of the Project. The Signalling and Train Control System shall provide full protection of ATP in ATP/DTO/ATO/UTO mode of the train running. The ATS functions like ARS, Timetable, Passenger information system interface etc shall work in bi-directional running also.
107	Part 2	Particular Specifications	4.17.1	The Signalling and Train Control System shall control the movement of following Trains to avoid frequent occurrences of acceleration and braking. This function shall not compromise the headway and capacity requirements.	The Signalling and Train Control System shall control the movement of following Trains to have comfortable acceleration and braking duly meeting the ride quality requirements. This function shall not compromise the headway and capacity requirements.
108	Part 2	Particular Specifications	4.19.8.2	 Electromagnetic compatibility (EMC) IEC 61000-4-1 Electrostatic Discharge IEC 61000-4-2 Radio frequency field IEC 61000-4-3 Electrical fast transient/burst IEC 61000-4-4 Power Surge IEC 61000-4-5 Conducted RF IEC 61000-4-6 Power frequency magnetic field IEC 61000-4-8 Pulse magnetic field IEC 61000-4-9 Damped oscillatory magnetic fieldIEC 61000-4-10 Voltage dips, short interruptions IEC 61000-4-13 Stoltage fluctuation IEC 61000-4-14 Conducted disturbance IEC 61000-4-16 Fipple of DC power supply IEC 61000-4-17 Variation of power frequency IEC 61000-4-28 T Digital Radio phone IEC (Latest Version) 	 Immunity & emission requirements: EN61000-6-1 to 6-4, for Test procedure, EN 6100-4-2 to 4-6, 4-8, 4-9, 4-11 are applicable for immunity testing and EN 55011 will be applicable for emission testing.
109	Part 2	PS-Appendix 2P-6	4.19.8.5.b	As a minimum requirement, the equipment must be immune to field strength of 20V/m in the frequency range of 27 to 2000 MHz	As a minimum requirement, the equipment must be complaint to the testing as per IEC 61000-4-3
110	Part 2	General Specifications	4.2.1	Within 14 days of the installation of any software by the Contractor, the Contractor shall submit to the Engineer for retention by the Employer and the Engineer, two backup copies of the software, which shall include, without limitation: a) all licenses in favour of the Employer for their use. b) all source and executable codes; c) all design documentation relating to the software; and d) any specified development tools required for maintenance of the software, including, but not limited to, editors, compilers and linkers.	Within 14 days of the installation of any software by the Contractor, the Contractor shall submit to the Engineer for retention by the Employer and the Engineer, two backup copies of the software, which shall include, without limitation: a) all licenses in favour of the Employer for their use. b) all executable codes; c) all documentation relating to the software; and d) any specified software/hardware tools required for maintenance of the software.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
111	Part 1	Bidding Forms	4.2.2	5. Comprehensive maintenance of the RPS system including its spares, consumables till the end of the DNP of Stage 7	5. Comprehensive maintenance of the Video Wall system including its spares, consumables till the end of the DNP of Stage 7
112	Part 2	PS- Appendix 2E	4.3.1	The ATP system shall work on the principle of moving block. The Contractor shall determine the architecture for the trackside ATC network which shall form the basis of his design in order to meet the functional, and performance requirements of these specifications. The contractor shall design the length of track, number of allowable Trains in a section, number of stations, and the number of	The ATP system shall work on the principle of moving block. The Contractor shall determine the architecture for the trackside ATC network which shall form the basis of his design in order to meet the functional, and performance requirements of these specifications. The contractor shall design the length of track, number of allowable Trains in a section, number of stations, and the number of interlocking and other trackside elements with which the ATC must interface, combined with redundancy requirements so as to meet the overall safety, availability, reliability, and maintainability criteria of the PS.
113	Part 2	Particular Specifications	4.3.5	The Reliability measure for the Signalling & Train Control system shall be mean time between maintenance actions (MTBMA). The Signalling & Train Control system shall achieve MTBMA of no less than 7 days per 12 route Km of the Line. MTBMA is the average time between maintenance being required on a piece of equipment, sub- system or a system, The equipment shall be clubbed as (a) Trackside ATC (b) On-board ATC (c) ATS (d) CBI including Multi-Section Digital Axle Counter, signal, point machine etc. (e) TWC. MTBMA of 7 days shall be achieved for each group. MTBMA includes both preventive and corrective maintenance.	The Reliability measure for the Signalling & Train Control system shall be mean time between maintenance actions (MTBMA). MTBMA is the average time between maintenance being required on a sub-system. The equipments shall be clubbed as (a) Trackside ATC (b) On-board ATC (c) ATS, VMS (d) CBI including Multi-Section Digital Axle Counter, signal, point machine etc. (e) DCS including CBTC and non-CBTC radio. MTBMA of 7 days shall be achieved for each group per 12 km. For on-board ATC, the 7 days shall be acheived for a group of 7 trains. MTBMA includes both preventive and corrective maintenance activities.
114	Part 2	Safety Manual	4.3.6	The Contractor shall produce a Contract Specific Construction OHS&E new Austrian tunnelling method (NATM)Plan and submit to the Employer /Engineer within 28 days of commencement	Deleted.
115	Part 2	Particular Specifications	4.4.3	iii) Initial Delay to train service exceeding 30 minutes, or closure of signalling /ATP functionality for 900m on both up and down lines for more than 2 hours, or implementation of single line working for a period of 1 hour or more.	iii) Initial Delay to train service exceeding 30 minutes, OR closure of signalling /ATP functionality for 900m on both up and down lines for more than 2 hours, OR implementation of single line working for a period of 1 hour or more, OR requirement of train operator(s) to walk to train(s) stopped outside station in viaduct or tunnel in one or more trains to resume the train movement of the stranded train(s).
116	Part 1	Bidding Forms	4.5.15		PRICE CENTRE 'J3' – On-board Signalling Equipments – Catenary Maintenace Vehicles: J3.1 Receipt of onboard ATP/ATO and TWC equipment and associated accessories for CMV Contractor(s) – For 03 CMVs. 40% J3.2 Receipt of on-board Driver's HMI equipment, speedometer and associated accessories for CMV Contractor(s) - For 03 CMVs 20% J3.3 Supervision of Installation at theCMV Contractor(s)'s factory, joint testing and certification on the test track as well as in main line and commissioning for Regular/Revenue service - For 03 CMVs 40%

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
117	Part 2	PS-Appendix 2P-8	5. INTERFACE- Division of Responsibility		Item: Display of TVS/E&M SCADA system feed in Video wall systems at OCC/BOCC. STC contractor: Shall connect the feed and arrange for the display of PSD health information TVS contractors: Shall extend the TVS/E&M SCADA system feeds in a format compatible with the displays, as specified by the Signaling Contractor.
118	Part 2	Particular Specifications	5.10.1	The Signalling and Train control system shall include facilities for manual setting and manual release of work zone protections and other route/point/signal blocks as a SIL 4 functionality in the interlocking system.	The Signalling and Train control system shall include facilities for manual settingup of Signal, point, route blocks and their release in case of operational exigencies, as a SIL 2 operation from ATS with double confirmation from the Operator
119	Part 2	Particular Specifications	5.10.10	It shall be only possible to lift Maintenance block/work zone protection, Temporary speed restriction, Route block (particular route is blocked), Signal block (particular signal blocked for both Mainline and Depot) and Point block (throwing of point blocked) from the interlocking VDU at OCC or stations depending on the existing level of control. The logic shall be implemented in the interlocking.	It shall be only possible to lift Maintenance block/work zone protection, Temporary speed restriction, Route block (particular route is blocked), Signal block (particular signal blocked for both Mainline and Depot) and Point block (throwing of point blocked) from the ATS and the interlocking VDU at OCC or stations depending on the existing level of control. The logic shall be implemented in the interlocking.
120	Part 2	Particular Specifications	5.11.1	Passenger evacuation path begins from the Rolling stock end door to the Track access doors of PSD through the track.	Passenger evacuation path begins from the Rolling stock end door to the Track access doors of PSD through the track. The evacuation path can be defined involving both tracks (eg: Evacuation through a tunnel cross passage), based on the operational requirement.
121	Part 2	Particular Specifications	5.13.1.2	Docking shall be achieved if the Train is stopped within the limits defined in chapter 4 of this PS and proved to be stationary (or moving at less than 1 Kmph).	Docking shall be achieved if the Train is stopped within the limits defined in chapter 4 of this PS and proved to be stationary (or moving at less than 1 Kmph for 1 sec approximate).
122	Part 2	Particular specifications	5.13.2.3	If any door or emergency exit door on a Train is detected to be unlocked while the Train is in UTO/ATO/ATP/RM mode and in motion, the system shall apply brake to stop the train.	If any door or emergency exit door on a Train is detected to be unlocked while the Train is in UTO/DTO/ATO/ATP/RM mode and in motion, the system shall apply brake to stop the train.
123	Part 2	Particular specifications	5.13.2.5	In ATO & UTO mode the Train shall be prevented from departing unless all train/PSD doors are closed.	In UTO/DTO/ATP mode the Train shall be prevented from departing unless all train doors and PSD doors are closed and locked. In RM mode the train shall be prevented from departing unless all train doors are closed and locked.
124	Part 2	Particular Specifications	5.14.2.4		For those trains which has stopped in the designated stopping window, an emergency opening;/closing of the train door shall open and close the corresponding PSD.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
125	Part 2	PS- Appendix 2M	5.2.1	Software used in ATP system should have been developed in conformity with a software engineering standard EN 50126, EN 50128, EN 50159-1&2, & EN 50129 issued by European Committee for Electro technical Standardization (CENELEC) with special relevance to safety critical applications.	Software used in ATP system should have been developed in conformity with a software engineering standard EN 50126, EN 50128, EN 50159-1&2, & EN 50129 issued by European Committee for Electro technical Standardization (CENELEC) with special relevance to safety critical applications. The contractor can propose equivalent IEC standards, with a Gap analysis duly certified by an independent safety assessor. The acceptance of the equivalant standards is subject to the Engineers satisfaction regarding the equivalance of the EN standard and the proposed standards, especially in the point of view of the safety parameters.
126	Part 2	Particular Specifications	5.2.1	a) Colour VDU monitors of 22 inches LED/TFT, and a suitable equipment to drive the VDU.	a) Colour VDU monitors of 24 inches LED/TFT, and a suitable equipment to drive the VDU.
127	Part 2	PS- Appendix 2M	5.2.2	The communication provided between various ATC equipments and between ATC equipment and interlocking system shall comply with the requirements for transmission of vital safety information conforming to CENELEC standards EN 50159-1 & 2 and IEC 62280 -1&2.	The communication provided between various ATC equipments and between ATC equipment and interlocking system shall comply with the requirements for transmission of vital safety information conforming to CENELEC standards EN 50159-1 & 2 and IEC 62280 -1&2. The contractor can propose equivalent IEC standards, with a Gap analysis duly certified by an independent safety assessor. The acceptance of the equivalant standards is subject to the Engineers satisfaction regarding the equivalance of the EN standard and the proposed standards, especially in the point of view of the safety parameters.
128	Part 2	Particular Specifications	5.2.2.2	Stage 2: Along with stage 1, CMBT- Sholinganallur of Corridor 5 which also includes the passenger operation in service loop connecting corridor 4 and corridor 5, including all possible intermediate turn-backs.	Stage 2: Along with stage 1, CMBT- Elcot of Corridor 5 which also includes the passenger operation in service loop connecting corridor 4 and corridor 5, including all possible intermediate turn-backs.
129	Part 2	Particular Specifications	5.2.2.3	Stage 3A: Along with stage 2, Sholinganallur- Nehru Nagar of Corridor 3, including all possible intermediate turn-backs.	Stage 3A: Along with stage 2, Sholinganallur- Nehru Nagar of Corridor 3, connection to C5-Elcot and including all possible intermediate turn-backs.
130	Part 2	Particular specifications	5.2.2.7	Stage 5: Along with stage 4, Madhavaram milk colony- Kellys of Corridor 3, including all possible intermediate turn backs.	Stage 5: Along with stage 4, Venugopal Nagar- Kellys of Corridor 3, including all possible intermediate turn backs.
131	Part 2	Particular Specifications	5.20.11.1	SMR of each station provided with Interlocking Logic Master unit and stations with points and crossings shall be provided with maintenance and diagnostic computer with monitoring and diagnostic software. All other stations SER shall have facility to plug the diagnostic laptop.	SMR of each station provided with Interlocking Logic Master unit and stations with points and crossings/ one station in each unit block of traffic controller control region (5 km approximate) shall be provided with maintenance and diagnostic computer with monitoring and diagnostic software. All other stations SER shall have facility to plug the diagnostic laptop.
132	Part 2	Particular specifications	5.20.14.4	All workstation displays shall support high-resolution (1920 x 1200 or higher with 16:10 aspect ratio) colour graphics; all workstations shall be 22-inch flat screen LED screen. All the workstations will be provided with suitable printer ports. All workstation displays for VMS shall be 4K resolution (3840 x2160) and flat screen with 32-inch size.	All workstation displays shall support high-resolution (1920 x 1200 or higher with 16:10 aspect ratio) colour graphics; all workstations shall be 24-inch flat screen LED screen. All the workstations will be provided with suitable printer ports. All workstation displays for VMS shall be 4K resolution (3840 x2160) and flat screen with 32-inch size.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
133	Part 2	Particular Specifications	5.20.15.1 to 5.20.15.3	Ergonomic study, console, and chairs of control centres 5.20.15.1 The contractor shall conduct a comprehensive ergonomic study covering as a minimum- the seating position of each controller, the comfortable chair and console design, the lighting level, sound quality, the unhindered view of the video wall system for all controllers etc. The study shall be done separately for the OCC, BOCC, DCC and security control rooms. 5.20.15.2 The signalling contractor shall interface with Civil and MEP contractors to ensure that the overall ergonomic study recommendations are implemented. 5.20.15.3 The consoles for all workstations and the chairs for all controllers shall be designed, supplied and installed by Signalling contractor in OCC, BOCC, DCC and security control room.	Ergonomic study, console, and chairs of control centres 5.20.15.1 The contractor shall conduct a comprehensive ergonomic study for OCC, BOCC, DCCs, SCCs. 5.20.15.2 As an input to the ergonomic study, the STC contractor shall update the number of controller positions and the workstations per control. This process shall be done as a part of the Interface forum discussions. 5.20.15.3 The Ergonomic study shall cover as a minimum cover- a) The layout of the OCC (Plan and elevation) b) The viewing angle to the work station screens and the video wall, c) The height and other parameters of Indian male and Female d) The chair, console and footrest design e) The lighting levels, optimized for control room application suitable for the detailed layout f) Identification of the heat sources of the control rooms and proposing the optimum temperature for the human and the equipments. g) Identification of the sound sources and proposing the ambient noise level to be maintained and proposal for building materials and carpets etc for ensuring the ambient sound within the limit. h) The size of the font to be used in videowalls for each controller visibility. The study shall be done separately for the OCC, BOCC, DCCs and SCCs.
134	Part 2	Particular Specifications	5.20.15.4 to 5.20.15.5		Ergonomic study, console, and chairs of control centres 5.20.15.4 The signalling contractor shall interface with Civil and MEP contractors for the respective control rooms to ensure that the overall ergonomic study recommendations are implemented. The acoustic properties of the materials used for cladding the walls and carpeting shall be ensured that it is suitable to achieve the prescribed acoustic levels for the control centres. The heat load (for complete control room) and UPS load (for Signalling and VMS systems) also shall be provided to MEP as a part of the study. 5.20.15.5 The consoles for all workstations and the chairs for all controllers shall be designed, supplied and installed by Signalling contractor in OCC, BOCC, DCCs and security control rooms. For the controllers which are shown as future provision, the console shall be installed initially but the work stations will be procured in future. The number of screens, workstations, other equipments etc needs to be coordinated by the signalling contractor with other interfacing contractors namely, Rolling stock contractors, PSD contractors, Telecom contractors, TETRA radio contractor, Power SCADA contractors, TVS/E&M SCADA contractors etc. The console design shall as a minimum meet a) The space requirements for the equipment cabinets of all applicable systems. b) The ventilation requirements for the cabinets c) Space requirement for screens d) The ergonomic study inputs e) The colour and aesthetics of the control room g) Storage facility for manuals and other documentations, booklets. h) The power socket requirements inside the control room g) Storage facility for manuals and other documentations, booklets. h) The power socket requirements inside the cabinet enclosure for various systems in which respective system contractors can terminate their power cable.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
135	Part 2	Particular Specifications	5.20.15.6	Ergonomic study, console, and chairs of control centres 5.20.15.6 This study shall be conducted based on relevant international standards. a) ISO 11064 1-3 b) BS 5940 c) ISO 18152 d) ISO 6385 e) ISO 13406-2 f) CIBSE lighting guide	Ergonomic study, console, and chairs of control centres 5.20.15.6 This study shall be conducted based on relevant international standards as a minimum as follows: a) BS ISO 11064 1-7 b) BS ISO 10075 c) BS ISO 10075 c) BS ISO 10775 c) BS ISO 13732 d) BS ISO 9241 e) BS 5940 c) ISO 18152 d) ISO 6385 e) ISO 13406-2 f) CIBSE lighting guide 5.20.15.7 For BOCC, the STC contractor shall Interface with Phase 1 Signalling, Telecom, TVS SCADA, Power SCADA contractors apart from the Phase 2 contractors. The inputs from Phase 1 contractors shall also be used for ergonomic study, console design and all other associated designs. 5.20.15.8 The STC Contractor shall design the under-floor cable trays for OCC, BOCC, DCCs and SCCs. The STC contractor shall identify the requirement of all other system contractors in the Interface forum and design the common underfloor cable trays (Data and Power) and install. The EMC management plan shall be adhered to avoid EMC related issues. The STC contractors to provide easy access in the nominated locations to the cable trays 5.20.15.9 The baseline for the Interface for control rooms shall start with Appendix 2U, which is a preliminary design document which can be used as the indicative baseline on OCC and BOCC design.
136	Part 2	Particular specifications	5.20.16 (5.20.16.1 to 5.20.16.4)	Rear Projection System (RPS) and Video wall. 5.20.16.1 The Contractor shall provide Rear Projection System (RPS) for OCC/BOCC for Signalling, Way-side CCTV, On-board CCTV and for Power SCADA system. 5.20.16.2 The technology for the projection system shall be a Laser based rear projection video wall display system and shall be designed for round the clock operation. 5.20.16.3 The Resolution shall be 1920 x 1080 full HD with 16.7 million colours or higher. The matrix shall be made of 70-inch diagonal size cubes. The screen should be of almost Zero Gap technology (Inter-screen gap < 0.3 mm). Screen should be of minimum 3 layers with a Hard Backing to prevent bulging. 5.20.16.4 The life of Laser light source should be minimum 1,00,000 hrs. in normal operation.	Video wall system. 5.20.16.1 The Contractor shall provide complete Video Wall System (VWS) of same make in OCC, BOCC, DCCs, SCCs for all systems namely Signalling ATS, Way-side CCTV, On-board CCTV, Power SCADA, E&M SCADA system, RTR-DMS systems, PSD, Signalling Diagnostics systems etc. 5.20.16.2 The technology for the screen shall be LCD with LED light source. The video wall system (including its controllers and power supply units) shall be designed for round the clock operation. The life of light source, controller, power supply and the panel shall be minimum 1,00,000 hrs. in normal operation. 5.20.16.3 The Resolution shall be 1920 x 1080 full HD with 16.7 million colours or higher. The matrix shall be made of 55-inch diagonal size LCD panels. The LCD panels shall have colour and brightness correction feature comparing to the other LCD panels in the same video wall. As the screens shall be capable of displaying static image for a very long duration without causing any damage to the health or performance of the LCD screen without causing any distortion in the shape or colour of the image. 5.20.16.4 The screen should be of almost Zero Gap technology with no bezel preferably or very thin bezel (combined bezel width of maximum 0.88 mm). The active pixel of one LCD panel to the active pixel of the adjacent LCD panel shall be minimum and not more than 1.5 mm. The LCD panels shall have anti bulging properties.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
137	Part 2	Particular specifications	5.20.16 (5.20.16.5 to 5.20.16.8)	5.20.16.5 Each Display unit should have dual redundant hot swappable power supply. Redundant processors & redundant controller with auto testing facility shall be used. Single failure of equipment or cable link shall not result in the failure/ blanking of display system completely or partially. 5.20.16.6 Dust protection: Projection unit should meet IEC/ EN-60529 requirements (IP6X certification) and should submit a certificate from a third-party laboratory. 5.20.16.7 The system should have self- correction system with software based to perform health monitoring that allows timely detection of faults. The system related alarms and the diagnostic log files of the Rear Projection System shall be made available in the maintenance and diagnostics workstation at OCC. 5.20.16.8 The cube and controller should be from the same manufacturer and the system OEM shall have its own service center in India.	5.20.16.5 The Video wall system shall have redundant hot swappable power supply installed outside the video wall screens. Redundant processors & redundant controller with auto testing facility shall be used. Single failure of equipment or cable link shall not result in the failure/ blanking of display system completely or partially. 5.20.16.6 The LCD screen Panels shall be fan less in nature with zero ambient noise. The Screens shall have necessary dust protection features so that ambient dust shall not degrade the performance of the screen in course of time. 5.20.16.7 The system should have self-correction system with software based to perform health monitoring that allows timely detection of faults. The system related alarms and the diagnostic log files of the video wall System shall be made available in the maintenance and diagnostics workstation at OCC. 5.20.16.8 The LCD panel and controller should be from the same manufacturer and the system OEM shall have its own service centre in India. The Video Wall shall have software-based facility which creates a uniform colour and brightness adjustments across the LCD panels of any video wall.
138	Part 2	Particular specifications	5.20.16 (5.20.16.9 to 5.20.16.10)	5.20.16.9 The system should support third party integration. 5.20.16.10 The S & TC contractor shall also provide the driver/controller hardware to connect the Power SCADA system with the RPS. The S & TC contractor shall coordinate with the Power SCADA System Contractor & provide them details of the proposed RPS and communication protocol requirements so that the SCADA system would be able to drive the RPS screens through the driver/controller provided by the S &TC contractor. Similarly interfacing shall be done with on-board CCTV system (VMS) and Way-side CCTV system (with Telecom contractors).	5.20.16.9 The system should support third party integration. Apart from the integration to the Signalling system, the S & TC contractor shall also provide the driver/controller hardware to connect the Power SCADA system with the VWS. The S & TC contractor shall coordinate with the Power SCADA System Contractor & provide them details of the proposed VWS and communication protocol requirements so that the SCADA system would be able to drive the VWS screens through the driver/controller provided by the S & TC contractor. Similarly interfacing shall be done with on-board CCTV system (VMS) and Way-side CCTV system (with Telecom contractors), Rolling stock RTR-DMS systems, TVS/E&M SCADA systems, PSD contractors et to project their SCADA/video feeds on any video wall in the OCC/BOCC. The system shall provide facility to the operator to display one window enlarged into multiple LCD panels of the same video wall. The system shall also provide facility for displaying feeds of multiple system on the same LCD panel of the video wall.5.20.16.10 The video walls shall be mounted with floor supports capable of providing precise alignment of the LCD panels for the life cycle of the video wall. The mount shall have provision for adjusting the position of the LCD panels for the life cycle of the video wall. The mount shall be covered with an edge protection panel aesthetically to match the overall aesthetics of the control room. The mounting shall be in a manner that the removal and replacement of any LCD panel in a videowall can be undertaken without removing other LCD panels of the screen on either side shall be covered using aesthetically matching covers/ panels with suitable material meeting applicable fire hazard norms and standards. The details of the mount shall below the screen on either side shall be covered using aesthetically matching covers/ panels with suitable material meeting applicable fire hazard norms and standards. The details of the mounting arrangements loading factors, edge protection arrangements, cover pan
139	Part 2	Particular specifications	5.20.16.12	The Contractor shall propose the overall size and layout of the RPS video wall at OCC and Shall consult the Engineer before finalizing the display screen. The approximate number of cubes in OCC shall be 87 and that of BOCC shall be 30. The final number of the cubes shall be arrived by the comprehensive ergonomics study to be done by the signalling contractor. The overall design of RPS of OCC shall have provision for minimum 20 km extension of lines.	The baseline for the Interface for Videowalls shall start with Appendix 2U, which is a preliminary design document which can be used as the indicative baseline on OCC and BOCC design Videowall Deisgn.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
140	Part 2	Particular specifications	5.20.16.13	RPS at OCC: The allocation of the screen space/cubes for various systems viz signalling, on-board CCTV, Power SCADA, way-side CCTV of Phase 2 shall be finalized in detailed design phase and shall be incorporated in the ergonomic study of various controller positions.	Video walls at OCC: The contractor shall develop detailed video wall layout for the OCC using Appendix 2U as the base document. All the video walls in the OCC shall be capable of displaying inputs from ATS system, VMS system, CCTV system, Traction SCADA systems, TVS/E&M SCADA systems, RTR-DMS systems. Provision shall be provided for the Employer to integrate additional two systems in future to the video wall systems without the support of the contractor/supplier.
141	Part 2	Particular specifications	5.20.16.14	RPS at BOCC: The RPS at BOCC shall be able to display the inputs from systems of Phase 1 also apart from phase 2. The allocation of the screen space/cubes for various systems viz signalling, on-board CCTV, Power SCADA, way-side CCTV shall be dynamically selected by the Operator. The RPS system shall be capable of accepting the feeds from various systems of Phase 1 and Phase 2 and display the feeds on the RPS system.	Video wall at BOCC: The contractor shall develop detailed video wall layout for the OCC using Appendix 2U as the base document. A common video wall is envisaged which shall be used for displaying the inputs from all systems referred above. In addition to it, the video wall system shall be interfaced to recieve the feeds of Phase 1 systems namely, signalling system, CCTV system and Traction SCADA system to display these feeds also into it.
142	Part 2	Particular specifications	5.20.16.15	Video wall at Security Control Room at OCC and BOCC: LCD video walls (4K resolution) with LED light source shall be provided. The video wall shall be bezel less in nature and the inter screen gap shall be less than 5 mm. The approximate diagonal size of each screen shall be 55-65 inch. The approximate wall area will be 20 sq m. The LCD video wall modules shall be capable of 24x 7 application and the life of light source of the screen shall be not less than 80,000 hours. The detail size and number shall be identified in ergonomic study. The screen shall have redundant controller and power supply and cable link, to avoid single point failure. The video wall shall be carable of accepting feeds from the on-board CCTV system and the way-side CCTV system and display. The screen layout shall be configurable for the Operator. The signalling contractor shall provide all redundant controllers for receiving the feeds.	Video wall at Security Control Room: Security control room are provided in OCC building and BOCC building. The security control room at OCC shall be having video wall of 3 numbers of 3x2 LCD panels. Each video wall caters for 2 security controllers. The video walls shall be capable of recieving inputs from ATS system, VMS system and CCTV system. For th security control room in BOCC building, the video wall layout remains the same. Additionally, these videowalls shall have the inputs from the Phase 1 CCTV systems to be displayed. The video wall for security control room can be wall mounted or floor mounted based on the layout design by the STC contractor.
143	Part 2	Particular specifications	5.20.16.16	Video wall at Depot Control Centre (Poonamallee and Madhavaram Depot): LCD video wall of the same make used in SCC shall be used in DCCs also. This video wall shall be capable of accepting feeds from the on-board CCTV system, way-side CCTV system and ATS and display. The signalling contractor shall provide all redundant controllers for receiving the feeds. The detail size and number shall be identified in ergonomic study. Approximately 8 screens and 12 screens shall be planned for Poonamallee Depot and Madhavaram Depot respectively.	Video wall at Depot Control Centre (Poonamallee and Madhavaram Depot): For a depot; Video wall of LCD panels 3x2 is envisaged in the depot control room catering for the two depot controllers. This video wall shall be capable of accepting feeds from the Signalling system, CCTV system, RTR DMS systems. The video wall for Depot control room can be wall mounted or floor mounted based on the layout design by the STC contractor.
144	Part 2	Particular Specifications	5.20.23.10		One train in a tunnel section (OTTS) 5.20.23.10.1 ATS shall have facility to restrict only one train in a tunnel ventiltion section. 5.20.23.10.2 Facility shall be provided to switch ON and OFF OTTS by the Operator in the ATS. ON/OFF facility shall be provided section wise and tunnel wise. i.e. the Operator shall have facility to ON/OFF this function for a specific tunnel between any two stations independently. 5.20.23.10.3 Switching ON of this facility shall ensure that only one train is present at a time inside a tunnel section (between two stations, precise location of the ventilation section shall be obtained in the Interface forum). Switching OFF of this facility shall allow a maximum of two trains per tunnel ventilation section at a time.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
145	Part 2	Particular Specifications	5.20.23.11		Minimum distance between two trains 5.20.23.11.1 For elevated and at grade sections, the minimum safety distance requirement of the ATP shall be the minimum distance to be maintained between two trains in a section. 5.20.23.11.2 For Underground sections, the minimum distance between two trains travelling in a tunnel ventilation section shall not be less than 400m, except in the case of emergency movement in UTO as desribed in Clause 5.24 of Particular specifiction. In emergency movement, the trains can be as close as the ATP design permits.
146	Part 2	Particular Specifications	5.20.23.4.1	The Signalling and Train Control System shall detect Trains that have remained stationary between stations for more than a time interval which shall be user configurable. This condition shall be treated as an alarm and shall be shown on the workstation & RPS screen suitably.	The Signalling and Train Control System shall detect Trains that have remained stationary between stations for more than a time interval which shall be user configurable. This condition shall be treated as an alarm and shall be shown on the workstation & VWS screen suitably.
147	Part 2	Particular specifications	5.20.23.5.1	A command shall be provided on Workstations to hold a specific Train at a designated platform in UTO/ATO/ATP mode of driving, preventing departure of the Train until a release command is issued. The hold command shall be capable of being issued at any time before the Train arrives at the platform or subsequent to its arrival at the platform.	A command shall be provided on Workstations to hold a specific Train at a designated platform in UTO/DTO/ATO/ATP mode of driving, preventing departure of the Train until a release command is issued. The hold command shall be capable of being issued at any time before the Train arrives at the platform or subsequent to its arrival at the platform.
148	Part 2	Particular	5.20.23.5.3	Activation of this command should be suitably indicated on the RPS.	Activation of this command should be suitably indicated on the VWS.
149	Part 2	Particular Specifications	5.20.23.6.3	Activation of this command should be suitably indicated on the RPS.	Activation of this command should be suitably indicated on the VWS.
150	Part 2	Particular Specifications	5.20.23.8.3	Activation of this command should be suitably indicated on the RPS.	Activation of this command should be suitably indicated on the VWS.
151	Part 2	Particular Specifications	5.20.24.7.6	Dwell time optimization in stations (except starting platform) shall be done using CCTV trigger. Station CCTV system shall provide a trigger once passenger boarding is complete for the train to close doors and start from the platform. ATS shall use this input and start the train from platform once passenger boarding is complete as an early departure. However, the train shall have an effective dwell time (incl door closure time and reaction time) not less than the minimum time provided in the timetable or ATR. The time savings owing to the early departure shall be used as additional run time reserve for next station travel time and consumed for energy optimization.	Dwell time optimization in stations (except starting platform) shall be done using CCTV trigger. Station CCTV system shall provide a trigger once passenger boarding is complete for the train to close doors and start from the platform. ATS shall use this input and start the train from platform once passenger boarding is complete as an early departure. However, the train shall have an effective dwell time (incl door closure time and reaction time) not less than the minimum time provided in the timetable or ATR. The time savings owing to the early departure shall be used as additional run time reserve for next station travel time and consumed for energy optimization.Details of the same needs to be finalised in the design phase. Clause 4.1.18 and 4.1.19 of Appendix 2P-3 also needs to be referred
152	Part 2	Particular Specifications	5.20.24.9.4		ATR shall obtain the input of the Temporary speed restrictions and adjust the runtime reserve in prior to entering the TSR area to minimise the impact of TSR on the schedule.
153	Part 2	Particular Specifications	5.20.4.14	Ethernet network shall be based on 10 Gbps or better standard.	The CBTC network and the non-CBTC network shall be designed to have a bandwidth requirements for the respective functionalities. Sufficent margin shall be build for project exigencies, partial failures of the network and future expansions.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
154	Part 2	Particular specifications	5.20.7.1	The Signalling and Train Control System shall provide a mechanism to transfer Train control from the OCC/BOCC to a specified Station/DCC and vice versa. This mechanism shall be cooperative; the OCC/BCC and SCR/DCC must mutually agree to the change in control. Stations under Station control status shall be clearly displayed as such upon the RPS display and the detailed view.	The Signalling and Train Control System shall provide a mechanism to transfer Train control from the OCC/BOCC to a specified Station/DCC and vice versa. This mechanism shall be cooperative; the OCC/BCC and SCR/DCC must mutually agree to the change in control. Stations under Station control status shall be clearly displayed as such upon the Video wall system display and the detailed view.
155	Part 2	Particular Specifications	5.20.8.1	The system shall be operated with the CBI control workstation with VDU displays from each station having interlocking unit or centrally from OCC in the event of failure of ATS servers at OCC and BOCC. Details shall be finalized during detailed design stage.	The system shall be operated with the CBI control workstation with VDU displays from a station in each unit block of the ACR or centrally from OCC in the event of failure of ATS servers at OCC and BOCC. Details shall be finalized during detailed design stage.
156	Part 2	Particular Specifications	5.20.9.12		The unit block size of any ACR for traffic controllers shall be 5 km approximately. The contractor shall submit the proposal for dividing the line into ACR units for the NoNO of the Engineer. The ACR units shall be defined based on the operational concepts and traffic controller allocation. The boundaries of the ACR can even be inside a station where certain platforms and lines are part of one ACR unit and other platforms in another ACR unit (Okkiyam thoraipakkam, Elcot). The details to be identified and finalised in the design stage.
157	Part 2	Particular Specifications	5.20.9.13		The unit block size of any ACR for station controllers shall be one station area. The ACR of the station controller shall allow controlling one or more unit blocks (station areas) at a time.
158	Part 2	Particular Specifications	5.21.3.13		The AOA for the two depot controllers shall be different as one depot controller manages the train movement related responsibilites, where as the second depot controller manages and coorinates the maintenace related activities. The details of the AOA for different Depot controllers shall be finalised in design phase.
159	Part 2	Particular Specification	5.22.11	The VMS workstation provided for each traffic controllers shall obtain the AOA and ACR automatically from the corresponding ATS workstations. The eventbased trigger for each workstation shall be based on the geographical area mapped to the controller position in the ATS. Change in the control area shall be possible in VMS workstation manually also.	The VMS workstation provided for each traffic controllers shall obtain the AOA and ACR automatically from the corresponding ATS workstations. The eventbased trigger for each workstation shall be based on the geographical area mapped to the controller position in the ATS.
160	Part 2	Particular Specifications	5.22.14	The video feed based on an event triggering shall be of high quality (not more than full HD) and shall obtain highest priority in band width allocation. The events and the designated location to display (traffic controller, passenger controller, RPS, station controller etc.) shall be decided in the detail design phase. Priority of video streams based on various concurrent events shall be formalised and submitted to the Engineer for NoNO. The facility shall be provided to automatically queue the video streams in case of large number of concurrent events.	The video feed based on an event triggering shall be of high quality (not more than full HD) and shall obtain highest priority in band width allocation. The events and the designated location to display (traffic controller, passenger controller, VWS, station controller etc.) shall be decided in the detail design phase. Priority of video streams based on various concurrent events shall be formalised and submitted to the Engineer for NoNO. The facility shall be provided to automatically queue the video streams in case of large number of concurrent events.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
161	Part 2	Particular Specifications	5.22.5	The latency of the live video stream shall not be more than 500 milli seconds.	The latency of the live video stream shall not be more than 500 milli seconds in normal conditions. in rare conditions, in which a combination of failure occurs the latency can be more than 500 milli seconds. In those cases, if the latency is more than 500msec, a visible indication shall be provided to the Operator along with the video stream in the VMS screen.
162	Part 2	Particular Specifications	5.22.7	The VMS system shall have interface with the RPS video wall system at OCC and BOCC to display the train CCTV videos.	The VMS system shall have interface with the video wall system at OCC and BOCC to display the train CCTV videos.
163	Part 2	Particular Specifications	5.23.10.10 i)	The connection fiber to OCC and BOCC shall have path diversity. For Koyambedu OCC, the two number of fibers shall connect from Vadapalani Station. For BOCC at Nandanam Metro Bhavan, the two fibers shall connect from Alandur station. The contractor shall lay the connection fibers in Phase 1 viaducts and tunnels with path diversity (one cable in UP line cable tray and one cable in Down line cable tray) and connect the OCC and BOCC to the corridors of Phase 2.	The connection fiber to OCC and BOCC shall have path diversity. For Koyambedu OCC, the two number of fiber cable (144 core each)shall connect from Vadapalani Station. For BOCC at Nandanam Metro Bhavan, the two fiber cables (144 core each) shall connect from Alandur station. The contractor shall lay the OFC in Phase 1 viaducts and tunnels with path diversity (one cable in UP line cable tray and one cable in Down line cable tray) and connect the OCC and BOCC to the corridors of Phase 2.
164	Part 2	Particular Specifications	5.23.10.10.g	The contractor shall provide two main splice box cabinet (one for Up line and one for DN line) per station for the termination of optical fiber cable. The slice box cabinet shall have provision for accommodating the fiber spool to store the extra length of the cable. (10 m either end). The internal routing of fiber tubes/cores shall be concealed inside a maintenance hatch and the splice box shall have further segregation to splice the cores of respective system. These segregated boxes shall have independent lock and key arrangement apart from the main lock and key arrangement of the cabinet.	The contractor shall provide two main splice box cabinet (one for Up line and one for DN line) per station for the termination of optical fiber cable, installed in track side junction boxes adjacent to station. The splice box cabinet shall have provision for accommodating the fiber spool to store the extra length of the cable. (10 m either end). The internal routing of fiber tubes/cores shall be concealed inside a maintenance hatch and the splice box shall have further segregation to splice the cores of respective system. These segregated boxes shall have independent lock and key arrangement apart from the main lock and key arrangement of the cabinet.
165	Part 2	Particular Specifications	5.23.10.2	The data transmission from wayside to OCC and other locations for CBTC data traffic and non-CBTC data may use the same switching network. The Network shall be configured such that CBTC traffic will always have priority over other traffic.	The data transmission from wayside to OCC and other locations for CBTC radio data traffic and non-CBTC radio data may use totally seperated switching network which includes separate fibre cores, switches, routers, access points etc.
166	Part 2	Particular Specifications	5.23.10.4	The maximum traffic interruption time on any circuit due to link, node or any other failure shall be less than 200 milli seconds.	The maximum duration of interruption has to be designed in such a way that: For non-CBTC network, a link node failure shall not cause any disruption to the normal working of various functionalities handled by various sub- networks. For CBTC network, the failure shall not cause any disruption to the train movement including an Emergency brake.
167	Part 2	Particular Specifications	5.23.8	(e) Network security -(e) All essential equipment elements of the Network shall achieve a security, common criteria certification, of EAL (Evaluation Assurance Level) Level 3 or above in compliance to ISO/IEC 15408 under an internationally recognised scheme and assessed by an accredited independent test house.	(e) Network security -(e) All essential equipment elements of the Network shall achieve a security, common criteria certification, of EAL (Evaluation Assurance Level) Level 3 or above in compliance to ISO/IEC 15408 under an internationally recognised scheme and assessed by an accredited independent test house. Equivalant standard can also be proposed by the contractor.
168	Part 2	Particular Specifications	5.23.8	 (e) Network security (d). Protection shall be provided against such threats, as listed below, which are in accordance with classifications as defined by ITU-T: Masquerade ("spoofing"): pretence of authorized status by an impostor. 	 (e) Network security (d). Protection shall be provided against such threats, as listed below, which are in accordance with classifications as defined by ITU-T: Masquerade ("spoofing") or equivalant: pretence of authorized status by an impostor.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
169	Part 2	Particular Specifications	5.23.9.16	The non-CBTC radio communication system shall IEEE 802.11.n or higher. The throughput of non-CBTC radio for the communication from train to the wayside shall be 32 mbps or higher in all scenarios. The non-CBTC radio shall use minimum 2 x2 MIMO spatial streams.	The non-CBTC radio communication system shall IEEE 802.11.ac or higher. The throughput of non-CBTC radio for the communication from train to the wayside shall be 100 mbps or higher in all scenarios. The non-CBTC radio shall use minimum 2 x2 MIMO spatial streams.
170	Part 2	Particular Specifications	5.23.9.20	The data of various sub-networks in the non-CBTC radio shall be dynamic with a minimum threshold as per demand and availability of the band width. Priority for each data traffic shall be defined as a part of network planning and shall be submitted to the Engineer for NoNO. Additional two subnetworks shall be made available for future use for other maintenance systems mounted on rolling stock.	Not used.
171	Part 2	Particular Specifications	5.23.9.21		The contractor shall provide radio masts of appropriate length for installing the wireless access points in the Viaducts and Depots. For Tunnels, suitable fixure shall be provided. The radio masts shall be made of non- corrosive material like stainless steel or can be Galvanized steel. The hot dip galvanization shall comply to IS 209 and the minimum average zinc coating shall be 1000g/m2. The mast along with the load of the wireless access points shall be capable of withstanding a windspeed of 200kmph from any direction without any attention required. The mast design and the mounting design shall be in a manner that it withstands the vibrations causing because of the train movements on the track. Suitable washers, check nuts shall be provided. For viadcuts, the base of the mast shall be designed to match the provisions of the bolts provided in the Viaduct. The anti-corrosive material property for the fixture in tunnel shall be same as that of the radio mast. In Depots, STC contractor shall construct suitable foundation for the masts duly interfacing with Civil and track contractors. The design of the mast, its structural stability etc shall be certified by an Independent structural consultant and contractor shall submit the same for NoNO of the Engineer. The radio masts in the Depot and viaduct shall be provided with a provision to lower it for maintenace of the antennas mounted on it. The lowering provisions shall be designed in a manner that the same shall be possible to be done in a safe manner (suitable hinge arrangement or alternative to be provided in base plate) using minimum manpower. Necessary special tools aiding the lowering and hoisting shall also be provided in sufficient numbers.
172	Part 2	Particular Specifications	5.23.9.4	h) Other VPNs (suitable sub-network) for future requirement.	h) Other VLANs (suitable sub-network) for future requirement.
173	Part 2	Particular Specifications	5.23.9.8	The radios each shall use one of the free ISM bands. (2.4 GHZ and 5.8 GHZ). CBTC radio shall preferably use 5.8 GHZ.	The radios each shall use the free frequency bands in 2.4 GHZ and 5 GHZ.
174	Part 2	Particular Specifications	5.23.9.8	The radios each shall use one of the free ISM bands. (2.4 GHZ and 5.8 GHZ). CBTC radio shall preferably use 5.8 GHZ.	The non-CBTC radio shall work in the free bands available in 5 Ghz range. (5.150 onwards). CBTC radio shall use either 2.4 Ghz or 5 Ghz frequency bands.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
175	Part 2	Particular Specifications	5.24.1		 5.24 Smoke/Fire scenarios and Signalling system response. 5.24. 1 Fire/smoke alarm trigger inside a train, in motion or capable of moving from one station to other. 5.24.1.1 The priority of the incident train shall be set into high, so that in all crossovers and signals, the train obtains highest priority in junction management logic, to enable full speed non-stop movement of the incident train into the next passenger platform. 5.24.1.2 The "next passenger platform" shall be reserved for the incident train. Any train already occupying this platform shall vacate this platform immediately. Any train travelling ahead of the incident train, approaching the platform reserved, shall skip the platform, and continue its travel enabling the platform availability for the incident train. 5.24.1.3 The incident train as well as the train ahead in the same section, if any, shall be operated with zero run time reserve (all -out mode) to enable earlier reception of incident train on the platform reserved. 5.24.1.4 The incident train shall stop at the designated stopping point and open the doors on the platform side. The doors shall continue to be open unless the Operator from OCC closes it through specific command in ATS terminal. 5.24.1.5 The train following the incident train shall not start from the previous platform automatically. If the following train has already entered the section where the incident train is present, the following train shall have an immediate braking. 5.24.1.6 The smoke/fire alarm trigger shall be latching type until the Operator resets it in the ATS terminal/or in the train, a appropriate. 5.24.1.7 Appropriate audio-visual alarms shall be triggered in OCC and the Station control Room of the platform reserved for the incident train. Passenger information systems of the station and the trains involved shall be triggered by ATS for appropriate information. The details to be finalized in the design phase.
176	Part 2	Particular Specifications	5.24.2		5.24. 2 Fire/smoke identified outside a train, in motion or capable of moving from one station to other. 5.24.2.1 The OCC operator shall be provided facility to classify a train to a fire/smoke incident train from the ATS terminal. The remaining system response shall be as in 5.24.1.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
177	Part 2	Particular Specifications	5.24.3.1 to 5.24.3.2		 5.24.3 Fire/smoke identified inside/outside a train, and the train in crippled condition inside tunnel. (Reference NFPA 130) 5.24.3.1 One train inside the tunnel ventilation section 5.24.3.1.1 The Fire/smoke alarm shall be either triggered by the alarm system of the rolling stock OR the operator shall classify the train as train on fire/smoke. 5.24.3.1.2 The end evacuation procedure shall be commended by the Operator using necessary commands from the ATS terminal. 5.24.3.2 Two train inside the tunnel ventilation section with incident train being the second. 5.24.3.2.1 The Fire/smoke alarm shall be either triggered by the alarm system of the rolling stock OR the operator shall classify the train as train on fire/smoke. 5.24.3.2.1 The Fire/smoke alarm shall be either triggered by the alarm system of the rolling stock OR the operator shall classify the train as train on fire/smoke. 5.24.3.2.1 The Fire/smoke alarm shall be either triggered by the alarm system of the rolling stock OR the operator shall classify the train as train on fire/smoke. 5.24.3.2.3.2 The first train (non-incident train) shall be operated with zero run time reserve out of the tunnel ventilation section with high priority assigned for all junction management logic. 5.24.3.2.3 The end evacuation procedure shall be commenced by the Operator using necessary commands from the ATS terminal.
178	Part 2	Particular Specifications	5.24.3.3		 5.24.3.3 Two train inside the tunnel ventilation section with incident train being the first. 5.24.3.3.1 The Fire/smoke alarm shall be either triggered by the alarm system of the rolling stock OR the operator shall classify the train as train on fire/smoke. 5.24.3.3.2 Once the incident train is crippled (i.e. fire/smoke is classified and the train comes to zero speed/EB applied) an Emergency brake shall be applied in the second train (non-incident train) immediately. 5.24.3.3.3 Facility shall be provided for Emergency reversal (turn back) of the non-incident train to the previous platform (outside the tunnel ventilation section) with a single command in the ATS terminal in UTO/DTO/ATO mode. The stoppage time for the train for reversal shall not be more than 10 to 15 seconds including the system response and the time to facilitate the automatic train movement from the Signaling side. The movement in the reverse direction shall be in full sectional speed. The platform reserved for the second train, i.e., the non-incident train (previous passenger platform) shall be provided for mergency reversal of the third train from the other direction. If already third train is present on the platform or entered partially into the platform, the fourth train shall be stopped immediately to facilitate the emergency reversal of the third train into the tunnel to make space for the second train to enter the reserved platform. The detailed control logic for this scenario, to extract the non-incident train from the tunnel ventilation section in the minimum possible time shall be developed during detailed design and is subject to No-No from the Engineer. 5.24.3.3.4 Irrespective of the location or train under fire, provision shall be provided for emergency reversal of any train in the section to the previous platform. For those trains already on platform, facility shall be there to emergency reverse these train to the mid-section making way for other train to occupy the platform.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
179	Part 2	Particular specifications	5.3.2.5	Whenever any train get delocalized, the train shall be able to be operated in a crawling movement with reduced speed (15 kmph) with a command from OCC under the safety supervision of ATP in UTO without a driver inside the train. This is to facilitate the upgradation back to UTO in full speed once the localization and associated conditions are achieved. This facility is provided for the resumption of the train movement and upgradation back to UTO mode without any requirement of manual intervention inside train. The front camera of the train shall be automatically displayed in the OCC VMS system, whenever the crawling is activated.	Preferred Requirement: (Possiblity to be examined in the design phase and shall be implemented, if feasible) Whenever any train get delocalized, the train shall be able to be operated in a crawling movement with reduced speed (15 kmph) with a command from OCC under the safety supervision of ATP in UTO without a driver inside the train. This is to facilitate the upgradation back to UTO in full speed once the localization and associated conditions are achieved. This facility is provided for the resumption of the train movement and upgradation back to UTO mode without any requirement of manual intervention inside train. The front camera of the train shall be automatically displayed in the OCC VMS system, whenever the crawling is activated.
180	Part 2	Particular Specifications	5.3.9.1	At the turnback stations the train is operated automatically by the ATC to the turn back track and back to the terminal station without driver. Additionally, there should be facility for automatic turns back at platform of the terminal station & intermediate turn back station when train is directly received on the dispatch platform by using the crossover in front of the station. It shall be possible to enter the automatic turn back mode from ATO mode.	At the turnback stations the train is operated automatically by the ATC to the turn back track and back to the terminal station without driver. Additionally, there should be facility for automatic turns back at platform of the terminal station & intermediate turn back station when train is directly received on the dispatch platform by using the crossover in front of the station. In this case the reversal will happen with passengers on the platform It shall be possible to enter the automatic turn back mode from ATP/ATO/DTO/UTO mode. The mode shall be available in the terminal station as well as all intermediate terminal stations
181	Part 2	Particular Specifications	5.4.2	Point machine failures causing the use of RM/ROS operation, shall not be of an area longer than 250m in the normal or reverse direction of travel.	Point machine failures causing the use of RM/ROS operation, shall not be of an area longer than 250m in the normal or reverse direction of travel. The requirement of a train operator boarding the train needs to arise at the previous passenger platform for a point failure scnenario.
182	Part 2	Particular Specifications	5.4.4	Any delocalization of train, the train shall be able to be operated in a crawling movement with reduced speed (15 kmph) with a command from OCC under the safety supervision of ATP in UTO without a manual intervention requirement at the train. This is to facilitate the upgradation back to UTO in full speed once the localization and associated conditions are achieved. This facility is provided for the resumption of the train movement and upgradation back to UTO mode without any requirement of manual intervention inside train. If the train doesn't have adequate distance to fulfill the requirements of upgradation to UTO mode before reaching the next passenger platform, the train shall enter the platform partially in crawling movement and stop waiting for the roving attendant to enter the train from the platform.	Preferred Requirement: (Possiblity to be examined in the design phase and shall be implemented, if feasible): Any delocalization of train, the train shall be able to be operated in a crawling movement with reduced speed (15 kmph) with a command from OCC under the safety supervision of ATP in UTO without a manual intervention requirement at the train. The crawling movement is to facilitate the upgradation back to UTO in full speed once the localization and associated conditions are achieved. This facility is provided for the resumption of the train movement and upgradation back to UTO mode without any requirement of manual intervention inside train. If any TSR exists in the track section which warrants an MSS of less than 15 kmph, then the lower speed value shall apply.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
183	Part 2	Particular Specification	5.4.5	Any failure of DCS, causing a dead spot in the Wi-Fi communication between the train and the wayside inside the viaduct or Tunnel, the Operator shall have the facility to initiate a command, from the ATS terminal in OCC, to the train to move in a crawling speed (of 15 kmph) as speed for a fixed distance. This movement shall be under the safety supervision of the ATP. This instruction shall be communicated to the train borne systems through the bi-directional TETRA communication radio channel. Necessary checks to ensure the safety and integrity shall be ensured by the vital systems of signalling. Once the DCS system starts working in this movement, the train shall start communicating with the way-side systems and upgrade to UTO in full speed without a manual intervention after localization and achievement of other associated conditions.	Irrespecive of the location of delocalization of train in the mid section because of a momentary failure or a temporary loss of communication (eg: Just outside platform before entering), the train shall get upgraded into UTO mode before reaching the operational stopping point on the subsequent platform while travelling in RM mode or Crawl mode. The ATC track side equipment installations (balises, loops, beacons etc) and the ATC software logics shall be in a manner to acheive this functionality. This shall be complied in the normal direction as well as reverse direction movement (bi-directional movement) on any line/platform.Details of the implementation shall be finalised in the design phase.
184	Part 2	Particular Specifications	5.4.8		Total shut down/Total failure of signalling equipments pertaining to one area shall not cause loss of functionality of OCC and BOCC to monitor and control the signalling system which are outside the area where the shutdown/ total failure has occurred.
185	Part 2	Particular Specifications	5.6.10	The turnout/point monitoring system shall be part of the Maintenance and diagnostics system.	Not used.
186	Part 2	Particular specification	5.6.3	The maintenance and diagnostics system shall be either an integrated system (preferred option) or shall be a combination of separate diagnostics system especially for signalling, DCS, RPS and VMS. For standalone systems, necessary document s shall be submitted to the Engineer describing the pros and cons and technical reasons for a NoNO to proceed).	The maintenance and diagnostics system shall be either an integrated system (preferred option) or shall be a combination of separate diagnostics system especially for signalling, DCS, Video wall system and VMS. For standalone systems, necessary document s shall be submitted to the Engineer describing the pros and cons and technical reasons for a NoNO to proceed).
187	Part 2	Particular specifications	5.7.3.2	The Contractor shall provide two identical data transfer servers installed and commissioned- one in OCC building and another at BOCC building. All prescribed data shall be transferred to both the servers identically irrespective of which ATS servers are functional.	The Contractor shall provide two identical data transfer servers installed and commissioned- one in OCC building and another at BOCC building. All prescribed data shall be transferred to both the servers identically irrespective of which ATS servers are functional. Each server shall be provided with appropriate redundancy or RAID level sothat the failure doesnt stop the service or cause loss of data.
188	Part 2	Particular specifications	5.7.3.4	The contractor shall provide the APIs for integrating minimum 99 external servers to which the data can be transmitted with necessary authentication. The servers shall be either physical servers or cloud servers connected over Internet	The contractor shall provide the APIs for integrating minimum 99 external servers to which the data can be transmitted with necessary authentication. The servers shall be either physical servers or cloud servers connected over Internet. The Data trnasfer server shall have a Interface management software with adequate access for the employer to manage the selective access rights (selective data for selected servers) for the data seperarly for the all 99 connections envisaged.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
189	Part 2	Particular Specifications	5.7.3.6	The contractor shall ensure the security of the data as well as the system by two level approved cyber security means like Fire wall. It is proposed that the first level of security (firewall or equivalent) measures is implemented between the transfer server and the ATS. The second level peripheral security measure shall be provided between the transfer server and the external servers.	The contractor shall ensure the security of the data as well as the system by two level approved cyber security means like Fire wall. It is proposed that the first level of security between tranfer server and ATS shall be by Hardware means (eg: unidirectional communication diode etc). The second level of protection is between the the transfer server and the external servers. This can be a firewall of appropriate security. Both the level of security is under the scope of STC contractor
190	Part 2	Particular specifications	5.7.4.2.2	The real time data shall be transmitted in a regular interval. The frequency of updating of each information shall be decided in the detail design phase. The transfer server shall relay this information to the external communication nodes.	The real time data shall be transmitted in a near to realtime interval. The frequency of updating of each information shall be decided in the detail design phase. The transfer server shall relay this information to the external communication nodes based on the data access rights set by the management software. All realtime telegrams shall consist of the time stamp of creation of the data telegram.
191	Part 2	Particular specifications	5.7.4.3		User Transfer Folder Data 5.7.4.3.1 The ATS system shall provide the facility for the employer to send any data from the ATS to the transfer folder earmarked in the data transfer server. The data type can be file type (screen grabs of ATS, maintenace alarm logs, maintenace data logs, etc). The ATS system shall also have the provision/dropdown option to send any data to this tranfer folder. The data in the transfer folder shall be available for the external communication nodes to access. 5.7.4.3.2 The VMS system shall be provided with facility to send the downloaded CCTV videos to the transfer folder in the transfer server. 5.7.4.3.3 The maintenace and diagnostics system shall be provided with facility to send the maintenance data to the transfer folder to extract the data safely to the external data transfer server.
192	Part 2	Particular Specifications	5.8.1.8	The system shall be able to close-up trains, in a safe manner using appropriate braking model, in stabling line of the depot and the mainline sidings for train without passengers parking in an automated /scheduled/remote manner in its nominated parking slots.	The system shall be able to close-up trains, in a safe manner using appropriate braking model, in stabling line of the depot and the mainline sidings for train without passengers parking in an automated /scheduled/remote manner in its nominated parking slots (currently 2 number of 3Car trains to be stabled on the siding which is of typically 6 car length slots). Movements within the sidings shall also be possible in an automated/scheduled manner in UTO/DTO/ATO/ATP/RM mode in all sidings and stabling lines, especially for those in Light house and Sipcot 2, which includes automatic induction and retrival from any stabling slot, where numerous stabling slots are provided as a part of additional stabling facilities.
193	Part 2	Particular Specifications	5.8.1.9		The Maximum Operating speed of a track section shall not be less than 5 kmph or 10% (whichever is higher by value), from the maximum speed certified for the track section (civil speed), on the mainline for a zero gradient track or raising gradient track. For a falling gradient track, the Maximum Operating Speed shall not be less than 10 kmph from the Civil speed. The minimum trip time for the sections shall be defined based on the Maximum Operating speed computed as above. The contractor shall ensure that the location uncertainty of the trains, Allowable overspeed permitted by CBTC system, Maximum allowable speed measurement error of the CBTC system, Maximum train acceleration rate possible at the time an overspeed condition is detected by the CBTC system, CBTC system reaction time and latencies etc, are designed in such a way to meet the above requirement. The track gradient value of the track section shall also be considered while designing the maximum operating speed. The rolling stock parameters may be identified from the Appendix 2P-1 of Particular Specifications and from the Interface forum with Rolling stock contractors.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
194	Part 2	Particular Specifications	5.8.10.3.10	The length of any axle counter section shall not be more than 900m.	The length of any axle counter section shall not be more than 1000m.
195	Part 2	Particular Specifications	5.8.11.13	Route indicators shall be LED matrix type capable of displaying – • M – For Main Line • L – For Left diversion • R-For Right diversion • S- For Siding. • D- For Depot	Route indicators shall be LED matrix type (two letter/digit) capable of displaying – First letter/digit • M – For Main Line • L – For Left diversion • R-For Right diversion • S- For Siding. • D- For Depot Second letter Numerical value corresponding to first, second or third diversion
196	Part 2	Particular Specifications	5.8.11.3	The mainline signals shall be installed on the Main lines and depot entry/exit, test tracks according to their modes and features as follows: • At stations with point and crossing for point protection catering for bidirectional working • Depot entry/exit locations • Test tracks • Any suitable location as warranted by the interlocking design	The mainline signals shall be installed on the Main lines and depot entry/exit, test tracks according to their modes and features as follows: • At stations with point and crossing for point protection catering for bidirectional working • Depot exit locations • Test tracks • Any suitable location as warranted by the interlocking design
197	Part 2	Particular Specifications	5.8.12.1	The maximum number of trains that can be processed by a single wayside controller shall be between 10 to 40. This shall be ensured with signalled headway of 90 sec and shall consider all train bunching scenarios of the trains in case of any failure.	The headway of 90 second is the requirement by the Employer. IEEE 1474 Para 5.1 enables the employer to define his requirement.
198	Part 2	Particular Specifications	5.8.13.10	Turn backs in ATP, DTO, ATO & UTO mode of operation shall also be provided at each platform in both directions in the timetable mode. Turn back at any location (including mid-section) shall also be possible.	Turn backs in ATP, DTO, ATO, UTO and RM mode of operation shall also be provided at each platform in both directions in the timetable mode. Turn back at any location (including mid-section) shall also be possible.
199	Part 2	Particular Specifications	5.8.13.7		Interlocking VDU workstations shall be provided at the Station Control Room one in each unit block of traffic controller control (every 5 km approximate). which shall be used as a backup in case of failure of the ATS sub- system. The ACR of this workstation shall be for the area under the unit block of ACR which it belongs to.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition	
200	Part 2	Particular Specifications	5.8.13.9	The Contractor shall develop and submit the system configuration drawing, Train movement specification, Signalling plan and route table to the Engineer for review. All turn backs provided by the track layout shall be permitted and shall be fully ATP protected.	The Contractor shall develop and submit the system configuration drawing, Train movement specification, Signalling plan and route table to the Engineer for review. All turn backs provided by the track layout shall be permitted and shall be fully ATP protected. While a turnback process is undergoing, any other train approaching the reversal track shall be able to travel till the passenger platform immediatly before the reveral track as a minimum. The Interlocking design shall permit this facility/flexibility,duly avoiding any deadlock and safety hazard.	
201	Part 2	Particular Specifications	5.8.7.1	The Signalling system shall stop all Train Consist movements in the area defined by the coverage of the SPKs when the SPKs is activated. The SPK functionality shall be implemented through the Interlocking system with a SIL 4 safety rating. This shall be applied to all Train Consist movement in UTO/DTO/ATO/ATP/RM/Cut-out Modes of Operation.	The Signalling system shall stop all Train movements in the area defined by the coverage of the SPKs when the SPKs is activated. The SPK functionality shall be implemented through the Interlocking system and ATC system with a SIL 4 safety rating. This shall be applied to all Train Consist movement in UTO/DTO/ATO/ATP/RM/Cut-out Modes of Operation.	
202	Part 2	Particular Specifications	5.8.7.2		When a SPK is released for a particular work zone, All virtual signal routes leading a train to the work zone shall be set to Red (Stop) condition. All routes from a physical signal which directly leads to the work zone (with no virtual signal in between, eg: reception signals at Interlock stations) shall also be blocked. For Physical signal routes, which leads to the work zone with virtual signals in between, the Green aspect for those routes shall be inhibited. Details shall be identifed and finalised in the design phase.	
203	Part 2	Particular specifications	5.8.8.1	g) Door obstruction synchronization etc.	g) not used.	
204	Part 2	Particular Specifications	5.8.8.4	PSD commands in ATP, ATO, DTO and UTO mode shall be transferred between On- board ATC or Interlocking to PSD directly or by faster route so that response time from instance of giving command from on-board ATC to reach the PSD system shall be less than 300 ms.	PSD commands in ATP, ATO, DTO,UTO and RM mode shall be transferred between On-board ATC to PSD directly or by faster route so that response time from instance of giving command from on-board ATC to reach the PSD controller shall be less than 1000 ms. This needs to be demonstrated as a part of the Factory/System acceptance test.	
205	Part 2	Particular Specifications	5.8.9.1	The contractor shall supply, install and commission Point machines for Depot and Mainline along with all associated roddings, external mechanical locks, supplementary drives, gauge plates etc.	The contractor shall supply, install and commission Point machines for Depot and Mainline along with all associated roddings, external mechanical locks, supplementary drives etc.	
206	Part 2	Particular Specifications	5.8.9.12	Provision shall be made for individual manual operation of each point. Electrical power shall get disconnected from the point drive under manual (crank handle) operation. Crank handles used for manual operation of point shall be interlocked with the interlocking such that removal of a crank handle shall prevent setting of relevant routes. The number of crank handles shall be optimized by suitable grouping such that the operational impact is minimal when a key has been taken out. The crank handle key along with the crank handle /lever etc. shall not be more than 1 kg in weight.	Provision shall be made for individual manual operation of each point. Electrical power shall get disconnected from the point drive under manual (crank handle) operation. Crank handles used for manual operation of point shall be interlocked with the interlocking such that removal of a crank handle shall prevent setting of relevant routes. The number of crank handles shall be optimized by suitable grouping such that the operational impact is minimal when a key has been taken out. The requirement of 24 hour operation shall also be considered while deciding the crank handle grouping and assosiated logic. The crank handle key along with the crank handle /lever etc., which needs to be carried to the point machine location from the control room together shall not be more than 1 kg in weight.	
SN	Part	Section	Clause	Original Bid condition	Revised bid condition	
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207	Part 2	Particular Specifications	5.8.9.2	Point machines on the main line shall be electric type with high thrust and shall conform to IRS 524 or International Standards and shall already be proven in Metro rail environment.	Point machines on the main line shall be electric type with high thrust and shall conform to International Standards and shall already be proven in Metro rail environment in India. Depot Point machines shall be electric type conform to IRS S24 and IRS S37 (for the motor)	
208	Part 2	Particular Specifications	5.8.9.21	Point/turnout condition monitoring system	Not used.	
209	Part 2	Particular Specifications	5.8.9.4	The mainline point machine shall be non-trailable and the depot Point machine shall be trailable in nature. Mainline point machine shall be used in Depot test track. In Depots, apart from test track, one more point (in each depot) shall be equipped with mainline point machine, which will also be used for training purpose.	III The mainline point machine and Depot point machine shall be non-trailable in nature. Mainline point machine shall be used in Depot test track also. In Depots, apart from test track, one more point (in each depot) shall be equipped with mainline point machine, which will also be used for training purpose.	
210	Part 2	Particular Specifications	5.9.10	Temporary speed restrictions shall be capable of being imposed over any track segment for any length in steps of 50m and 200m.	Temporary speed restrictions shall be capable of being imposed over any track segment for a maximum trac segmant length of 200m. It shall be possible to apply TSR in multiple adjacent segmants, if required.	
211	Part 2	Particular Specifications	5.9.13	Temporary speed restrictions shall only be lifted in a safe manner. The Signalling and Train Control System shall ensure that no-one can inadvertently remove or modify a temporary speed restriction.	Temporary speed restrictions shall only be lifted in a safe manner. The Signalling and Train Control System shall ensure that no-one can inadvertently remove or modify a temporary speed restriction. For the release of the TSR, a coordinated operation shall be performed in which the Local autorization button- LA button (which needs to be provided in all SCR and DCC in a secured manner) shall be pressed by the Operator while releasing the TSR in the ATS terminal.	
212	Part 2	Particular Specifications	5.9.2	The Temporary speed restriction function, its application and release shall be a SIL 4 function in ATP systems.	The application and release of TSR shall be through ATS with a SIL 2 functionality. The implementation in the ATP shall be in a SIL 4 manner. In the release process, the actuation of LA button, within a prescribed time, is mandatory, which is a vital input to ATP system	
213	Part 2	Particular specifications	5.9.4	The temporary speed restriction imposed by the Operator and by the system shall be shown distinctively in two different colours in the display screens.	The temporary speed restriction imposed by the Operator and by the system shall be shown distinctively in two different colours in the display screens. More than one temporary speed restriction can coexist in the same track section (eg: a sweeping zone and a operator entered TSR). The release of one temporary speed restriction shall not release other temporary speed restrictions in the same zone. The train shall follow the lowest temporary speed restriction of that section as the civil speed to derive the MSS.	
214	Part 2	Particular specifications	5.9.5	No Signalling and Train Control equipment failure shall cause the loss of an imposed temporary speed restriction. Normally for Cases of complete power failure etc. a safe method shall be provided for restoration of the imposed temporary speed restriction preferably through ATS system.	No Signalling and Train Control equipment failure shall cause the loss of an imposed temporary speed restriction. For normal failures (eg: Failure of a single card, power supply failure for a period of not more than 24 hours) the ATP system shall be capable of remembering all the temporary speed restrictions from the time of failure. For Cases of complete equipment failure or prolonged power failures for days which causes a deletion of the already implemented TSR, the system shall provide an alarm to prompt the Operator to re-enter the TSR and confirm before the commencement of train service in the affected section.	

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
215	Part 2	Particular Specifications	6.4.3.4	Development Process of ATS and ATO systems shall be designed, manufactured and validated to Safety Integrity levels as defined in the CENELEC standard EN50126, EN50128 and EN50129 as per the requirements for CBTC systems and shall be SIL 2 certified. The execution of safety critical commands pertaining to the interlocking system through the interlocking VDU at OCC & Stations, shall meet the requirements of SIL 4 level, as per above mentioned EN standards. Further, all potentially unsafe effects of safety-related functions performed by ATS and ATO shall be mitigated by mandatory interaction with SIL4 subsystems (ATP and CBI)	Development Process of ATS and ATO systems shall be designed, manufactured and validated to Safety Integrity levels as defined in the CENELEC standard EN50126, EN50128 and EN50129 as per the requirements for CBTC systems and shall be SIL 2 certified. The execution of commands pertaining to the interlocking system through the interlocking VDU at OCC & Stations, shall meet the requirements of SIL 2 level, as per above mentioned EN standards. Further, all potentially unsafe effects of safety-related functions performed by ATS and ATO shall be mitigated by mandatory interaction with SIL4 subsystems (ATP and CBI)
216	Part 2	Particular Specifications	6.4.3.5	Critical commands such as unblocking a blocked signal/ route/ maintenance area, emergency operation of a point or releasing a temporary speed restriction shall be implemented in a safe manner in VDU.	Critical commands (commands those which make more permissive state) such as unblocking a blocked signal/ route/ maintenance area, emergency operation of a point, door release, releasing a temporary speed restriction, as applicable, shall be implemented in a safe manner in ATS terminal and Interlocking VDU terminal. All these commands shall require a double confirmation from the Operator.
217	Part 2	Particular Specifications	6.4.3.6	Signalling system shall enable the Traffic Controller to take Train movement decision based on the indications available with him (i.e., ATS MMI/ Rear Projection Screen (RPS)/Interlocking VDU) in the event of failure of a signal or track equipment due to any reason when a Train operator is to be authorized to pass a signal at red/ blank.	Signalling system shall enable the Traffic Controller to take Train movement decision based on the indications available with him (i.e., ATS MMI/ Video Wall System (VWS)/Interlocking VDU) in the event of failure of a signal or track equipment due to any reason when a Train operator is to be authorized to pass a signal at red/ blank.
218	Part 2	Particular Specification	6.7.3	f) IP 52 for enclosures to be installed in equipment rooms.	f) IP 52 for all equipment enclosures to be installed in equipment rooms which includes active signalling electronic equipements, Termination racks, Relay racks, Power supply equipments, distribution boxes etc. In case if the contractor propose a lower IP rating, the contractor shall ensure that the cabinets/enclosures shall have provision to protect water ingress from water dripping from above using suitable means as approved by the engineer
219	Part 2	Particular Specifications	6.7.3	d) IP 55 for other trackside Signalling equipment including point machine.	d) IP 55 for other trackside Signalling equipment.
220	Part 2	Particular Specifications	6.7.3		g) IP 67 for Point machine type used in mainline.
221	Part 2	PS-Appendix 2R	A.17	Cable termination terminal blocks (WAGO or equivalent)	Cable termination terminal blocks (reputed make)
222	Part 2	PS-Appendix 2R	A.4	Relays, Modems, OLMs, Media converters, switches, servers, patch panels, spice boxes, routers, router power supply etc	Relays, Modems, OLMs, Media converters, switches, servers, patch panels, splice boxes,Communication diodes, routers, router power supply etc

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
223	Part 2	REQUIREMENTS FOR CONTRACTOR'S TECHNICAL PROPOSALS	B. Communication Based Train Control (CBTC)	 (xiii) System Requirements for Rear Projection Screen (RPS) at Operation Control Centre (OCC) and Back Up Control Centre (BOCC): The Contractor shall submit: a) Preliminary layout, Physical dimensions, aesthetic features, and visibility. b) Brief technical description and block schematic diagram. c) Power Supply requirements. 	 (xiii) System Requirements for Video Wall System (VWS) at OCC and BOCC The Contractor shall submit: a) Preliminary layout, Physical dimensions, aesthetic features, and visibility. b) Brief technical description and block schematic diagram. c) Power Supply requirements.
224	Part 2	PS-Appendix 2R	B.4	All other type of displays used (except RPS)	All other type of displays used (except Video wall system)
225	Part 2	PS-Appendix 2R	B.5	Rear Projection system (RPS) Nil. Spares and consumables for RPS shall be part of comprehensive maintenance,	Video Wall System (VWS) Nil. Spares and consumables for VWS shall be part of comprehensive maintenance,
226	Part 2	PS-Appendix 2R	C.9	Cable termination terminal blocks (WAGO or equivalent)	Cable termination terminal blocks (reputed make)
227	Part 3	Particular Conditions - Specific Provisions	Cl. 10 (SP 1.5)	Replace Sub-Clause 1.5 with the following: The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence: (a) the Contract Agreement along with Schedules, (b) the Letter of Acceptance (LOA), (c) Addendum/Corrigendum to Tender (d) the Particular Conditions – Part A (Contract Data) (e) the Particular Conditions – Part B (Specific Provisions) (f) the General Conditions (g) Employer's Requirements – Particular Specifications (h) Employer's Requirements – General Specifications (j) Price bid documents (j) Price bid documents (k) the Acknowledgement of Compliance with Guidelines for Procurement under Japanese ODA Loan (l) any other documents forming part of the contract If an ambiguity or discrepancy is found in the documents, the Engineer shall issue any necessary clarification or instruction.	Replace Sub-Clause 1.5 with the following: The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence: (a) the Contract Agreement along with Schedules, (b) the Letter of Acceptance (LoA), (c) Addendum/Corrigendum to Tender (d) the Particular Conditions – Part A (Contract Data) (e) the Particular Conditions – Part B (Specific Provisions) (f) the General Conditions (g) Employer's Requirements – Particular Specifications (h) Employer's Requirements – General Specifications (i) Responses to Prebid queries (j) Technical bid documents (k) Price bid documents (l) the Acknowledgement of Compliance with Guidelines for Procurement under Japanese ODA Loan (m) any other documents forming part of the contract If an ambiguity or discrepancy is found in the documents, the Engineer shall issue any necessary clarification or instruction.

SN	Part	Section	Clause	Original Bid condition	Revised bid condition	
228	Part 3	Particular conditions	Cl. 49 (SP 14.2) - 4th Para	The Second & final instalment of the Advance Payment may be paid after: (i) the required Bank Guarantee in the specified format from banks as mentioned above is submitted (ii) the evidence for satisfactory utilization of the First instalment of mobilization is submitted; (iii) mobilization of all the Key Personnel and Equipments as per contract and (iv) Completion of 60% of Preliminary design (Price Centre A2).	The Second & final instalment of the Advance Payment may be paid after: (i) the required Bank Guarantee in the specified format from banks as mentioned above is submitted (ii) the evidence for satisfactory utilization of the First instalment of mobilization is submitted; (iii) mobilization of relavant Key Personnel (Project Manager, Engineering Manager and Interface manager) as per contract and (ir Completion of 60% of Preliminary design (Price Centre A2).	
229	Part 2	GS- Appendix 2B	Contract Key Dates & Completion dates	N/A	Refer the Revised Access Dates and Key dates	
230	Part 2	PS-Appendix 2R	D.11	Cable termination terminal blocks (WAGO or equivalent)	Cable termination terminal blocks (reputed make)	
231	Part 2	PS- Appendix 2C	Depot control Room (Depot building)- 2 Depots		Depot controller -VDU- No of postions: 1 Screens: 2	
232	Part 2	PS- Appendix 2C	Depot control Room (Depot building)- 2 Depots	Depot controller (ATS work station) No of postions: 1 Screens each: 3	Depot controller (ATS work station) No of postions: 2 Screens each: 3	
233	Part 2	PS-Appendix 2D	Depot control Room (Depot building)- 2 Depots	Depot Controller 1 Video wall Depot controller 1 1	Depot Controller Controller position: 2 Screen per controller: 1 # work stations required for powering the video wall shall be extra from above.	
234	Part 1	Section - III. EVALUATION AND QUALIFICATION CRITERIA (EQC)	EQC 2.4.1	In case of JV: All Parties Combined: N/A Each Member -> Must Meet Requirement Lead Member -> N/A	In case of JV: All Parties Combined: N/A Each Member -> NA Lead Member -> Must Meet Requirement	

SN	Part	Section	Clause	Original Bid condition	Revised bid condition	
235	Part 2	PS-Appendix 2R	G.1	Point machine each type (Depot and mainline) 10% of used item of each type	Point machine each type (Depot and mainline) 10% of used item of Mainline Point machine 20% of used item of Depot Point machine	
236	Part 2	PS-Appendix 2P-2	INTERFACE- Division of Responsibility		Item: Display of PSD diagnostics system feed in Video wall systems at OCC/BOCC. STC contractor: Shall connect the feed and arrange for the display of PSD health information PSD contractors: Shall extend the PSD diagnostics systems feed in a format compatible with the displays, as specified by the Signaling Contractor.	
237	Part 2	PS-Appendix 2P-3	INTERFACE- Division of Responsibility	Item: Display of CCTV images in RPS at OCC/BCC and display screens in SCC STC contractor: Shall connect the feed and arrange for the display of CCTV information Telecom contractor: Shall extend the video feed in a format compatible with the displays, as specified by the Signaling Contractor.	Item: Display of CCTV images in Video Wall at OCC/BOCC/DCC/SCC. STC contractor: Shall connect the feed and arrange for the display of CCTV information Telecom contractor: Shall extend the video feed in a format compatible with the displays, as specified by the Signaling Contractor.	
238	Part 2	PS-Appendix 2P-10	Name	Interface protocol between Signalling and Train Control system (S&TC) and Train Auto wash plant system	Interface protocol between Signalling and Train Control system (S&TC) and Depot Machines	
239	Part 2	PS-Appendix 2C	OCC theatre (BOCC building)	Traffic Controllers Controller postion:10 Screens per controller: 3 Traffic controller -VDU: Controller postion:10 Screens per controller:3 Passenger information controller: controller position:4 Screens per controller: 2 Asst. Chief controller: Controller position:3 Screens per controller: 3 Chief controller: Controller position: 1 Screens per controller: 1 Fault management Controller (FMC): CPntroller position: 1 Screens per controller: 3 Centralised maintenance and diagnostic workstation* (FMC desk) 1 Screen per controller: 2 Realtime and playback*: event log and train borne log tracing workstation (FMC desk) 1 Screen per controller: 1 Rear Projection system 1 As per ergonomic study Auxiliary controller COntroller position: 1 Screen per controller: 1 Online Timetable workstation 1 Screen per controller: 1	Traffic Controllers Controller postion:6 Screens per controller: 3 Traffic controller -VDU: Controller postion:6 Screens per controller:2 Passenger information controller: controller position:2 Screens per controller: 3 Asst. Chief controller: Controller position: 2 Screens per controller: 3 Chief controller: Controller position: 2 Screens per controller: 1 Fault management Controller position: 2 Screen per controller: 1 Fault management Controller (FMC): Controller position: 2 Screens per controller: 3 Centralised maintenance and diagnostic workstation* (FMC desk) 2 sets Screen per controller: 2 Realtime and playback*: event log and train borne log tracing workstation (FMC desk) 2 sets Screen per controller: 1 Online Timetable workstation (Cheif controller desk) 1 Screen per controller: 1 # work stations required for powering the video wall shall be extra from above.	

SN	Part	Section	Clause	Original Bid condition	Revised bid condition
240	Part 2	PS-Appendix 2D	OCC theatre (BOCC building)	Traffic Controllers Controller positions: 10 Screen per controller: 1 Passenger information controller Controller positions: 4 Screen per controller: 2 Rear Projection system 1 As per ergonomic study	Traffic Controllers Controller postion:6 Screens per controller: 1 Passenger information controller: controller position:2 Screens per controller: 1 Asst. Chief controller: Controller position: 2 Screens per controller: 1 Chief controller: Controller position: 1 Screens per controller: 1 Rolling stock controller: Controller position: 2 Screen per controller: 1 # work stations required for powering the video wall shall be extra from above.
241	Part 2	PS-Appendix 2C	OCC theatre (OCC building)	Traffic Controllers Controller postion:10 Screens per controller: 3 Traffic controller -VDU: Controller postion:10 Screens per controller:3 Passenger information controller: controller position:4 Screens per controller: 2 Asst. Chief controller: Controller position: 3 Screens per controller: 3 Chief controller: Controller position: 1 Screens per controller: 1 Fault management Controller (FMC): CPntroller position: 1 Screens per controller: 3 Centralised maintenance and diagnostic workstation* (FMC desk) 1 Screen per controller: 2 Realtime and playback*: event log and train borne log tracing workstation (FMC desk) 1 Screen per controller: 1 Rear Projection system 1 As per ergonomic study Auxiliary controller COntroller position: 1 Screen per controller: 1 Online Timetable workstation 1 Screen per controller: 1	Traffic Controllers Controller postion:9 Screens per controller: 3 Traffic controller -VDU: Controller postion:9 Screens per controller:2 Passenger information controller: controller position:2 Screens per controller: 3 Asst. Chief controller: Controller position: 3 Screens per controller: 3 Chief controller: Controller position: 1 Screens per controller: 1 Rolling stock controller: Controller position: 3 Screen per controller: 1 Fault management Controller (FMC): Controller position: 3 Screens per controller: 3 Centralised maintenance and diagnostic workstation* (FMC desk) 3 sets Screen per controller: 2 Realtime and playback*: event log and train borne log tracing workstation (FMC desk) 3 sets Screen per controller: 1 Online Timetable workstation (Cheif controller desk) 1 Screen per controller: 1 # work stations required for powering the video wall shall be extra from above.
242	Part 2	PS-Appendix 2D	OCC theatre (OCC building)	Traffic Controllers Controller positions: 10 Screen per controller: 1 Passenger information controller Controller positions: 4 Screen per controller: 2 Rear Projection system 1 As per ergonomic study	Traffic Controllers Controller postion:9 Screens per controller: 1 Passenger information controller: controller position:2 Screens per controller: 1 Asst. Chief controller: Controller position:3 Screens per controller: 1 Chief controller: Controller position: 1 Screens per controller: 1 Rolling stock controller: Controller position: 3 Screen per controller: 1 # work stations required for powering the video wall shall be extra from above.
243	Part 2	REQUIREMENTS FOR CONTRACTOR'S TECHNICAL PROPOSALS	PART A: Technical Information Signalling and Train Control Systems	F Rear Projection Screen (RPS) OCC/BCC Laser Type	F Video Wall System (VMS) OCC/BCC/DCC/SCC LCD type
244	Part 2	REQUIREMENTS FOR CONTRACTOR'S TECHNICAL PROPOSALS	PART B: Information regarding Performance of the offered equipment elsewhere	F Rear Projection Screen (RPS) OCC/BCC Laser Type	F Video Wall System (VMS) OCC/BCC/DCC/SCC LCD type

SN	Part	Section	Clause	Original Bid condition	Revised bid condition	
245	Part 2	REQUIREMENTS FOR CONTRACTOR'S TECHNICAL PROPOSALS	Part C: Proposal for Sub- Contracted Works	B Rear Projection Screen (RPS) Laser type	B Video Wall System (VMS) LCD type	
246	Part 2	PS-Appendix 2D	Security Control Room (BOCC building)	Video wall 1 Video wall	# work stations required for powering the video wall shall be extra from above.	
247	Part 2	PS-Appendix 2D	Security Control Room (OCC building)	Video wall 1 Video wall	# work stations required for powering the video wall shall be extra from above.	
248	Part 2	PS-Appendix 2C	Table	Screens per position 22"LCD screen	Screens per position 24"LCD screen	
249	Part 2	PS- Appendix 2C	Training Room	As per PS 5.16.25	As per PS 5.20.26.2	
250	Part 2	PS- Appendix 2C		Depot control Room (Depot building)- 2 Depots Depot Controller No of controllers: 1 Screen per position: 3 Video wall 1 Videowall	Depot control Room (Depot building)- 2 Depots Depot Controller No of controllers: 2 Screen per position: 3 Depot controller VDU: 1 Screen per position: 2 Video wall 1 Videowall	
251	Part 2	Particular Specifications	14.7.5		The contractor shall submit all necessary interface control documentation of ATS system with all other sub- systems of Signalling, namely Interlocking, ATP, ATO/UTO,DCS,VMS etc The document shall clearly identify the protocols and all other communication parameters, Interface telegrams, IP addresses, encryption details, data structure, definition of data etc used for this project, so that the employer, if found necessary, can adopt any third party ATS system in future and integrate to the Signalling system (Interlocking, ATP,UTO,DCS,VMS) supplied by the contractor with no support requirement from the contractor. The document shall be validated as a part of the testing of the signaling system to ensure the correctness. This shall be one of the design documents to be submitted during detailed design phase, for Notice of No Objection from the Engineer.	
252	Part 2	PS-Appendix 2P-12			Refer the Appendix 2P-12 attached	
253	Part 2	PS-Appendix 2P-11			Refer the Appendix 2P-11 attached	

Key Date Ref.	Description	Calendar days from Commenc ement date	Associated Price Centres for purposes of Liquidated Damages
SIG- ARE04- KD-004	Complete joint installation and testing of Signalling train borne equipment for the proto type rake (3 cars) at the car builders factory	760	Total of Price Centres - J2.3.2 (proportionate cost)
SIG- ARE04- KD-005	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 1 st production rakes (6 Train sets) installation	800	Total of Price Centres - J2.1.2, J2.2.2 (proportionate cost)
SIG- ARE04- KD-006	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 2 nd production rakes (6 Train sets) installation	860	Total of Price Centres - J2.1.2, J2.2.2 (proportionate cost)
SIG- ARE04- KD-007	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 3 rd production rakes (6 Train sets) installation	920	Total of Price Centres - J2.1.2, J2.2.2 (proportionate cost)
SIG- ARE04- KD-008	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 4 th production rakes (6 Train sets) installation	980	Total of Price Centres - J2.1.2, J2.2.2 (proportionate cost)
SIG- ARE04- KD-009	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 5 th production rakes (6 Train sets) installation	1040	Total of Price Centres - J2.1.2, J2.2.2 (proportionate cost)
SIG- ARE04- KD-010	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 6 th production rakes (6 Train sets) installation	1100	Total of Price Centres - J2.1.2, J2.2.2 (proportionate cost)
SIG- ARE04- KD-011	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 7 th production rakes (5 Train sets) installation	1160	Total of Price Centres - J2.1.2, J2.2.2 (proportionate cost)
SIG- ARE04- KD-012	Complete joint installation and testing of Signalling train borne equipment for the 1 st production rakes (6 Train sets) at the car builders factory	860	Total of Price Centres - J2.3.2 (proportionate cost)
SIG- ARE04- KD-013	Complete joint installation and testing of Signalling train borne equipment for the 2 nd production rakes (6 Train sets) at the car builders factory	920	Total of Price Centres - J2.3.2 (proportionate cost)
SIG- ARE04- KD-014	Complete joint installation and testing of Signalling train borne equipment for the 3 rd production rakes (6 Train sets) at the car builders factory	980	Total of Price Centres - J2.3.2 (proportionate cost)
SIG- ARE04- KD-015	Complete joint installation and testing of Signalling train borne equipment for the 4 th production rakes (6 Train sets) at the car builders factory	1040	Total of Price Centres - J2.3.2 (proportionate cost)
SIG- ARE04- KD-016	Complete joint installation and testing of Signalling train borne equipment for the 5 th production rakes (6 Train sets) at the car builders factory	1100	Total of Price Centres - J2.3.2 (proportionate cost)
SIG- ARE04- KD-017	Complete joint installation and testing of Signalling train borne equipment for the 6 th production rakes (6 Train sets) at the car builders factory	1160	Total of Price Centres - J2.3.2 (proportionate cost)
SIG- ARE04- KD-018	Complete joint installation and testing of Signalling train borne equipment for the 7 th production rakes (5 Train sets) at the car builders factory	1220	Total of Price Centres - J2.3.2 (proportionate cost)
	Key dates Associated to Rolling stock - ARE02 Contract		
SIG- ARE02- KD-001	Complete preliminary definition of mechanical and electrical interface between Signalling train borne equipment and rolling stock of ARE 02	300	Total of Price Centres – A2.1+A2.2+A2.3+A2.4
SIG- ARE02- KD-002	Complete Final Detailed Design Submission for the ARE 02 Rolling stock in accordance with Specification	500	Total of Price Centres – D1.S3A.1.1, D1.S3A.1.3, D1.S3A.1.4,

Key Date Ref.	Description	Calendar days from Commenc ement date	Associated Price Centres for purposes of Liquidated Damages
			D1.S3A.1.8, D1.S3A.1.10, D1.S3A.1.11
SIG- ARE02- KD-003	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the proto type rake (3 cars) installation	750	Total of Price Centre J1.1 +J1.2 (proportionate share)
SIG- ARE02- KD-004	Complete joint installation and testing of Signalling train borne equipment for the proto type rake (3 cars) at the car builders factory	810	Total of Price Centre J1.3 (proportionate share)
SIG- ARE02- KD-005	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 1 st production rakes (8 Train sets) installation	1010	Total of Price Centre J1.1 +J1.2 (proportionate share)
SIG- ARE02- KD-006	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 2 nd production rakes (7 Train sets) installation	1070	Total of Price Centre J1.1 +J1.2 (proportionate share)
SIG- ARE02- KD-007	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 3 rd production rakes (7 Train sets) installation	1140	Total of Price Centre J1.1 +J1.2 (proportionate share)
SIG- ARE02- KD-008	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 4 th production rakes (7 Train sets) installation	1200	Total of Price Centre J1.1 +J1.2 (proportionate share)
SIG- ARE02- KD-009	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 5 th production rakes (6 Train sets) installation	1260	Total of Price Centre J1.1 +J1.2 (proportionate share)
SIG- ARE02- KD-010	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 6 th production rakes (6 Train sets) installation	1310	Total of Price Centre J1.1 +J1.2 (proportionate share)
SIG- ARE02- KD-011	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 7 th production rakes (6 Train sets) installation	1370	Total of Price Centre J1.1 +J1.2 (proportionate share)
SIG- ARE02- KD-012	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 8 th production rakes (8 Train sets) installation	1450	Total of Price Centre J1.1 +J1.2 (proportionate share)
SIG- ARE02- KD-013	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 9 th production rakes (7 Train sets) installation	1510	Total of Price Centre J1.1 +J1.2 (proportionate share)
SIG- ARE02- KD-014	Complete delivery of the Signalling train borne equipment to the Rolling Stock Contractor's car building factory for the 10 th production rakes (7 Train sets) installation	1570	Total of Price Centre J1.1 +J1.2 (proportionate share)
SIG- ARE02- KD-015	Complete joint installation and testing of Signalling train borne equipment for the 1 st production rakes (8 Train sets) at the car builders factory	1070	Total of Price Centre J1.3 (proportionate share)
SIG- ARE02- KD-016	Complete joint installation and testing of Signalling train borne equipment for the 2 nd production rakes (7 Train sets) at the car builders factory	1130	Total of Price Centre J1.3 (proportionate share)
SIG- ARE02- KD-017	Complete joint installation and testing of Signalling train borne equipment for the 3 rd production rakes (7 Train sets) at the car builders factory	1200	Total of Price Centre J1.3 (proportionate share)
SIG- ARE02- KD-018	Complete joint installation and testing of Signalling train borne equipment for the 4 th production rakes (7 Train sets) at the car builders factory	1260	Total of Price Centre J1.3 (proportionate share)
SIG- ARE02- KD-019	Complete joint installation and testing of Signalling train borne equipment for the 5 th production rakes (6 Train sets) at the car builders factory	1320	Total of Price Centre J1.3 (proportionate share)

Key Date Ref.	Description	Calendar days from Commenc ement date	Associated Price Centres for purposes of Liquidated Damages
SIG- ARE02- KD-020	Complete joint installation and testing of Signalling train borne equipment for the 6 th production rakes (6 Train sets) at the car builders factory	1370	Total of Price Centre J1.3 (proportionate share)
SIG- ARE02- KD-021	Complete joint installation and testing of Signalling train borne equipment for the 7 th production rakes (6 Train sets) at the car builders factory	1430	Total of Price Centre J1.3 (proportionate share)
SIG- ARE02- KD-022	Complete joint installation and testing of Signalling train borne equipment for the 8 th production rakes (8 Train sets) at the car builders factory	1510	Total of Price Centre J1.3 (proportionate share)
SIG- ARE02- KD-023	Complete joint installation and testing of Signalling train borne equipment for the 9 th production rakes (7 Train sets) at the car builders factory	1570	Total of Price Centre J1.3 (proportionate share)
SIG- ARE02- KD-024	Complete joint installation and testing of Signalling train borne equipment for the 10 th production rakes (7 Train sets) at the car builders factory	1630	Total of Price Centre J1.3 (proportionate share)
	Stage 1 Revenue Service		
	Wayside Equipment		
SIG-S1- KD-001	Complete Preliminary Design Submission for the entire Phase 2 in accordance with Specification	180	Total of Price Centre A2
SIG-S1- KD-002	Complete Final Detailed Design Submission for the Stage 1 in accordance with Specification	360	Total of Price Centre B.S1.1
	Poonamallee Depot		
SIG-S1- KD-003	Complete installation and testing of Signalling equipment on test track in Poonamalle Depot	560	Total of cost centres B.S1.2.3 to 2.8, B.S1.2.10, B.S1.2.11, B.S1.3.4, B.S1.3.6
SIG-S1- KD-004	Complete installation and testing of Signalling equipment on Priority Section (Stabling Line 8 to 14, Inspection Bay 1 to 2) in Poonamalle Depot	650	Total of cost centres B.S1.2.3 to 2.8, B.S1.2.10, B.S1.2.11, B.S1.3.4, B.S1.3.6
SIG-S1- KD-005	Complete installation and testing of Signalling equipment on Non Priority Section (Stabling Line 1 to 7, Inspection Bay 3 to 4, Repair bay, Depot Open Area) in Poonamalle Depot	780	Total of cost centres B.S1.2.3 to 2.8, B.S1.2.10, B.S1.2.11, B.S1.3.4, B.S1.3.6
SIG-S1- KD-006	Complete SAT of entire Signalling system in Test Track and interlocking system for priority area of depot, with safety case	680	B.S1.4
SIG-S1- KD-007	Complete SAT of entire Signalling system in Test Track and interlocking system for Non priority area of depot, with safety case	840	B.S1.4
	C4-ECV02		
SIG-S1- KD-008	Complete installation and testing of Communication Network backbone for Corridor 4 -ECV 02 Section	670	Total of cost centres B.S1.2.2, B.S1.2.3, B.S1.3.4, B.S1.3.5
SIG-S1- KD-009	Complete installation and static testing of the Signalling system (excluding part for Poonamalle Depot operation) for Corridor 4 ECV 02	760	Total of cost centres B.S1.2.1, B.S1.2.2, B.S1.2.5 To 2.11, B.S1.3.1, B.S1,3.2, B.S1.3.3, B.S1.3.5, B.S1.3.7
SIG-S1- KD-010	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Poonamalle Depot operation) for Corridor 4 ECV 02	1020	B.S1.4

Key Date Ref.	Description	Calendar days from Commenc ement date	Associated Price Centres for purposes of Liquidated Damages
	C4-ECV01		U
SIG-S1- KD-011	Complete installation and testing of Communication Network backbone for Corridor 4 -ECV 01 Section and make it available to Interfacing Contractors for various systems testing together with OCC and associated equipment in Administration Building	720	Total of cost centres B.S1.2.2, B.S1.2.3, B.S1.3.4, B.S1.3.5
SIG-S1- KD-012	Complete installation and static testing (including interface testing with OCC) of the Signalling system (excluding part for Poonamalle Depot operation) for Corridor 4 ECV 01	810	Total of cost centres B.S1.2.1, B.S1.2.2, B.S1.2.5 To 2.11, B.S1.3.1, B.S1,3.2, B.S1.3.3, B.S1.3.5, B.S1.3.7
SIG-S1- KD-013	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Poonamalle Depot operation) for Corridor 4 ECV 01	1020	B.S1.4
SIG-S1- KD-014	Issue of Completion Certificate including safety case (Including conditions for O&M) for Stage 1 Revenue Service	1050	B.S1.4
SIG-S1- KD-015	CMRL -ISA Assessment for CMRS	1080	B.S1.4
SIG-S1- KD-016	Achieve Operational Acceptance for Stage 1 Revenue Service	1590	B.S1.4
	Stage 2 Revenue Service		
	Wayside Equipment		
SIG-S2- KD-001	Complete Final Detailed Design Submission for the Stage 2 in accordance with Specification	710	C.S2.1
SIG-S2- KD-002	Complete installation and testing of Communication Network backbone for Corridor 5 -ECV 02 Section and make it available to Interfacing Contractors for various systems testing together with OCC and associated equipment in Administration Building	930	Corresponding detailed cost centres of Stage 2, on the same pattern as in Stage 1 above
SIG-S2- KD-003	Complete installation and static testing (including interface testing with OCC) of the Signalling system (excluding part for Poonamalle Depot operation) for Corridor 5 ECV 02	1020	Corresponding detailed cost centres of Stage 2, on the same pattern as in Stage 1 above
SIG-S2- KD-004	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Poonamalle Depot operation) for Corridor 5 ECV 02	1200	Corresponding detailed cost centres of Stage 2, on the same pattern as in Stage 1 above
	C5-ECV 03		
SIG-S2- KD-005	Complete installation and testing of Communication Network backbone for Corridor 5 -ECV 03 Section	890	Corresponding detailed cost centres of Stage 2, on the same pattern as in Stage 1 above
SIG-S2- KD-006	Complete installation and static testing of the Signalling system (excluding part for Poonamalle Depot operation) for Corridor 5 ECV 03	980	Corresponding detailed cost centres of Stage 2, on the same pattern as in Stage 1 above
SIG-S2- KD-007	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Poonamalle Depot operation) for Corridor 5 ECV 03	1200	Corresponding detailed cost centres of Stage 2, on the same pattern as in Stage 1 above
SIG-S2- KD-008	Issue of Completion Certificate including safety case (Including conditions for O&M) for Stage 2 Revenue Service	1230	Corresponding detailed cost centres of Stage 2,

Key Date Ref.	Description	Calendar days from Commenc ement date	Associated Price Centres for purposes of Liquidated Damages
			on the same pattern as in Stage 1 above
SIG-S2- KD-009	CMRL - ISA Assessment for CMRS	1260	Corresponding detailed cost centres of Stage 2, on the same pattern as in Stage 1 above
SIG-S2- KD-010	Achieve Operational Acceptance for Stage 2 Revenue Service	1770	Corresponding detailed cost centres of Stage 2, on the same pattern as in Stage 1 above
	Stage 3 Revenue Service		
	Wayside Equipment		
SIG-S3- KD-001	Complete Final Detailed Design Submission for the Stage 3 in accordance with Specification	730	Sum of D1.S3A.1, D2.S3B.1
	Complete installation and testing of Communication Naturals	010	Corresponding datailed
KD-002	backbone for Corridor 3 -ECV 01 Section	910	cost centres of Stage 3B, on the same pattern as in Stage 1 above
SIG-S3- KD-003	Complete installation and static testing of the Signalling system (excluding part for Poonamalle Depot operation) for Corridor 3 ECV 01	1000	Corresponding detailed cost centres of Stage 3B, on the same pattern as in Stage 1 above
SIG-S3- KD-004	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Poonamalle Depot operation) for Corridor 3 ECV 01	1310	Corresponding detailed cost centres of Stage 3B, on the same pattern as in Stage 1 above
	CP08-EV01		
SIG-S3- KD-005	Complete installation and testing of Communication Network backbone for Corridor 3 -EV 01 Section and make it available to Interfacing Contractors for various systems testing together with OCC and associated equipment in Administration Building	1040	Corresponding detailed cost centres of Stage 3A, on the same pattern as in Stage 1 above
SIG-S3- KD-006	Complete installation and static testing (including interface testing with OCC) of the Signalling system (excluding part for Poonamalle Depot operation) for Corridor 3 EV 01	1130	Corresponding detailed cost centres of Stage 3A, on the same pattern as in Stage 1 above
SIG-S3- KD-007	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Poonamalle Depot operation) for Corridor 3 EV 01	1310	Corresponding detailed cost centres of Stage 3A, on the same pattern as in Stage 1 above
SIG-S3- KD-008	Issue of Completion Certificate including safety case (Including conditions for O&M) for Stage 3 Revenue Service	1340	Corresponding detailed cost centres of Stage 3A, on the same pattern as in Stage 1 above
SIG-S3- KD-009	CMRL -ISA Assessment for CMRS	1370	Corresponding detailed cost centres of Stage 3A, on the same pattern as in Stage 1 above

Key Date Ref.	Description	Calendar days from Commenc ement date	Associated Price Centres for purposes of Liquidated Damages
SIG-S3- KD-010	Achieve Operational Acceptance for Stage 1 Revenue Service	1880	Corresponding detailed cost centres of Stage 3A, on the same pattern as in Stage 1 above
	Stage 4A Revenue Service		
	Wayside Equipment		
SIG- S4a-KD- 001	Complete Final Detailed Design Submission for the Stage 4A in accordance with Specification	900	E1.S4A.1
	C4-UG02		
SIG- S4a-KD- 002	Complete installation and testing of Communication Network backbone for Corridor 4 -UG 02 Section and make it available to Interfacing Contractors for various systems testing together with OCC and associated equipment in Administration Building	1080	Corresponding detailed cost centres of Stage 4A, on the same pattern as in Stage 1 above
SIG- S4a-KD- 003	Complete installation and static testing (including interface testing with OCC) of the Signalling system (excluding part for Madhavaram Depot operation) for Corridor 4 UG 02	1170	Corresponding detailed cost centres of Stage 4A, on the same pattern as in Stage 1 above
SIG- S4a-KD- 004	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Madhavaram Depot operation) for Corridor 4 UG 02	1350	Corresponding detailed cost centres of Stage 4A, on the same pattern as in Stage 1 above
SIG- S4a-KD- 005	Issue of Completion Certificate including safety case (Including conditions for O&M) for Stage 4a Revenue Service	1380	Corresponding detailed cost centres of Stage 4A, on the same pattern as in Stage 1 above
SIG- S4a-KD- 006	CMRL -ISA Assessment for CMRS	1410	Corresponding detailed cost centres of Stage 4A, on the same pattern as in Stage 1 above
SIG- S4a-KD- 007	Achieve Operational Acceptance for Stage 4A Revenue Service	1920	Corresponding detailed cost centres of Stage 4A, on the same pattern as in Stage 1 above
	Stage 4B Revenue Service		
	Wayside Equipment		
SIG- S4b-KD- 001	Complete Final Detailed Design Submission for the Stage 4B in accordance with Specification	750	E2.S4B.1
	Madhavaram Depot		
SIG- S4b-KD- 002	Complete installation and testing of Signalling equipment on Zone 1&2 - workshop building its approaches, shunting neck 01 and Test track including train delivery area in Madhavaram Depot	930	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above

Key Date Ref.	Description	Calendar days from Commenc ement date	Associated Price Centres for purposes of Liquidated Damages
SIG- S4b-KD- 003	Complete installation and testing of Signalling equipment on Zone 3&4 - second half of stabling line + connection to mainline in Madhavaram Depot	1020	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above
SIG- S4b-KD- 004	Complete SAT of entire Signalling system in Test Track and interlocking system for Zone 1 & 2 of depot ,with safety case	960	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above
SIG- S4b-KD- 005	Complete SAT of entire Signalling system in Test Track and interlocking system for Zone 3 & 4 of depot ,with safety case	1080	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above
	CP10-EV03		
SIG- S4b-KD- 006	Complete installation and testing of Communication Network backbone for Corridor 5 -EV 03 Section	1090	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above
SIG- S4b-KD- 007	Complete installation and static testing of the Signalling system (excluding part for Madhavaram Depot operation) for Corridor 5 EV 03	1180	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above
SIG- S4b-KD- 008	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Madhavaram Depot operation) for Corridor 5 EV 03	1430	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above
	CP06-UG06		
SIG- S4b-KD- 009	Complete installation and testing of Communication Network backbone for Corridor 5 -UG 06 Section and make it available to Interfacing Contractors for various systems testing together with OCC and associated equipment in Administration Building	1140	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above
SIG- S4b-KD- 010	Complete installation and static testing (including interface testing with OCC) of the Signalling system (excluding part for Madhavaram Depot operation) for Corridor 5 UG 06	1230	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above
SIG- S4b-KD- 011	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Madhavaram Depot operation) for Corridor 5 UG 06	1410	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above
SIG- S4b-KD- 012	Issue of Completion Certificate including safety case (Including conditions for O&M) for Stage 4b Revenue Service	1440	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above
SIG- S4b-KD- 013	CMRL -ISA Assessment for CMRS	1470	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above

Key Date Ref.	Description	Calendar days from Commenc ement date	Associated Price Centres for purposes of Liquidated Damages
SIG- S4b-KD- 014	Achieve Operational Acceptance for Stage 4B Revenue Service	1980	Corresponding detailed cost centres of Stage 4B, on the same pattern as in Stage 1 above
	Stage 5 Revenue Service		
	Wayside Equipment		
SIG-S5- KD-001	Complete Final Detailed Design Submission for the Stage 5 in accordance with Specification	1050	Total of Price Centre F.S5.1
	CP01-UG01		Corresponding detailed cost centres of Stage 5, on the same pattern as in Stage 1 above
SIG-S5- KD-002	Complete installation and testing of Communication Network backbone for Corridor 3-UG 01 Section	1230	Corresponding detailed cost centres of Stage 5, on the same pattern as in Stage 1 above
SIG-S5- KD-003	Complete installation and static testing of the Signalling system (excluding part for Madhavaram Depot operation) for Corridor 3 UG 01	1320	Corresponding detailed cost centres of Stage5, on the same pattern as in Stage 1 above
SIG-S5- KD-004	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Madhavaram Depot operation) for Corridor 3 UG 01	1570	Corresponding detailed cost centres of Stage 5, on the same pattern as in Stage 1 above
	CP02-UG02		¥
SIG-S5- KD-005	Complete installation and testing of Communication Network backbone for Corridor 3 -UG 02 Section and make it available to Interfacing Contractors for various systems	1300	Corresponding detailed cost centres of Stage5, on the same pattern as in Stage 1 above
SIG-S5- KD-006	Complete installation and static testing (including interface testing with OCC) of the Signalling system (excluding part for Madhavaram Depot operation) for Corridor 3 UG 02	1390	Corresponding detailed cost centres of Stage5, on the same pattern as in Stage 1 above
SIG-S5- KD-007	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Madhavaram Depot operation) for Corridor 3 UG 02	1570	Corresponding detailed cost centres of Stage5, on the same pattern as in Stage 1 above
SIG-S5- KD-008	Issue of Completion Certificate including safety case (Including conditions for O&M) for Stage 5 Revenue Service	1600	Corresponding detailed cost centres of Stage5, on the same pattern as in Stage 1 above
SIG-S5- KD-009	CMRL -ISA Assessment for CMRS	1630	Corresponding detailed cost centres of Stage5, on the same pattern as in Stage 1 above
SIG-S5- KD-010	Achieve Operational Acceptance for Stage 5 Revenue Service	2140	Corresponding detailed cost centres of Stage5, on the same pattern as in Stage 1 above
	Stage 6 Revenue Service		
	Wayside Equipment		
SIG-S6- KD-001	Complete Final Detailed Design Submission for the Stage 6 in accordance with Specification	1280	Total of Price Centre G.S6.1

Key Date Ref.	Description	Calendar days from Commenc ement date	Associated Price Centres for purposes of Liquidated Damages
	CP03-UG03		
SIG-S6- KD-002	Complete installation and testing of Communication Network backbone for Corridor 3-UG 03 Section and make it available to Interfacing Contractors for various systems	1460	Corresponding detailed cost centres of Stage 6, on the same pattern as in Stage 1 above
SIG-S6- KD-003	Complete installation and static testing of the Signalling system (excluding part for Madhavaram Depot operation) for Corridor 3 UG 03	1550	Corresponding detailed cost centres of Stage 6, on the same pattern as in Stage 1 above
SIG-S6- KD-004	Complete System Acceptance Test and Integrated Testing the Signalling system (including part for Madhavaram Depot operation) for Corridor 3 UG 03	1730	Corresponding detailed cost centres of Stage 6, on the same pattern as in Stage 1 above
SIG-S6- KD-005	Issue of Completion Certificate including safety case (Including conditions for O&M) for Stage 6 Revenue Service	1760	Corresponding detailed cost centres of Stage 6, on the same pattern as in Stage 1 above
SIG-S6- KD-006	CMRL-ISA Assessment for CMRS	1790	Corresponding detailed cost centres of Stage 6, on the same pattern as in Stage 1 above
SIG-S6- KD-007	Achieve Operational Acceptance for Stage 6 Revenue Service	2300	Corresponding detailed cost centres of Stage 6, on the same pattern as in Stage 1 above
	Stage 7 Revenue Service		
	Wayside Equipment		
SIG-S7- KD-001	Complete Final Detailed Design Submission for the Stage 7 in accordance with Specification	1170	Total of Price Centre H1.S7A.1 and H2.S7B.1
	CP04-UG04		
SIG-S7- KD-002	Complete installation and testing of Communication Network backbone for Corridor 3-UG 04 Section	1470	Corresponding detailed cost centres of Stage 7A, on the same pattern as in Stage 1 above
SIG-S7- KD-003	Complete installation and static testing of the Signalling system (excluding part for Madhavaram Depot operation) for Corridor 3 - UG 04	1560	Corresponding detailed cost centres of Stage 7A, on the same pattern as in Stage 1 above
SIG-S7- KD-004	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Madhavaram Depot operation) for Corridor 3 - UG 04	1740	Corresponding detailed cost centres of Stage 7A, on the same pattern as in Stage 1 above
	CP05-UG05		
SIG-S7- KD-005	Complete installation and testing of Communication Network backbone for Corridor 3 -UG 05 Section and make it available to Interfacing Contractors for various systems	1450	Corresponding detailed cost centres of Stage 7A, on the same pattern as in Stage 1 above
SIG-S7- KD-006	Complete installation and static testing (including interface testing with OCC) of the Signalling system (excluding part for Madhavaram Depot operation) for Corridor 3 UG 05	1540	Corresponding detailed cost centres of Stage 7A, on the same

Key Date Ref.	Description	Calendar days from Commenc ement date	Associated Price Centres for purposes of Liquidated Damages
			pattern as in Stage 1 above
SIG-S7- KD-007	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Madhavaram Depot operation) for Corridor 3 UG 05	1740	Corresponding detailed cost centres of Stage 7A, on the same pattern as in Stage 1 above
	C4-UG01		
SIG-S7- KD-008	Complete installation and testing of Communication Network backbone for Corridor 4 -UG 01 Section and make it available to Interfacing Contractors for various systems testing together with OCC and associated equipment in Administration Building	1350	Corresponding detailed cost centres of Stage 7B, on the same pattern as in Stage 1 above
SIG-S7- KD-009	Complete installation and static testing (including interface testing with OCC) of the Signalling system (excluding part for Poonamallee Depot operation) for Corridor 4 UG 01	1440	Corresponding detailed cost centres of Stage 7B, on the same pattern as in Stage 1 above
SIG-S7- KD-010	Complete System Acceptance Test and Integrated Testing of the Signalling system (including part for Poonamallee Depot operation) for Corridor 4 UG 01	1740	Corresponding detailed cost centres of Stage 7B, on the same pattern as in Stage 1 above
SIG-S7- KD-011	Issue of Completion Certificate including safety case (Including conditions for O&M) for Stage 7 Revenue Service	1770	Corresponding detailed cost centres of Stage 7B, on the same pattern as in Stage 1 above
SIG-S7- KD-012	CMRL -ISA Assessment for CMRS	1800	Corresponding detailed cost centres of Stage 7B, on the same pattern as in Stage 1 above
SIG-S7- KD-013	Achieve Operational Acceptance for Stage 7 Revenue Service	2310	Corresponding detailed cost centres of Stage 7B, on the same pattern as in Stage 1 above

Key Date Ref.	Description	Calendar days from commencement
SIG- OMV- KD-001	Complete preliminary definition of mechanical and electrical interface between Signalling train borne equipment and OMV	180.00
SIG- OMV- KD-002	Complete Final Detailed Design Submission for the OMV in accordance with Specification	260.00

Key Date Ref.	Description	Calendar days from commencement
SIG- OMV- KD-003	Complete delivery of the Signalling train borne on board equipment for OMV 1 (Corridor 4) to the Contractor's car building factory for installation	490.00
SIG- OMV- KD-004	Complete joint installation and testing of Signalling train borne equipment for the OMV 1 at the car builders' factory	550.00
SIG- OMV- KD-005	Complete Static & Dynamic (integration)testing for OMV 1 in the Depot & Main line	820.00
SIG- OMV- KD-006	Complete delivery of the Signalling train borne on board equipment for OMV 2 (Corridor 5) to the Contractor's car building factory for installation	770.00
SIG- OMV- KD-007	Complete joint installation and testing of Signalling train borne equipment for the OMV 2 at the car builders' factory	830.00
SIG- OMV- KD-008	Complete Static & Dynamic (integration)testing for OMV 2 in the Depot & Main line	1100.00
SIG- OMV- KD-009	Complete delivery of the Signalling train borne on board equipment for OMV 3 (Corridor 3) to the Contractor's car building factory for installation	770.00
SIG- OMV- KD-010	Complete joint installation and testing of Signalling train borne equipment for the OMV 3 at the car builders' factory	830.00
SIG- OMV- KD-011	Complete Static & Dynamic (integration)testing for OMV 3 in the Depot & Main line	1220.00

Table 2: Site Access Dates

Access Date Ref.	Access Date Description	Access Days from Commencement date	Provision of Earthing, UPS & Air con in the Signaling equipment room & Station Control room
Poonamallee Depo	t		
SIG-S1-AD-001	Access Date to Signaling Contractor in Poonamallee Depot at Test Track and Stabling Lines	570	630
SIG-S1-AD-002	Access Date to Signaling Contractor in Poonamallee Depot at Inspection Bay Lines, Repair Bay Lines and Depot Open Area	740	800
SIG-S1-AD-003	Access Date to Signaling Contractor for Signaling Rooms at Poonamalle Depot	520	580
Corridor 4 – ECV 0	2	1	
SIG-S1-AD-004	Access Date to Signaling Contractor for Viaduct section from Porur Bypass Crossing to Katupakkam at Corridor 4 ECV 02	500	560
SIG-S1-AD-005	Access Date to Signaling Contractor for Viaduct section from Katupakkam to Poonamallee Bypass including Poonamallee Depot Approch line at Corridor 4 ECV 02	640	700
SIG-S1-AD-006	Access Date to Signaling Contractor for Station rooms at Any 2 stations of Corridor 4 ECV02	270	330
SIG-S1-AD-007	Access Date to Signaling Contractor for Station rooms at All stations of Corridor 4 ECV 02	340	400
Corridor 4 – ECV 0	1		1
SIG-S1-AD-008	Access Date to Signaling Contractor for Viaduct section from Power House to Saligramam at Corridor 4 ECV 01	510	570
SIG-S1-AD-009	Access Date to Signaling Contractor for Viaduct section from Saligramam to Porur Bypass Crossing at Corridor 4 ECV 01	690	750
SIG-S1-AD-010	Access Date to Signaling Contractor for Station rooms at Any 3 stations of Corridor 4 ECV 01	290	350
SIG-S1-AD-011	Access Date to Signaling Contractor for Station rooms at All stations of Corridor 4 ECV 01	350	410
OCC at Koyambed	u & BCC at Nandhanam		
SIG-S1-AD-012	Access dates for theatre and all equipment rooms, complete with all MEP works & all architectural finishes in OCC at Koyambedu and BCC at Nandhanam	660	720
Corridor 5 – ECV 0	2		

SIG-S2-AD-001	Access Date to Signaling Contractor for Viaduct section from CMBT to End of MIOT Flyover at Corridor 5 ECV 02	780	840	
SIG-S2-AD-002	Access Date to Signaling Contractor for Viaduct section from End of MIOT Flyover to Puzhuthivakkam station at Corridor 5 ECV 02	900	960	
SIG-S2-AD-003	Access Date to Signaling Contractor for Station rooms at Any 6 stations of Corridor 5 ECV 02	790	850	
SIG-S2-AD-004	Access Date to Signaling Contractor for Station rooms at All stations of Corridor 5 ECV 02	840	900	
Corridor 5 – ECV 0	3			
SIG-S2-AD-005	Access Date to Signaling Contractor for Viaduct section from Puzhuthivakkam to Vellakal at Corridor 5 ECV 03	780	840	
SIG-S2-AD-006	Access Date to Signaling Contractor for Viaduct section from Vellakal to Shollinganallur at Corridor 5 ECV 03	860	920	
SIG-S2-AD-007	Access Date to Signaling Contractor for Station rooms at Any 5 stations Corridor 5 ECV 03	770	830	
SIG-S2-AD-008	Access Date to Signaling Contractor for Station rooms at All stations Corridor 5 ECV 03	820	880	
Corridor 3 – ECV 0	1	1		
SIG-S3-AD-001	Access Date to Signaling Contractor for Viaduct section from Sholinganallur to Semmancheri (6 km stretch) at Corridor 3 ECV 01	780	840	
SIG-S3-AD-002	Access Date to Signaling Contractor for Viaduct section from Semmancheri to Sipcot 2 (100% viaduct) at Corridor 3 ECV 01	890	950	
SIG-S3-AD-003	Access Date to Signaling Contractor for Station rooms at Any 5 stations of Corridor 3 ECV 01	790	850	
SIG-S3-AD-004	Access Date to Signaling Contractor for Station rooms at All stations of Corridor 3 ECV 01	840	900	
Corridor 3 – EV 01				
SIG-S3-AD-005	Access Date to Signaling Contractor for Viaduct section from Taramani Ramp to Karapakkam Station (6 km stretch) at Corridor 3 EV 01	880	940	
SIG-S3-AD-006	Access Date to Signaling Contractor for Viaduct section from Karapakkam station to Sholinganalur station (100% viaduct) at Corridor 3 EV 01	1020	1080	
SIG-S3-AD-007	Access Date to Signaling Contractor for Station rooms at Any 2 stations of Corridor 3 EV 01	760	840	

SIG-S3-AD-008	Access Date to Signaling Contractor for Station rooms at All stations of Corridor 3 EV 01	850	910
Corridor 4 – UG 02			
SIG-S4a-AD-001	Access Date for Tunnel Section at Corridor 4 UG 02 to Signaling Contractor	1050	1110
SIG-S4a-AD-002	Access Date for Station rooms at Any 2 stations at Corridor 4 UG 02 to Signaling Contractor	880	940
SIG-S4a-AD-003	Access Date for Station rooms at All Stations at Corridor 4 UG 02 to Signaling Contractor	920	980
Corridor 5 - Madhav	varam Depot		
SIG-S4b-AD-001	Access Date for Signaling rooms at Madhavaram Depot to Signaling Contractor	830	890
SIG-S4b-AD-002	Access Date to Signaling Contractor for Priority Areas – Zone 1 (Workshop building its approaches, shunting neck 01 and Test track including train delivery area) and Zone 2 (Inspection building its approaches, ETU, PWL and its approaches)	820	880
SIG-S4b-AD-003	Access Date to Signaling Contractor for Non- Priority Areas – Zone 3 (Half of stabling line and its approaches and coach wash) and Zone 4 (Second half of stabling line and connection to mainline)	910	970
Corridor 5 – EV 03			
SIG-S4b-AD-004	Access Date to Signaling Contractor for Viaduct section - Assisi Nagar to Retteri station & CMBT to Thirumangalam station at Corridor 5 – EV 03	930	990
SIG-S4b-AD-005	Access Date to Signaling Contractor for Viaduct section – Reterri Station to Ramp , Thirumangalam to Nathamuni & Venugopal Nagar to Assisi Nagar at Corridor 5 – EV 03	1060	1090
SIG-S4b-AD-006	Access Date for Station rooms at Any 3 stations at Corridor 5 EV 03 to Signaling Contractor	860	920
SIG-S4b-AD-007	Access Date for Station rooms at All stations at Corridor 5 EV 03 to Signaling Contractor	910	970
Corridor 5 -UG 06			· · · · · · · · · · · · · · · · · · ·
SIG-S4b-AD-008	Access Date for Tunnel Section from Villivakkam Metro to Nathamuni - Corridor 5 UG 06 to Signaling Contractor	1080	1140
SIG-S4b-AD-009	Access Date for Tunnel Section from Kolathur Junction (including ramp) to	1120	1180

	Villivakkam Metro - Corridor 5 UG 06 to Signaling Contractor		
SIG-S4b-AD-010	Access Date for Station rooms at Any 2 stations at Corridor 5 UG 06 to Signaling Contractor	1090	1150
SIG-S4b-AD-011	Access Date for Station rooms at All stations at Corridor 5 UG 06 to Signaling Contractor	1120	1180
Corridor 3 – UG 01	1	1	
SIG-S5-AD-001	Access Date for Tunnel Section from Venugopal Nagar to Sembiyam at Corridor 3 UG 01 to Signaling Contractor	1200	1260
SIG-S5-AD-002	Access Date for Station rooms at Any 4 stations - Corridor 3 UG 01 to Signaling Contractor	900	960
SIG-S5-AD-003	Access Date for Station rooms at All Stations - Corridor 3 UG 01 to Signaling Contractor	1040	1100
Corridor 3 – UG 02			
SIG-S5-AD-004	Access Date for Tunnel Section from Sembiyam to Purasaiwakkam High Road at Corridor 3 UG 02 to Signaling Contractor	1280	1340
SIG-S5-AD-005	Access Date for Station rooms at Any 2 stations - Corridor 3 UG 02 to Signaling Contractor	1000	1060
SIG-S5-AD-006	Access Date for Station rooms at All Stations - Corridor 3 UG 02 to Signaling Contractor	1180	1240
Corridor 3 -UG 03	1		
SIG-S6-AD-001	Access Date for Tunnel Section from Purasaiwakkam High Road to Royapettah Govt. Hospital at Corridor 3 UG 03 to Signaling Contractor	1440	1500
SIG-S6-AD-002	Access Date for Station rooms at Any 3 stations - Corridor 3 UG 03 to Signaling Contractor	1100	1160
SIG-S6-AD-003	Access Date for Station rooms at All Stations - Corridor 3 UG 03 to Signaling Contractor	1200	1260
Corridor 3 -UG 04			
SIG-S7-AD-001	Access Date for Tunnel Section from Royapettah Govt.Hospital to Greenways at Corridor 3 UG 04 to Signaling Contractor	1440	1500
SIG-S7-AD-002	Access Date for Station rooms at Any 4 Stations - Corridor 3 UG 04 to Signaling Contractor	1160	1220

SIG-S7-AD-003	Access Date for Station rooms at All stations - Corridor 3 UG 04 to Signaling Contractor	1220	1280
Corridor 3 - UG 05			
SIG-S7-AD-004	Access Date for Tunnel Section from Taramani to Indira Nagar at Corridor 3 UG 05 to Signaling Contractor	1330	1390
SIG-S7-AD-005	Access Date for Tunnel Section from Greenways to Indira Nagar at Corridor 3 UG 05 to Signaling Contractor	1420	1480
SIG-S7-AD-006	Access Date for Station rooms at Any 2 stations - Corridor 3 UG 05 to Signaling Contractor	1130	1190
SIG-S7-AD-007	Access Date for Station rooms at All stations - Corridor 3 UG 05 to Signaling Contractor	1230	1290
Corridor 4 - UG 01			
SIG-S7-AD-008	Access Date for Tunnel Section from Light House to Thirumayilai Metro (excl. Thirumayilai station) at Corridor 4 UG 01 to Signaling Contractor	1060	1120
SIG-S7-AD-009	Access Date for Tunnel Section from Boat Club House to Thirumayilai Metro at Corridor 4 UG 01 to Signaling Contractor	1320	1380
SIG-S7-AD-010	Access Date for Station rooms at Any 3 Stations - Corridor 4 UG 01 to Signaling Contractor	870	930
SIG-S7-AD-011	Access Date for Station rooms at All stations - Corridor 4 UG 01 to Signaling Contractor	920	980

Degree 3 Finishes Details:

- Complete Wall Plastering and painting
- Complete raised floor, and false flooring except for locations where panels have to be installed after completion of works by the Interfacing contractor
- Complete internal glazing
- Permanent doors and ironmongery installed
- Plumbing and Sanitary fittings complete and ready for testing
- Degree 3 (D-3) finish includes Cable tray connectivity from Viaduct/Tunnel side to the Equipment rooms as also cable tray connectivity between rooms in various levels (concourse/platform/street levels) and between public areas in these levels, as applicable.
- Access date to the Viaduct & Tunnel sections to include Access to all S&TC Cable trays, finished track complete with welding and hand over of all turn-outs (as per mutually agreed acceptance criteria)

Chennai Metro Interface Sheet	Contract A	ASA-04	Contract B	E&M Contract Number	Sheet # : 1	Rev # : A2		
	Signalling &Train Control (S&TC)		MEP Elevated or UG Section or					
	(Interface Leaa)		Depot (Interface Follower)					
 Brief description of interface scope: 1. Cable trays in tunnel/at grade section for main cable laying 2. Cable trays in elevated/UG station areas/depot areas for main cable laying 3. Earthing arrangements in Equipment & Control rooms 4. <u>UPS Supply for S&TC Equipments</u> 5. <u>VAC provision in Equipment & Control rooms (where applicable)</u> 6. Time schedule & sequencing of works 								
Contract A(Signalling & Train DESIGN STAGE Contract B(E&M Elevated/Tunnel						/Tunnel		
<i>ST/E&M-01</i> : (a) For the main c the details of cables sections/depot out-d dimensions, number	<i>ST E&M-01</i> : (a) Contract B shall design the cable supporting arrangements for the main cable route, duly meeting the requirements of Contract-A ,including required minimum separation between HV system cables & S&TC system cables (b) Shall co-ordinate with the Civil Contractor regarding space-proofing, openings/cut-outs in slabs/walls/civil structure etc , required for the main cable route.							
<i>ST/E&M-02</i> : (a) For the main cable route Contract-A Shall give the details of cables to be laid in the elevated/UG Station areas & depot indoor areas ,including the weight, dimensions, numbers & bending radii			<i>ST/E&M-02</i> : (a) Contract B shall design the cable supporting arrangements for the main cable route in elevated/UG Station areas & Depot indoor areas, duly meeting the requirements of Contract-A					

Chennai Metro Interface Sheet	Contract A	ASA-04	Contract B	E&M Contract Number	Sheet # : 1	Rev # : A2	
ST/E&M-03: Shall advise the earthing scheme of S&TC system			 (b) Shall co-ordinate with the Civil Contractor regarding space-proofing, openings/cut-outs in slabs/walls/civil structure etc, required for the main cable route, to enable Contract A achieve a short & technically feasible cable route ST/E&M-03: Shall plan for extending the Station Main earth terminal to Equipment & Control rooms of S&TC system and for terminating them on a suitable strip inside the room 				
ST/E&M-04: (a)Shall advise/confirm the UPS Power load of S&TC equipment in the Station/Depot (b) Shall plan for laying suitable cables for extending the dual UPS feed inside the Equipment room, for termination & distribution within the room & outside			ST/E&M/04: Shall plan for the UPS system accordingly and provide double feeders (with suitable protection) at a suitable place in the UPS room ST/E&M-05: At applicable locations, shall design the VAC system accordingly and also plan the AC ducts to avoid				
 ST/E&M-05: (a)Shall advise/confirm the heat loads generated by S&TC equipments within the Equipment & Control Rooms (at applicable locations) (b) Shall advise the lay-out of S&TC equipments in Equipment/Control rooms 			condensation on installed S&T equipments				

Chennai Metro Interface Sheet	Contract A	ASA-04	Contract B	E&M Contract Number	Sheet # : 1	Rev # : A2	
Contract A(Signalling & Tele	/ INSTALLATION Contract B(E&M Elevated/Tunnel GE Section/Depots)						
<i>ST/E&M-06:</i> Shall work in of Contractor to ensure smooth p damage to structures/Equipment	ST/E&M-06: Shall co-ordinate the sequence of execution of work and their associated durations, to ensure proper site access to S&TC Contractor, to ensure smooth progress of works, duly avoiding any damage to structures/equipments, cables already installed						
<i>ST/E&M-07</i> : Shall verify that requirements for laying of S&TC cables are met and lay the cables			<i>ST/E&M-07:</i> Shall install the main cable route support system (duly earthed) in the tunnel/at grade areas/Depot outdoor areas				
<i>ST/E&M-08:</i> Shall verify that requirements for laying of S&TC cables are met and lay the cables			<i>ST/E&M-08:</i> Shall install the main cable route support system (duly earthed) in the elevated/UG Stations & Depot indoor areas				
<i>ST/E&M-09</i> : Shall install the S&TC equipments in Equipment & Control rooms			ST/E&M-09: Shall install the VAC system in Equipment/Contro rooms , if applicable,duly meeting the requirements of S&TC Contractor in respect of equipment lay-outs/rack locations ST/E&M-10: Shall provide the MEP earth strip in Equipment & Control rooms				

Chennai Metro Interface Sheet	Contract A	ASA-04	Contract B	E&M Contract Number	Sheet # : 1	Rev # : A2	
ST/E&M-10: Shall make arrange connection to all cabinets & rack ST/E&M-11: Shall arrange for th from UPS room to Signaling Eq	ST/E&M-11: Shall install the dual feeder supply of UPS output for the load of S&TC Contractor, duly checking jointly the condition of cables laid by S&TC Contractor from UPS room to Signaling Equipment room						
Contract A(Signalling Control)	Contract A(Signalling & Train TEST & COMMISIONNING STAGE Contract B(E&M Elevated/Tunnel Control) Section/Depots)						
<i>ST/E&M-12</i> : Shall participate in the earth resistance value test from MET terminal to Station Earth and satisfy himself that it is within limits.			<i>ST/E&M-12</i> : (a)Shall produce earth resistance value test report as accepted by Power Supply Contractor, for main station earth (b) Shall demonstrate resistance value from Equipment room till main earth				
ST/E&M-13: Shall check the availability of UPS supply in Signaling Equipment room, check its characteristics as per specifications and then extend the UPS supply to various equipments in the room as well as outside the room			ST/E&M-13: Shall extend UPS supply for S&T loads, through dual feeders ST/E&M-14: At applicable stations, shall switch on the VAC				
ST/E&M-14: Shall verify the s system	atisfactory work	ing of the VAC	system for S&TC Equipment & Control Rooms				

Appendix 2P-12

Interface protocol between Signalling and Train Control system (STC) and Overhead Catenary Maintenance Vehicle system (OMV)

Interface protocol between Signalling and Train Control system (STC) and Overhead Catenary Maintenance Vehicle system (OMV)

1 INTRODUCTION

1.1 General

- 1.1.1 This specification covers the interface requirements between Signalling & Train Control Contract ASA-04 and OMV Contract(s).
- 1.1.2 This document shall be read in conjunction with the relevant paragraphs of the General Specification. The Contractors shall ensure all requirements of the General Specification and PS pertaining to interfaces are fully resolved and implemented.
- 1.1.3 In the event of a conflict between any Particular Specification and this specification, the requirements of this Interface Specification shall prevail.

2 Interface Responsibilities

- 2.1.1 The responsibility for specification and provision of the requirements for the works that interface with Designated Contractors' equipment are tabulated in corresponding section of the document.
- 2.1.2 The requirements specified herein are by no means exhaustive and it remains the Contractors responsibilities to develop and execute jointly an Interface Plan after the commencement of the works and throughout the execution of works, to ensure that:
 - a) All interfacing issues between the two Contracts are satisfactorily resolved.
 - b) Supply, installation and testing of equipment and software are fully co-ordinated.
 - c) That all equipment supplied under the Contracts is fully compatible with each other, whilst meeting the requirements of the respective Specifications.
 - d) All the construction tolerances at the interface shall meet the requirements of the respective specifications relating to the interface points
 - e) Interface contractors shall mutually respect each other's project timelines with respect to the interface requirements.
 - f) Interface contractors shall finalize their respective interface equipment only after clear agreement on interface requirements with the other designated contractors.
 - g) Interface contractors shall ensure that in any case, no equipment of their system shall be put into production or installation without meeting the interface requirements spelt out in this Appendix or in the Technical Specification.
 - Test procedures, troubleshooting manuals and any other documentation shall be updated with technical details from of each contractor and shall be submitted to CMRL

3 Interface Management

3.1.1 Signalling and Train Control Contractor shall be the Lead Contractor. The Lead Contractor shall be responsible to initiate, plan, coordinate and produce jointly with the Participating Contractors all the required interfaces and interface design documents and interface progress reports for submission to The Engineer/ CMRL for acceptance. The

Lead Contractor shall also prepare and issue all interface meeting of minutes within 3 days of the meeting and provide bi-weekly interface progress reports to all the participating contractors for information. Later, forwarding of issued minutes of meeting and bi-weekly interface progress reports to concerned Contractors shall be lead contractor's responsibility.

- 3.1.2 OMV contractor(s) shall be the participating contractor. The Participating Contractors shall collaborate fully with the Lead Contractor in the development and finalization of the interface design, joint production of the interface documents and interface progress reports.
- 3.1.3 The Signalling & Train Control system will be awarded as a separate contract for train operation in Communication Based Train Control (CBTC) system in all the three corridors of Phase 2 and in-between the corridors as inter-corridor operation. There will be a single STC contract for the Phase 2 (Corridor-3, Corridor-4, Corridor-5, and all depots). STC Contractor shall interface accordingly with the OMV contractor(s) of Phase 2.
- 3.1.4 All the participating contractors shall ensure that copy of the Interface design documents submitted to the Engineer/CMRL.
- 3.1.5 The costs for all interface design and testing works shall be deemed to be included in the Contract sum of respective contracts regardless of the actual extent of effort required or expended by the Contractor.
- 3.1.6 The Contractors shall be fully responsible for the management and control of their respective subcontractors in relation to all interfacing activities carried out under the Contract.
- 3.1.7 Where-ever requirements of OCC are mentioned in this chapter, the same shall mean to be implemented for both Operations Control Centre (OCC) and Backup Control centre (BOCC).

4 Interface Requirements

- 4.1.1 The OMV shall be equipped with CBTC equipment with <u>redundant</u> ATP systems to operate in GoA 1 mode as per EN62290.
- 4.1.2 The ATP operation of OMV is envisaged with no other vehicle coupled into it. The coupler status shall be vitally monitored.
- 4.1.3 The Signalling system shall use continuous moving block approach for OMV similar to that of approach for Rolling stock.
- 4.1.4 The Automatic Train Protection (ATP) system shall issue the Emergency braking commands to OMV when safety limits are exceeded or when over-speed is detected. The removal of traction effort and the correct application of Emergency brakes in OMV shall be the responsibility of OMV Contractor. The ATP system shall be responsible for monitoring of speed and the issuing of braking commands when safety speed limits are exceeded.
- 4.1.5 The Signalling system design shall provide facility for the ATP movement of OMV into the work zone. Once inside within the work zone, the OMV shall be able to move as many times as possible in both the directions in ATP mode without the intervention from the OCC/SCR. The system shall protect the OMV from moving outside the work zone area in ATP mode unless a route is set by the Operator from OCC/SCR.

- 4.1.6 The OMV contractor shall provide the Signalling contractor the acceleration and braking rates of the OMV. The Guaranteed Emergency Braking rate shall also be provided to the signalling contractor for incorporating in his design.
- 4.1.7 The signalling system shall design the speed curves for the OMV taking this into consideration. The model for calculating the Safe Braking Distance (SBD) shall identify and take into account various system's response times and Train Operator's reaction times and shall be in accordance with IEEE 1474.1 standard.
- 4.1.8 The STC contractor shall design the system in a way that no additional length shall be added to the Interlocking overlaps designed based on the Rolling stock characteristics because of OMV characteristics. Instead, the sectional speed of OMV be reduced to match the overlaps, if requirement arises.
- 4.1.9 The OMV contractor shall ensure that the OMV is designed for a maximum speed which provides a nonstop average speed of the OMV as a minimum 40 kmph. The signalling system shall control the OMV in such a way that the ATR regulates the recommended speed based on the Operational scenario.
- 4.1.10 The OMV contractor shall provide the tare weight of the OMV to the signalling contractor in the design phase. The signalling contractor shall use this data for ATS related reports and calculation.
- 4.1.11 The high critical alarms and information shall be transmitted to ATS through the CBTC radio itself. The mode change, Emergency brake etc are some of the critical alarms. The instantaneous speed of OMV, Direction of travel etc shall be some of the information to be transmitted to ATS by Train-borne signalling system. The list of high critical of signalling system shall be decided in design phase.
- 4.1.12 Since the OMVs are Diesel Powered Vehicles, signalling system shall <u>not</u> take the OHE status while providing authority of movement for OMVs.
- 4.1.13 Both the contractors shall provide adequate support for CMRL (as interface designs, installation checks, test documents, technical information etc.) for liaison with the independent safety assessors (ISA) and with other statutory regulators.

Mode of Operation

4.1.14 Automatic Train Protection (ATP or Coded Manual Mode)

(i) Identification and enforcement of maximum speed at which the OMV may operate, shall be in accordance with the maximum design safe speed.

(ii) Identification and display of actual speed, target speed, target distance, and the <u>operating speed (recommended speed/advisory speed)</u>.

(iii) Provision of an audio-visual warning to the OMV operator when the system identifies that the OMV is operating at a speed more than the maximum safe speed; recognition of a delay of 2s for the OMV operator to react and do service brake application to reduce the speed. If the operator fail to reduce the speed below the maximum safe speed in a specified time an irrevocable Emergency Brake application shall be made, automatically till the vehicle attain zero speed.

4.1.15 Restricted Manual (RM) and Run-on Sight (ROS) Mode

(i) In RM mode, the maximum train speed shall be controlled by the on-board ATP, to a limit not exceeding 25 kmph. This mode shall be available only when the on-board ATP equipment is operational.

(ii) The running monitoring shall be the same as for RM. The ATP shall give cab signal indications as soon as the train reaches a track position where normal running can be resumed. The ATP authorizes the ROS request.

4.1.16 Cut-out (or By-pass) Mode

(i) By-pass Mode shall be provided for use in the event of failure of the ATP system. In this mode, the OMV speed shall be controlled entirely by the operator, to a limit speed as in Operating orders.

(ii) The ATP Cut-out (By-pass) Mode shall be initiated by the OMV operator operating a sealed Safety Cut-out Switch (SCS) and simultaneously breaking its seal. The operation shall be recorded by the on-board digital counter and OCC/BCC & DCC. The SCS shall be provided by OMV Contractor. The on-board non-resettable digital counter shall be provided by the Signalling Contractor.

Hardware Interfaces

- 4.1.17 The Signalling Contractor shall provide the OMV Contractor with a list of equipment to be supplied by the Signalling Contractor and installed by the OMV Contractor on the OMV. The list of equipment shall include, but not be limited to the following:
 - a) Train-borne ATP/ATO equipment for OMV
 - b) Communication Based Train Control (CBTC) modules
 - c) Various types of antennas
 - d) Speed / acceleration measuring devices including tacho-generators, accelerometers, switches etc., as appropriate.
 - e) Signalling driving console display with buzzer for both cabs of all OMVs.
 - f) All complete length of <u>cables and connectors</u> to connect Signalling equipments to the Train-borne signalling unit including all intermediate connectors as applicable.
- 4.1.18 STC Contractor shall supply at OMV Contractor factory, as per the requirement of the OMV contractor, pre-wired equipment racks with all other equipments.
- 4.1.19 The train-borne signalling equipments shall consist of separate compact modular subrack for each function, readily replaceable and mounted on the train-borne signalling equipment rack located in the ATC compartment provided in the OMV (only one location). The hardware shall be the same as that of used in Rolling stocks of CMRL phase 2 project except the ATO/UTO equipments required for ATO or UTO mode of Operation, which shall not be required as ATO/UTO mode of operation is not envisaged.
- 4.1.20 Any train borne signalling equipments to support ATS related functionalities like timetable operation, ATR etc, if required, shall be part of the train borne signalling equipments for OMV. The ATR functionality for OMV shall be based on the run time control as no dwell time/ station stoppage is defined for it.
- 4.1.21 The ATP systems shall have similar configuration of the Rolling stock similar level of redundancy for train borne equipment and other peripheral equipments like antennas, tacho meter etc.
- 4.1.22 The CBTC radio shall have similar level of redundancy that of the rolling stock. For non-CBTC radio and its switch, redundancy is not required. Currently, non-CBTC radio will be used for centralised diagnostic data/log collection of Signalling. The future provisions of virtual networks making use of the non-CBTC bandwidth shall be provided (similar to that of the rolling stock) for operator to utilise for various future purposes.
- 4.1.23 The Signalling Contractor shall submit drawings showing the recommended placement of their train borne ATP/ATO equipment in the OMV in consultation with the OMV contractor. This is in addition to specifying the locations where the exterior equipment has to be mounted for optimal performance.
- 4.1.24 The OMV Contractor shall ensure that ATC compartments shall be compatible with the car without affecting the intended maintenance utility of OMV. The complete assemblies shall be capable of being mounted in a suitable position. The assemblies shall be secured from inadvertent human interference but shall be easily accessible for inspection and maintenance when required. The Signalling driving console (HMI) display shall be mounted in the appropriate position in OMV Operator's desk on both ends considering the overall ergonomics.
- 4.1.25 The Signalling and OMV Contractors shall develop and produce detailed descriptions of interfaces, as follows (Not exhaustive):
 - a) Signalling equipment cubicle environment requirements.

- b) Signalling equipment internal temperature.
- c) Vibration and shock.
- d) Humidity.
- e) Ventilation requirements.
- f) All equipment dimensions, mounting arrangements and necessary clearances.
- g) Cable size/type/routing and specifications.
- h) Electro-magnetic interference protection.

In addition to the above, the Signalling contractor shall provide the following information (Not exhaustive)

- a) Weights and dimensions
- b) Quantity
- c) Equipment layout and clearances relative to the rack enclosure, including envelopes for operation, installation and removal.
- d) Models of all train-borne equipment with fixing holes and cable connectors together with installation details and layout details
- e) Fixing details
- f) Smoke and toxicity level release information.
- g) Enclosure performance, IP rating
- 4.1.26 The Signalling and OMV Contractors are required to develop in more detail the electrical interfaces, not limited to, as follows:
 - a) Type and Number of Interface Points If relays are to be used for interface, only voltage-free contact shall be used.
 - b) Signalling System Outputs and Train Control Interfaces
 - c) Power Supply Interface The power supply wiring between the OMV power supply and the signalling connector shall be supplied and connected by OMV Contractor. The Signalling Contractor will specify the power requirements. There shall be no relays or contacts between the negative return connection and the battery terminals.
 - d) Power Supply Isolation The Signalling Contractor shall co-ordinate with the OMV Contractor to ensure that all electronics can withstand the voltage spikes at the input of the ATC equipment, as specified in EN50155.
 - e) Transient Suppression The Signalling Contractor shall interface with the OMV Contractor for the required details where Signalling Contractor can produce the design of the Signalling's relay coils spike suppression circuit to eliminate the possible interference due to disconnection of power from the ATC system.
 - f) Earthing Requirements The earthing shall be designed to minimise the noise voltage generated and to avoid creating earth loops susceptible to magnetic field and differences in potential. The Signalling Contractor shall specify the earth impedance required for the earthing point.
- 4.1.27 The Signalling and Rolling Stock Contractors shall coordinate with each other to ensure all works are carried out seamlessly. The following split (Not limited to) of installation works are envisaged between the Signalling and Rolling Stock Contractors:
 - a) Signalling Contractor Responsibilities:
 - i. Supply of the train-borne signalling equipment rack (for OMV) containing the signalling equipment, fully wired and tested.

- ii. Train-borne signalling equipment rack supplied with anti-vibration pads which shall be installed by OMV Contractor
- iii. Junction box, where signalling cables terminate, if applicable
- iv. Complete set of Signalling Cables from the signalling equipment rack to all signalling equipments.
- v. Supply of all free mating connectors, plug couplers etc for vital and non-vital information communication between OMV and Train-borne signalling equipments.
- vi. Supply of all connectors for power supply requirements of train-borne signalling equipment.
- vii. Provide equipment such as antennas, tachometer, sensors, relay coils, etc related to the Signalling system.
- viii. Provide the non-resettable digital counter for cut-out mode operation.
- ix. Mounting details and dimensions of interior and the exterior equipment.
- x. Suitable coupling for connection to the ATC system, if applicable.
- b) OMV Responsibilities:
 - i. Provide all supports, brackets braces, mounting holes, etc. to ensure proper mounting and to allow adequate maintenance access to the train-borne signalling equipment.
 - ii. Provide adequate supports and stress relieving provisions for the cabling of signalling equipment after these are mounted to ensure that cables are not fouling, chaffing, or unduly stressed with other equipment.
 - iii. Good ventilation facilities (e.g., ventilation louvers/ openings) in the train-borne signalling compartments shall be provided to allow air into the train-borne signalling equipment rack and to prevent condensation.
 - iv. Shall install each of exterior Signalling equipment on OMV.
 - v. Mounting brackets for junction box housing.
 - vi. Appropriate cables for Power supply and earthing till the interface connectors of the train borne signalling equipment rack and its termination in the connector.
 - vii. Appropriate cables till the interfacing connectors for all vital and non-vital inputs and outputs and its termination in the interfacing connectors.
 - viii. Suitable support or clamping arrangement on the bogie for the flexible conduit to ensure that the connectors or cables shall not work loose or break due to the movement of flexible conduit even during the most adverse operation of the Trains. Such support / clamping arrangement shall ensure non-chaffing with other equipment or create undue stress on cables or connectors.
 - ix. Mounting plates and brackets for the exterior equipment
 - x. Suitable push buttons for RM selection etc.
 - xi. Rotary switches for the cut-out mode operation.
- 4.1.28 The screened cables used for the train-borne signalling equipment shall be properly terminated so that no return loops are formed to cause an electrically noisy environment within the train-borne signalling equipment cubicle wiring.
- 4.1.29 STC Contractor shall certify the procedure of fixation of relevant connections, cables to on-board STC equipment after their assembling in first vehicle at OMV contractor's premises. This procedure shall be agreed between STC contractor and OMV contractor and the same shall be followed for all the subsequent vehicles of the manufacturing. STC contractor shall conduct random inspections in OMV contractor's manufacturing unit, if required, to ensure proper procedure is followed in all OMVs. Any change to the agreed procedure based on the subsequent supplier recommendations, or failure observed in

previous OMVs, modification in the design, mounting arrangements shall be incorporated in complete fleet of OMVs.

- 4.1.30 Any re-installation, replacement of cables, connectors, equipment, antennas or modifications in mounting arrangements etc because of failures, damages, replacement because of quality issues, during the installation, T&C as well as DLP period, shall be taken up by the respective contractors, who was responsible for the supply or for the installation as per the original work. These replacements are included in the scope of this interface.
- 4.1.31 For compatibility, OMV and the train detection system (CBTC antennae/track circuits/axle counters), shall conform to EN 50238.
- 4.1.32 Vehicle control circuits shall be developed by the OMV Contractor. During the design stage, all the vehicle control circuits incorporating the identified interfaces shall be provided to STC Contractor. STC Contractor shall provide specific observations on these circuits to OMV Contractor. OMV Contractor shall suitably incorporate these observations in the design.
- 4.1.33 STC Contractors to ensure that all input and output signals exchanged between OMV equipment and on-board signalling equipment shall be recorded and shall be available for retrieval on demand for analysis/record in a centralised location.
- 4.1.34 OMV Contractor to ensure that safety/train control related signals including brakes, position of safety cut out switches, direction, coupler status etc. are communicated to the signalling Contractor.

Factory Installation and Testing

- 4.1.35 All the special equipment associated with the train borne ATC system, including the interface cables / wires between the train borne ATC and Train Radio shall be designed and supplied by STC contractors, as applicable, to OMV Contractor factory. Each contractor shall be aware of the locations of manufacturing plants.
- 4.1.36 STC contractor shall be responsible for providing all data and training of OMV Contractor staff in all aspects of ATC installation and verification wherever applicable. Necessary training material shall be provided to CMRL and OMV contractor for this purpose. The first set of ATC equipment shall be installed by OMV Contractor, under the supervision of STC contractor representatives, including the wiring for the interface of the ATC equipment with OMV.
- 4.1.37 STC contractor while handing over the STC equipment to OMV contractor for train fitment in manufacturing facility, shall provide the equipment fitness certificates and quality assurance certificates for all the equipment being handed over to OMV contractor.
- 4.1.38 STC contractor has to provide the material list, Part numbers, unique serial numbers for all the STC components of all OMV(s).
- 4.1.39 OMV Contractor shall provide facilities for comprehensive static and interface tests between Signalling and Telecommunications systems at his premises or at Depot as jointly agreed. Signalling and Telecommunication contractors shall be responsible for the provision of special test equipment and instrumentation.
- 4.1.40 The Signalling, OMV and TETRA contractors shall coordinate and conduct the integrated testing of OMV in mainline. The basic features of ATC, Braking and acceleration of OMV, Testing of Vital inputs (e.g.: Coupler status) etc shall be tested apart from TETRA calls to OCC and other talk groups.
- 4.1.41 Should the need arise for modifications in the configurations of respective equipment or systems as a result of Integration Test or otherwise, the scope of work and division of responsibility shall be jointly agreed amongst the contractors and detailed procedure shall be developed. OMV Contractor shall provide the requisite manpower to monitor and/or implement the modifications on OMV for work involving scope as identified in above clause.

EMI/EMC Interface

- 4.1.42 Regarding electromagnetic interference, STC Contractors shall provide a list of working frequencies and other sensitive requirements to the OMV Contractor, to enable OMV Contractor to avoid such frequency bands in design, and to provide devices to isolate the source of emission wherever required. STC Contractor will have first right of use for radio frequency 2.4GHz/5.8 GHz for CBTC application.
- 4.1.43 OMV, STC & TETRA Contractors shall ensure that the emission and immunity level of their respective equipment meet the requirements of EN50121-3-1 & EN50121-3-2.
- 4.1.44 OMV Contractor shall ensure that the return current, if any, in the track at the specified frequencies does not exceed the value specified by STC Contractor.
- 4.1.45 OMV and STC Contractors shall also jointly develop a test plan for verification of electromagnetic compatibility of OMV with signalling systems. The contractors shall work together to assure that all electronic and electrical equipment on OMV works properly without interfering with signalling sub-systems.
- 4.1.46 The cable layout of the signalling system in the cable ducts provided by OMV Contractor shall be jointly agreed. The separation between signalling cables and power cables of 25kV, 415 V 3 phase AC, 230 V AC 1 phase, 110 V DC and further other DC voltages rating shall be in accordance with accepted international practice and jointly agreed.

INTERFACE- Division of Responsibility

Signalling Contractor shall coordinate with Telecom contractor(s) in order to achieve the functional and operational requirements of the system. The roles and activities of the Contractors shall broadly include the following as a minimum but not limited to those mentioned in table below. Apart from the below table, the contractors shall also adhere to all the Interface specifications (as above) and the GS and PS requirements.
S. No	ltem	STC Contractor	OMV Contractor	
1	Train borne ATC equipment	To supply the equipment, its mounting details to the OMV Contractor's Works as per manufacturing schedule of OMV Contractor.	To provide space in the vehicle design for fixing and installation at the manufacturer's facility, by the OMV Contractor, under the supervision of STC Contractor. (The speed measuring sensor(s) and odometer(s) for non-ATC mode will be provided by OMV Contractor.)	
2	Antennae for ATP and TWC			
3	Speed measuring sensors and speedometer and its			
4	ATC Cab Displays (Train operator MMI) including special cables etc.			
5	Antennae for CBTC, CCTV including special cables etc.	To supply the equipment to the OMV Contractors Works.	To provide space in the vehicle design for fixing and installation at the manufacturer's facility, by the OMV Contractor, under the supervision of STC Contractor. To provide CPS to STC Contractor.	
6	Input and output signals interface	Furnish the requirement To review the Cable Principle Scheme (CPS). To Verify the installation at OMV Contractor manufacturing premises before dispatch the train.		
7	Power supply and earthing for train-borne unit equipment.	Furnish required voltage values and earthing requirements to OMV Contractor for respective scope. To review the earthing scheme, prepared by OMV Contractor.	To provide the required voltages and earthing To provide earthing scheme to STC Contractor.	
8	Climatic requirements for on board ATP/ATO/UTO equipment.	STC Contractor to specify the total heat load wattage, and maximum permitted temperature	OMV Contractor to provide Cab Air Conditioning. Suitable ventilation shall be provided by the contractor for the backside area of the console.	
9	EMI/EMC interface between the OMV and Signalling and Train Control, and Telecommunications.	STC Contractor shall advise EMI/EMC plan and test reports for Train borne equipment to OMV Contractor	OMV Contractor shall ensure the compliance of the requirements of STC Contractors for trainborne ATP.	

S. No	Item	STC Contractor	OMV Contractor
10	Guaranteed Emergency Brake Rate(GEBR)	STC Contractor shall share the logics used for GEBR	OMV Contractor shall furnish value of GEBR to STC Contractor.
11	Any other requirements from Employer's Representative - Technical Specification or this interface specification.	STC contractor shall ensure all the interface requirements pertaining to OMV Contractor are shared agreed and implemented mutually.	OMV contractor shall ensure all the interface requirements pertaining to STC Contractor are shared ,agreed and implemented mutually.
12	Detailed Interface document (DID)	STC contractor shall prepare DID and shall ensure that it covers Design, Interface Hazard log, Construction, Testing & Commissioning, Test report formats, Maintenance, etc.,	OMV contractor shall provide the necessary information as requested by STC contractor.

Appendix 2U

Base Document for OCC and BOCC design

(Indicative document)

1. Introduction

CMRL Phase 2 project is envisaged with one OCC at Koyambedu Depot for Controlling Corridor 3,4 and 5. Back up OCC for Phase 1 and Phase 2 (combined) is envisaged at Metro Bhavan Nandanam. This baseline document shall be used by the STC contractor to fine tune the number of controllers (as required), revise the number & orientations of workstations (based on requirements of the role, information content to be displayed, viewing distances, ergonomic considerations) etc. and develop the final layout and desks for the OCC, BOCC, DCCs and SCCs (which shall be subject to Notice of No-Objection of the Engineer).

2. Category of Controllers in OCC and BOCC

Traffic controllers (TC): Primary responsibility of controlling the train movement using the ATS and VDU workstations.

Assistant Chief Controllers (ACC): Oversees the working of Traffic controllers and takes tactical decisions on maintaining the train operations.

Rolling stock controllers (RSC): Oversees the health of Rolling stocks and do intervention through remote diagnostics & control systems of Rolling stock.

Fault management Controllers (FMC): Oversees the health of Signalling and PSD systems and do intervention through remote diagnostics & control systems of Signalling and PSD.

Traction power controllers (TPC): Operates the traction SCADA system and do interventions to resolve the failures in traction power system.

Auxiliary System controllers (ASC): Controls the TVS/E&M SCADA

Passenger Information Controllers (PIC): Controls the information flow on Realtime basis to Passengers, Stations and to other controllers and interacts with the passengers on the trains/stations/line side etc to handle unforeseen situations & emergencies

Chief controller (CC): The overall in charge of the control center. Responsible for all strategic decisions in OCC and over-all co-ordination between various Controllers, to ensure smooth operations & handling of unforeseen situations & emergencies.

3. Layouts

The preliminary layout of the OCC and BOCC is part of this document. The layout shall be used as an initial baseline for developing the OCC design duly incorporating the requirements and updated information from the Interfacing contractors and the Engineer. The baseline numbers for the controllers of various category can be identified from this layout. The numbers shall be fine-tuned based on the requirements arising out in the Interface forum and the instructions of the Engineer.

4. Workstation screens & Video walls

The workstations of respective systems (other than S&TC Contract related Work Stations) will be provided by the respective system contractor. The details of the size, number and type of equipment shall be collected by the STC contractor from all relevant system contractors and

incorporate the requirement in the console design, ergonomic study etc. The STC contractor shall provide the space for the cabinet, screens and associated equipments in the controller console. The mounting arrangement of the screens shall be part of the console. The interface shall also cover the cable routing/termination requirements of these systems contractors, meeting their power supply & communication link requirements etc. The console shall be aesthetically matching with the theme of the OCC for which the STC contractor has to coordinate and interface with Civil, MEP contracts and the architects of engineer and employer. The tentative baseline for working the number of workstations and screens can be based on the below figure for each controller.

OCC Job roles	No. of each role	Workstations & equipment		
Traffic Controller	тс 9	INCLIVED INC. VEDU ATS ATS ATS RCW TELECOM CCTV CCTV		
Assistant Chief Controller	АСС 3	ATS ATS ATS RCW TELECOM CCTV CCTV		
Rolling Stock Controller	RSC 3	ATS RSW RSW RSW CCTV Prince		
Traction Power . Controller	TPC 3			
Fault Management F Controller	EMC 3			
Auxillary System Controller	ASC 2	TVS TVS VAC/E&M VAC/E&M		
Chief Controller	CC 1	ATS ATS ATS RCW TTW TELECOM CCTV CCTV PHONE		
Passenger Information Controller	PIC 2	ATS ATS ATS RCW TELECOM CCTV CCTV		

5. Human factor study

The S&TC Contractor shall be responsible for Human Factors Integration (HFI) on the Phase II project.

HFI requires a combination of engineering design, task knowledge and the application of appropriate HF analysis, specification and testing practices. Best practice HF integration processes ensure that human task requirements are

Understood and that the match between user capabilities, task demands, and equipment are evaluated.

The S&TC Contractor shall appoint a suitably accredited Human Factors Delivery Manager (HFDM) and additional competent specialists as required for the design of control rooms. The HFDM shall be responsible for ensuring that Human Factors issues are identified and addressed in a systematic way and that appropriate assurance evidence is accrued through stakeholder consultation and workshops, task and workload analyses, operability trials, etc.

The HFDM shall produce a Human Factors Integration Plan (HFIP) within 3 months of contract award or as decided by the engineer for review and acceptance by the Engineer and will update the plan as required as the project progresses. The HFIP is a document that describes how HF engineering will be delivered throughout systems development. It defines the HF scope, HF team, specific HF activities, and how these are integrated into the project programme.

The HFIP shall define as a minimum:

a) The HF engineering scope, from user requirements validation through to testing and commissioning; the HF roles and assigned accredited individuals; how HF delivery will be coordinated across all stakeholders and contractors; and how HF issues will be tracked and closed-out.

b) Information required from the operations concept, and how all relevant stakeholders such as operations and maintenance representatives, will be engaged throughout design development.

c) The details of the key considerations and proposed methods for identifying and managing HF. These will include, but should not be limited to assumptions, dependencies and anticipated HF issues and risk.

d) The details of the key HF analyses and design activities for developing dependable systems. These will include, but not be limited to:

- system HF requirements.

- task analysis, and task synthesis.
- workload analysis.
- human reliability analysis.
- job design and role specification.
- user equipment interface specification.
- human computer interface, and alarm management specification.
- specification of processes and strategies.
- specification of training needs.

e) How HF findings will be incorporated into regulatory consultation and approvals processes, including measures that will be used to assess the usability of a system design, acceptance criteria for operability and end-user performance, human reliability, workload demands and the potential for occupational injuries or long-term health problems.

f) The diagrams attached to this Appendix can be taken as basic input documents for the detailed design of OCC, BOCC, DCC, Security Control Rooms, as per requirements listed above and those listed in the Technical Specifications.











